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SECTION 2. Applied mathematics.
Mathematical modeling.

MODEL OF DIGITALIZATION OF INDICATORS OF INDIVIDUAL CONSCIOUSNESS

Abstract: In the article, using the language of the description of situations "attribute – name – value – unit of measurement", a mathematical model of digitization of indicators of individual consciousness of the individual is developed. Cognitive analysis and modeling were carried out on the basis of the Inverse Model of the Principal Component Analysis [11]. An illustrative example is given of giving names to 6 correlated indicators of individual consciousness with given 4 latent factors of individual consciousness.

Key words: latent factors exceeding the threshold of moderate manifestation (perception by the individual) correlated indicators of the individual consciousness of the individual.

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МОДЕЛЬ ЦИФРОВИЗАЦИИ ПОКАЗАТЕЛЕЙ ИНДИВИДУАЛЬНОГО СОЗНАНИЯ

Аннотация: В статье с применением языка описания ситуаций «показатель – наименование – значение – единица измерения», разработана математическая модель цифровизации показателей индивидуального сознания индивида. Когнитивный анализ и моделирование проводились на основе Обратной Модели Главных Компонент. Приведен иллюстративный пример придания названий 6 коррелированным показателям индивидуального сознания при заданных 4 скрытых факторах индивидуального сознания.

Ключевые слова: скрытые факторы, превышающие порог умеренного проявления (восприятия индивидом) коррелированные показатели индивидуального сознания индивида

Введение.

На индивидуумы любой страны влияют разнородные факторы, воздействующие на его поведение, принятие решений в повседневной жизни, в быту, в бизнесе, в проявлениях социальной активности.

Общественный прогресс все быстрее изменяет индивидуальное сознание. В социальных группах существуют многочисленные маркеры «свой-чужой», связанные с раздельным проживанием «людей на красивых машинах» и быдла, которое «не должно сметь своё суждение иметь». Аналогичных факторов, ситуаций проявления или осуждения социального расизма во всех его проявлениях мы узнаем часто из СМИ. Государственные программы модернизации общественного сознания актуализируют проблему, особо

подчеркивая, что «занять место в передовой группе, сохраняя прежнюю модель сознания и мышления, невозможно» [1]. Новые отношения «власть-гражданское общество», модернизация индивидуального и общественного сознания актуализируют вопросы формализации предметной области «индивидуальное сознание», рассматриваемой в данной статье. Мы считаем не достаточными обличительные сообщения, заметки «борцов с коррупцией», поражающих нас как своим размахом, так и неэффективностью, невольно принуждающей нас к беспокойству, к смирению, к преодолению страха. К индивиду (например, в процессе менеджмента предприятия где есть АСУ «поддержка принятия решений») изредка или часто применяют меры принуждения, вынуждающих индивида прибегать к некоторому обману «в интересах



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дела». Существуют разные способы профилактики, борьбы с такими проявлениями. Но обличительный задор борцов всегда направлен на личности, они вызывают у индивида страх, стремление обмануть «систему менеджмента» «shnaiy ondru-kondru-aldau-korkyту».

Групп факторов, которых можно назвать «главными», определяющими существует очень много. Рассмотрим те факторы, которые в последнее время болезненно воспринимаются на бытовом уровне («на кухне»). Среди мнений, «проясняющих» нашу действительность, существуют такие как «если бог даст, то...», «жизнь наша - театр», «кругом обман и ...», «...заставят-никуда не денешься». Даже в поэзии звучат слова про угрозы, устрашения, запугивания «...бессердечных и бездушных что запугали чем-то полстраны» (<https://www.inpearls.ru/>). С телеэкранов в сюжетах фильмов разного жанра отчетливо внушаются существование не столько добра и зла, но и «менеджмент» их способов проявлений. Та или иная лож выдается за правду. Затронутые ассоциации, верования, а также технологии достижения целей исследованы и доступны научному сообществу [2-9].

Актуально иметь модели, раскрывающие в той или иной степени, суть социального явления. Слишком мало встречается попыток количественного измерения рассматриваемых ниже факторов, их взаимосвязей с измеряемыми социальными, экономическими, индивидуальными или с другими показателями. В текстах [2-9] изучаются смысловые, специальные, измеряемые факторы. Широко представлены зависимости между политическими, экономическими, социальными, индивидуальными свойствами, факторами, событиями. Но мало разработок по формализации [2-9].

Рассмотрим легко воспринимаемые индивидом скрытые факторы. Еще раз подчеркнем -мы утверждаем, что рассматриваемые факторы являются одними из многих, не являющихся определяющими в жизни общества. Будем считать источником проявлений 3-х из 4-х рассматриваемых факторов наличие дисбалансов между возможностями и потребностями, между возможностями и ответственностью.

Скрытые социально-экономические факторы

Известно, что существуют скрытые факторы, значения которых не измеряются, но они вычисляются как значения переменных, равных линейным комбинациям фактически измеряемых

показателей. Например, в работе [10] применяемые нами ниже главные компоненты (principal components) называют «смысловыми» (semantic variables). Смысл их передается в фразах «статус родителей», «средняя школьная оценка за устную речь». Другие фразы, передающие иные смыслы, приведены, например, в работах [11-14]. Число таких фраз равно $\ell=2,3,4$. Наши $\ell < n$ главные компоненты будем интерпретировать как главные содержательно имеющие экономический или иной смысл факторы. Им поставим в соответствие ℓ у-переменные. В модели число у-переменных полагаем равным числу n измеряемых показателей (представленных в модели через n z-переменные) реального объекта, но будем придавать названия только тем z-переменным, которые имеют веса, превышающие порог «умеренного» проявления (восприятия индивидом) коррелированных показателей индивидуального сознания индивида.

В нашей модели будем учитывать значения весов $\ell=4$ факторов $\lambda_1, \dots, \lambda_4$ (значения только ℓ из n у-переменных), будем определять названия, значения n коррелированных z-переменных z_1, \dots, z_n . Эту задачу схематично изобразим так: $\Lambda_{\ell \ell} \Rightarrow (y_1, y_2, \dots, y_{\ell}) \Rightarrow (R_{nn}, C_{nn}, Z_{mn})$. Для численного моделирования матрицы «весов» C_{nn} , матрицы безразмерных значений z-переменных Z_{mn} будем применять ОМ ГК [11], апробированная в других предметных областях [12-14].

Разработаем математическую модель цифровизации показателей индивидуального сознания для предметной области «индивидуальное сознание» (ИС).

Одним из примеров выявления факторов, скрываемых за измеряемыми показателями в школе у школьников и у родителей, является пример, опубликованный в статье [12]. Когнитивная карта и модель социально-экономических факторов карьерной успешности школьников муниципальных школ США позволили «вытянуть» содержательный вывод из данных. Обоснованность формализации в предметной области подтверждена двумя фразами для факторов, приводимых ниже. Схема изображается в виде ПМГК: $Z_{mn} \Rightarrow (R_{nn}, C_{nn}, \Lambda_{nn}, Y_{mn})$. Ей соответствует прямая смысловая схема: (смысл(z_1), ..., смысл(z_n)) \Rightarrow (смысл(y_1), смысл(y_2)), реализованная в работе [12]. Ниже с применением ОМ ГК реализована смысловая схема, обратная к приведенной выше: (смысл(y_1), смысл(y_2)) \Rightarrow (смысл(z_1), ..., смысл(z_n)).

При реализации прямой смысловой схемы были решены задачи по выявлению $\ell=2$ фактора (первые 2 столбца матрицы Y_{mn} содержат m значений у-переменных y_1, y_2), влияющих на будущую карьерную успешность школьника

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(целевой содержательный критерий). Остальные $n-l$ столбцов не рассматриваются, их дисперсии малы, интерпретируются как несущественные факторы системы. Элементы спектра $\Lambda_{nn}=\text{diag}(\lambda_1, \dots, \lambda_n)$, равны дисперсиям факторов. Но мы рассматриваем только существенные $\lambda_1, \dots, \lambda_l, l=2$.

Но в предметных областях «работают» разные целевые критерии. Поэтому мы будем использовать только формальные уравнения из модели (из ПМ АГК), но будем решать обратную задачу к задаче, решенной в ОМ АГК: $(y_1, y_2, y_3, y_4) \Rightarrow Z_{mn}$. Здесь Z_{mn} - таблица (матрица) размерности $m \times n$, где n - число моделируемых нами показателей. Они адекватны реальным измеряемым показателям, характеризующих рассматриваемую систему {«правильно», «принудительно», «с обманом», «под страхом»}. Фиксированные значения дисперсий от значений этих 4 факторов обозначим как $\lambda_1, \dots, \lambda_4$. Соответствующие параметры, переменные, уравнения ограничений, целевая функция разработаны, опубликованы в [11-14].

Для реализации нашей модели необходимо реализовать схему: $(\lambda_1, \dots, \lambda_n) \Rightarrow (y_1, y_2, y_3, y_4) \Rightarrow Z_{mn}$. Суть этой модели - в выборе 4-х главных факторов, определяющих $m > n$ значений $p > 4$ коррелированных показателей, характеризующих нашу систему {«правильно», «принудительно», «с обманом», «под страхом»}. Возможно, что каждый элемент нашей системы характеризуется разными числами показателей, например, $n=5+9+7+4=25$.

Рассмотрим систему из четырех некоррелированных y -переменных y_1, y_2, y_3, y_4 . Им в соответствие поставим 4 фактора проявления индивидуального сознания, их проявления полагаем независимыми. Поставим в соответствие этим 4 неизмеряемым показателям (обобщенным факторам) теоретические случайные величины $\xi_1, \xi_2, \xi_3, \xi_4$. Это позволит нам формализовать динамику, взаимосвязи, присущие реальным значениям наших 4 факторов.

Будем рассматривать безразмерные значения всех анализируемых переменных, включая переменные y_1, y_2, y_3, y_4 и переменные (назовем их z -переменные), образующие линейные комбинации $y_1 = z_1 c_{11} + \dots + z_n c_{n1}$, $y_2 = z_1 c_{12} + \dots + z_n c_{n2}$, $y_3 = z_1 c_{13} + \dots + z_n c_{n3}$, $y_4 = z_1 c_{14} + \dots + z_n c_{n4}$. Значения остальных модельных факторов y -переменных y_5, \dots, y_n моделируются, их значения удовлетворяют соотношениям $y_j = z_1 c_{1j} + \dots + z_n c_{nj}, j=5, \dots, n$, но их дисперсии пренебрежимо малы $\lambda_4 < \lambda_0, \dots, \lambda_n < \lambda_0$, причем значение λ_0 удовлетворяет критерию приближенного равенства нулю дисперсий y -переменных y_5, \dots, y_n .

Это означает с точки зрения математической статистики равенство нулю парных коэффициентов корреляции: $\text{corr}(z_1, y_2) = c_{12} = 0$, $\text{corr}(z_1, y_3) = c_{13} = 0$, $\text{corr}(z_2, y_3) = c_{23} = 0$. Доказательство факта о том, что матрица C_{66} собственных векторов является несимметричной корреляционной матрицей коэффициентов парной корреляции (y, z) -переменных, имеются в [15-17].

Нахождение смыслов скрытых социально-экономических факторов

Первый фактор (например, «статус родителей») имеет наибольшую дисперсию λ_1 [12]. Соответствующие ему значения будем выражать через значения 1-ой y -переменной y_1 с наибольшей изменчивостью-дисперсией λ_1 . Этим мы подтверждаем, что y -переменная y_1 является фактором наибольшей важности. Она (y -переменная) равна линейной комбинации n z -переменных, среди которых только некоторые (z_1, z_4) имеют «ощутимые» веса, а остальные - пренебрежимо малые, т.е. обнуляемые при «осмыслении» их веса. Веса $c_{11} = -0.6548$, $c_{14} = -0.7014$ принадлежат интервалу «заметных» корреляций. Все значения из этого интервала, если они являются коэффициентами уравнения, будут участвовать в процессе нахождения вышенайденного смысла переменной y_1 . Бесконечное множество пар весов из указанного интервала придадут один и тот же смысл переменной y_1 . Если $y_1 = z_1 c_{11} + \dots + z_n c_{n1}$, $y_2 = z_1 c_{12} + \dots + z_n c_{n2}$, $y_3 = z_1 c_{13} + \dots + z_n c_{n3}$, то $\text{смысл}(y_2) = c_{12} \times \text{смысл}(z_1) + c_{14} \times \text{смысл}(z_4)$. Здесь математическая модель выражается через y -переменную в виде функции вида $y_{12} = -0.6548 z_{11} - 0.7014 z_{14} + \varepsilon_2$. Смысл новой переменной №2 равен сумме зависимых между собой смыслов: $\text{смысл } 1$ и $\text{смысл } 2$, где $\text{смысл}(z_{11}) = \text{«Оплата штатного школьного персонала»}$ и $\text{смысл}(z_{14}) = \text{«средняя школьная оценка за устную речь»}$ выразим фразой, состоящее из 2 частей. $\text{Смысл } 1 = \text{«стимулирующее оплатой (производимой школой) влияние штатных учителей и смысл } 2 = \text{«профессиональное влияние учителей, оценивших успеваемость учеников в баллах»}$. Этими фразами мы описываем другие события и факты из той же многослойной проблемной области, но другими словами. Из линейной комбинации - суммы смыслов, формируем результирующий смысл $\text{смысл}(y_{12}) \approx -0.6548 * (\text{смысл}_1) - 0.7014 * (\text{смысл}_2) = -0.6548 * (\text{оплата школьного персонала в расчете на одного школьника}) - 0.7014 * (\text{средняя школьная оценка за устную речь}) \rightarrow -1 * (\text{оплата школьного персонала в расчете на одного школьника}) - 1 * (\text{средняя школьная оценка за устную речь})$. Так как «оплата школьного



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персонала в расчете на одного школьника» не может быть реализована без выставления оценок, то «оплата» служит фоном для выставления в журналах «средней школьной оценки за устную речь». Определяющей фразой является «средняя школьная оценка за устную речь». Так как 1-ая часть – «оплата школьного персонала в расчете на одного школьника», влияет на 2-ую часть, способствует реализации событий – экзаменов, результатом которых является появление в журналах средней оценки, то результирующим событием является «средняя школьная оценка за устную речь», и нашими целевыми факторами являются факторы ученика, а не факторы родителей, и не факторы школы, то в качестве результирующего смысла у-переменной y_2 назначаем смысл 2-ой части- «средняя школьная оценка за устную речь». Имеем равенство $\text{смысл}(y) = \text{смысл}_1 + \text{смысл}_2$.

Мы сформулировали содержательный смысл новой у-переменной №2: «стимулированное зарплатой влияние штатных учителей - профессионалов, оценивших успеваемость учеников в баллах». Мы использовали значения «баллов», приписываемых значениям z-переменной №4. При использовании другой переменной с другой единицей измерения смысл z-переменной №4 передавался бы другими фразами. Коротко смысл новой у-переменной №2 звучит так: «средняя школьная оценка за устную речь».

Этот фактор успешной карьеры «измеренная» посредством вычисленных значений у-переменной №2 y_2 содержит $\lambda_2 = 1.3953/6 * 100\% = 0.23255 * 100\% = 23.255\%$ информации, получившей конкретный смысл [12]. В итоге $43\% + 23.255\% = 83.485\%$ информации превращены в конкретные «цифровые» знания.

Опыт, приобретенный в этом примере, в других предметных областях пригоден и в нашем рассматриваемом случае. Сперва рассмотрим социально-экономические факторы, затем - факторы индивидуального сознания Термин «главная компонента» относится к прямой модели анализа главных компонент (principal component analysis [18]).

Главные скрытые факторы индивидуального сознания

Рассмотрим один из простых примеров моделирования, например, 4 скрытых обобщенных факторов индивидуального сознания, которые существенно влияют на индивиды, не подверженные влиянию социального расизма, в обществе. Назовем их обобщенно (shnaiy ondru, kondru, aldau, korkyutu). В казахскоязычной среде эти термины легко

воспринимаются и ассоциируются однозначно. Вопросы словесного выражения и восприятия фраз сложны, ибо каждый язык «по своему хорош», мы не претендуем ни на полноту их охвата, ни на окончательность выводов. Перевод на русский язык не сможет отразить указанных ассоциаций, даже скрупулезный подбор слов не сможет помочь. «Правильнее будет так...» - часто звучащие фразы при дискуссиях. Но сделаем хоть плохой, но перевод. Этой четверке слов соответствуют на русском языке слова «по правде (правильно) поступать», «принудить к...», «обмануть, чтобы...», «страху нагнать...».

Пусть $\lambda_1/n, \dots, \lambda_n/n$ – веса наших факторов, где элементы суммы подчиняются условию нормировки $\lambda_1/n + \dots + \lambda_n/n = 1$ для фиксации в %-ах доли каждого слагаемого. Мы выше зафиксировали $\ell = 4 < n$. Число n факторов должно быть больше числа ℓ скрытых обобщенных факторов, смыслы которых считаем известными. Пока мы рассмотрели $\ell = 4$ таких факторов. Элементы $\lambda_1, \dots, \lambda_n$, удовлетворяющие условию $\lambda_1 + \dots + \lambda_n = f_4 * n$, где f_4 – доля суммы 4-х элементов $\lambda_1, \dots, \lambda_n$ в сумме n элементов $\lambda_1 + \dots + \lambda_n = n$. Элементы $\lambda_1, \dots, \lambda_n$ являются параметрами из другой модели [11]. Они являются элементами спектра $\Lambda_{nn} = \text{diag}(\lambda_1, \dots, \lambda_n)$. Далее в отличие от модели из [12] спектр $\Lambda_{nn} = \text{diag}(\lambda_1, \dots, \lambda_n)$ неизвестной корреляционной матрицы R_{nn} назначим входным объектом ОМ ГК: $\Lambda_{nn} \Rightarrow (C^{(\ell)}_{nn}, R^{(\ell)}_{nn}, Y^{(\ell)}_{m,n}, Z^{(\ell)}_{m,n})$, $t=1, \dots, k_t$, $\ell=1, \dots, k_\ell$. Элементы $R_{nn}, C_{nn}, \Lambda_{nn}, Y_{mn}$ прямой модели главных компонент (ПМ ГК) $Z_{mn} \Rightarrow (R_{nn}, C_{nn}, \Lambda_{nn}, Y_{mn})$, применяемые в модели из [12], могут быть элементами и ОМ ГК. Λ -выборка $Z^{(\ell)}_{m,n} = Y^{(\ell)}_{mn} C^{(\ell)T}_{nn}$ моделируется в нашей модели цифровизации (оцифровки) показателей индивидуального сознания. Интересные свойства данной Λ -выборки доказаны в [11,19]. Пример применения ПМ ГК [12] поможет читателю понять детали применения ОМ ГК в излагаемой модели. В этих моделях применяется (H-Z)-модель, достаточно удачно применявшаяся в других предметных областях [11-17].

Рассмотрим нашу систему из четырех факторов. Им соответствуют 4 у-переменные y_1, y_2, y_3, y_4 , значения которых мы будем моделировать ниже. Число значений в каждой из 4-х у-переменных равно $m > n$, соответствует матрица собственных векторов $C_{66} = \{c_{ij}\}$. Матрице C_{66} соответствует матрица весов $C^2_{66} = \{c^2_{ij}\}$, [12-15] $i=1, \dots, 6$; $j=1, \dots, 6$. Элементы c_{ij} равны коэффициентам корреляции $c_{ij} = \text{corr}(y_i, z_j)$ между i-ой у-переменной и j-ой z-переменной. Значение коэффициента парной корреляции между двумя z-переменными $r_{ij} = \text{corr}(z_i, z_j)$ является константой (коэффициентом) линейной связи между значениями двух z-переменных [11,15]: $z_{kj} = r_{ij} * z_{ki}$, $k=1, \dots, m$, $i=1, \dots, n$, $j=1, \dots, n$. Так

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как $c_j^T c_j = 1, c_j = (c_{1j}, \dots, c_{nj})^T, c_{1j}^2 + \dots + c_{nj}^2 = 1$, то значения чисел c_{1j}, \dots, c_{nj} в сумме равных 1, являются весами при значениях z -переменных z_1, \dots, z_n . Ниже в критериях 1,2,3 используется степень коррелированности $c_{ij} = \text{corr}(y_i, z_j)$, превышающий пороговое значение, а специалистам по индивидуальному сознанию более привычен термин «вес». Поэтому всюду ниже значение $c_{ij} = \text{corr}(y_i, z_j)$ будем называть «вес», а значение c_{ij}^2 – вес i -ой z -переменной z_i .

Введем правила, выраженные условным оператором вида: ЕСЛИ...ТО ..., который словесно и конкретно выразим в виде Правил 0, 1, 2. Смысл чисел $\lambda_1, \lambda_2, \lambda_3$ и λ_4 при $n=6$ будет проясняться ниже по мере изложения.

Правило 0. Если $\lambda_1 \geq 1, \lambda_2 \geq 1, \lambda_3 \geq 1, \lambda_4 \geq 1$, то необходимо анализировать 1-ые 4 столбца матрицы собственных векторов $C_{66} = \{c_{ij}\}$. Матрице C_{66} соответствует матрица весов $C_{66}^2 = \{c_{ij}^2\}, i=1, \dots, 6; j=1, \dots, 6$.

Правило 1. В сумму слагаемых $y_{i1} = z_{i1}c_{1j} + z_{i2}c_{2j} + \dots + z_{in}c_{nj}, i=1, \dots, m, j=1$, включать только то слагаемое, в котором значение z -переменной имеет значимый вес, т.е. «вес» должен удовлетворять критерию $|c_{kj}| \geq \text{const}(1) = 0.48$, если $j=1$.

Правило 2. В сумму слагаемых $y_{i2} = z_{i1}c_{12} + z_{i2}c_{22} + \dots + z_{in}c_{n2}, i=1, \dots, m$, включать только то слагаемое, в котором значение z -переменной имеет значимый вес, т.е. «вес» должен удовлетворять критерию $|c_{kj}| \geq \text{const}(j) = 0.65$, если $j=2$.

Правило 3. В сумму слагаемых $y_{i3} = z_{i1}c_{1j} + z_{i2}c_{2j} + \dots + z_{in}c_{nj}, i=1, \dots, m, j=3$, включать только то слагаемое, в котором значение z -переменной имеет значимый вес, т.е. «вес» должен удовлетворять критерию $|c_{kj}| \geq \text{const}(3) = 0.48$, если $j=3$.

Правило 4. В сумму слагаемых $y_{i4} = z_{i1}c_{14} + z_{i2}c_{24} + \dots + z_{in}c_{n4}, i=1, \dots, m$, включать только то слагаемое, в котором значение z -переменной имеет значимый вес, т.е. «вес» должен удовлетворять критерию $|c_{kj}| \geq \text{const}(4) = 0.65$.

Математической моделью новых смысловых переменных являются функции вида $y_{ij} = z_{i1}c_{1j} + z_{i2}c_{2j} + \dots + z_{in}c_{nj}, i=1, \dots, m$, которые определяются используемой теоретической моделью [18]: ПМ ГК – как метода вычисления единственной матрицы Y_{mn} , состоящей из m значений некоррелированных n u -переменных с ограничениями на веса $c_{1j}^2 + c_{2j}^2 + \dots + c_{nj}^2 = 1$, на компоненты собственных векторов: $c_{11}c_{k1} + \dots + c_{n1}c_{kj} = 0, j \neq 1, k=1, \dots, n$.

При объяснении, присвоении названия z -переменной используем правило, где ощутимость влияния z -переменной выражается пороговым значением веса $|c_{kj}| \geq \text{const}(j), k \in \{1, \dots, n\}$ для j -ой u -переменной, $j=1, \dots, \ell$. Их применяем к данным о процессах обучения школьников в

муниципальных школах США. В соответствии с нашей целью «что-то увидеть в данных» в [20] использован «когнитивный подход в моделировании, ориентированный на то, чтобы активизировать интеллектуальные процессы исследователя (субъекта) и помочь ему зафиксировать свое представление проблемной ситуации в виде формальной модели». Методология моделирования в [20] основана на моделировании субъективных представлений экспертов о ситуации и включает модель представления знаний эксперта в виде ориентированного орграфа (когнитивной карты $[(Z, Y), C]$, где $(Z_{mn}, Y_{mn} = Z_{mn}C_{nn})$ – множество факторов (n z - и n y -переменных) ситуации, C_{nn} – множество измерений n^2 причинно-следственных отношений между факторами ситуации). Здесь же используем оператор ИИ к 2 фактам, 3 правилам. Наша анализируемая таблица чисел C_{66} уменьшается до 2 столбцов, т.е. анализируем только 2 столбца ее: C_{n2} .

Если выражаться простым языком, то значение u -переменной y_{ij} равно значению z_{i1} и вес этой переменной равен c_{1j} . Например, в нашем примере (см. ниже C_{66}) $y_{i1} = z_{i2}(0.1790) + z_{i3}(0.4803) + \dots + z_{i6}(0.4816)$. Из этих весов мы рассматриваем только значимые, т.е. рассматриваем те веса, абсолютное значение которого больше 0.48. Это позволит нам иметь дело только с теми весами и с названиями z -переменных, которые значимы. Остальные веса мы обнуляем при интерпретации – их вклад в значение z -переменной (с номерами 1 и 4) считаем малым. Здесь мы применили правило: $|c_{1j}| \geq 0.48$. Ниже убедимся, что таких весов в 1-ой u -переменной 4, их номера равны 2, 3, 5, 6. А во второй: c_{12} и c_{42} .

Для наглядности мы построили граф связей [12] между одной u -переменной и z -переменными, значимо влияющими на эту u -переменную. Для факта 1: $\lambda_1 = 3.6258$, назначим пороговое значение $c(1)$, его значение полагаем (субъективно) равным 0.48.

Мы конструировали [12] выводы по 3 правилам, по Факту 1. С применением причинно-следственной зависимости в виде функции

$y_{ij} = z_{i1}c_{1j} + z_{i2}c_{2j} + \dots + z_{in}c_{nj}, i=1, \dots, m, j=1, 2$, (при $j=1$ имеем $y_{i1} = 0.4803z_{i2} + 0.4982z_{i3} + 0.4805z_{i5} + 0.4816z_{i6} + \epsilon_1$), где некоторые из совокупности измеренных (в числах) воздействий $(c_{11}, c_{2j}, \dots, c_{nj})^T$ на 1-ую новую переменную системы (по своему критерию) обнуляем [20]. В ее формуле присутствуют только те переменные z_{ik} , которые имеют ненулевые веса $c_{kj} \neq 0$, выражающие отношения между факторами ситуации. Здесь $\ell=2$, ибо $\lambda_2 = 1.3953 > 1$ по критерию Кайзера-Дикмана. Наш выбор критерия связан с нашей возможностью придать



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смыслы двум доминирующим по величине дисперсии у-переменным.

В у-переменной №1 с наибольшей вариабельностью, равной $\lambda_1=3.6258$, пороговое значение $c(1)$ полагаем (субъективно) равным 0.4 [20]. Тогда значения c_k по модулю превышают пороговое значение $c(1)=0.48$, соответственно только 4 (из 6) z-переменных с номерами $k=2,3,5,6$. Они оказывают «ощутимое» влияние на у-переменную №1 (в том числе преимущественно обеспечивают дисперсию $\lambda_1=3.6258$ -наибольшую информативность, пропорциональную дисперсии) посредством «весов» $c_{21}=+0.4803, c_{31}=+0.4982, c_{51}=+0.4805, c_{61}=+0.4816$.

Аналогично введем факты и правила для новой переменной №2. Орграфы, если их изобразить на рисунке, принадлежат одной многослойной проблемной области. Дуги (с «весами» со знаком “минус”) орграфа имеют противоположное направление, чем дуги (с «весами» со знаком “плюс”) орграфа на рисунке 1 [12]. Для 2-ой у-переменной с вариабельностью, равной $\lambda_2=1.3953$, полагаем субъективно пороговое значение $c(2)$ на веса соответствующим умеренной связи и равным по модулю 0.65, ибо при $k=1$ и $k=4$ значения c_{12} и c_{42} по модулю превышают пороговое значение $c(2)=0.65$. Следовательно, только 2 z-переменные, характеризуют влияние **школы и учителей** на 2-ую у- переменную. Так z-переменная **школа** (с номером $k=1$) оказывает ощутимое влияние посредством «веса» $c_{12} = -0.6548$ на 2-ую новую переменную - «средняя оценка за устную речь в школе 6-классников», выставленную оплачиваемыми школой учителями («в расчете на одного школьника»). Средняя **школьная** оценка за устную речь школьника, выставленная оплаченными **школой учителями** оказывает ощутимое влияние (в направлении, противоположном, чем в новой переменной №1) посредством веса $c_{42} = -0.7014$. Для новой переменной №2 аналогично вышеизложенному понимается совокупность всех прямых влияний весов c_{k2} , $k=1,4$, удовлетворяющих Правилу 2 «ощутимости»: $|c_{kj}| \geq c(2)$.

Скрытые факторы индивидуального сознания

Индивидуальное сознание есть отражение общественного бытия отдельным человеком через призму конкретных условий его жизни и его психологических особенностей. Это значит, что в сознании индивида сосуществуют (в одних случаях гармонично сочетаясь друг с другом, а в других-находясь в антагонистических противоречиях) различные духовные пласты,

верования другие элементы. Индивидуальное сознание-своеобразный сплав общего, особенного и единичного в сознании личности.

Наше объяснение фактов и правил для модуля извлечения знаний ЭС из данных - совокупность смыслов, подчиняющихся правилам для цифровых фактов, в том числе вычисленных с применением прямой и обратной моделей главных компонент [11,18]. Такому «осмыслению» подвергаются сами элементы – матрицы Λ, C, Y этой теории [12].

Четыре главные компоненты: обозначим их Y_1, Y_2, Y_3, Y_4 , полагаем модельно некоррелированными, а соответствующие им факторы индивидуального сознания независимыми. Поставим в соответствие этим 4 не измеряемым показателям (обобщенным математическим факторам) теоретические случайные величины $\xi_1, \xi_2, \xi_3, \xi_4$. Значения показателей индивидуального сознания имеют размерности. Их идентификацию проведем в другой статье.

Наличие единицы измерения не удобно при делении или умножении 2-х величин разных размерностей. Например, значению величины x , равной $x=6га \times 10человек \setminus 7тракторов \times 1га$ невозможно назначить название. Лучше иметь дело с безразмерными величиной типа $x=6 \times 10 \setminus 7 \times 1$. Результирующее i-ое значение j-го показателя x_{ij}^0 равно сумме 2-х слагаемых: $x_{ij}^0 = z_{ij}s_j + x_j^{cp}$, $j=1, \dots, n$, $i=1, \dots, m$, и имеет конкретную размерность. Переменная величина $z_{ij} = (x_{ij}^0 - x_j^{cp}) / s_j$ очищена от размерности, она является стандартизованной переменной. Моделирование z-переменной независимо от средней x^{cp} и дисперсии s_j^2 позволяет придать сумме 2-х слагаемых: $x_{ij}^0 = z_{ij}s_j + x_j^{cp}$, $j=1, \dots, n$, $i=1, \dots, m$, заранее заданные свойства: среднее арифметическое значение j-ой x^0 -переменной равно x_j^{cp} , дисперсия j-ой x- переменной равна s_j^2 . Модельные z-переменные позволяют нам формализовать динамику изменений значений z-переменных, их взаимосвязи. А взаимосвязи между парами z-переменных-выборочные коэффициенты корреляции, смоделировать в точности равными заданным значениям. Последние значения могут быть такими, какими они являются у реальных значений z-переменных, линейные комбинации которых образуют наши 4 у-переменные Y_1, Y_2, Y_3, Y_4 . После окончание этапа моделирования мы присвоим единицы измерения каждому из z-переменных, веса при которых имеют абсолютные значения, превышающие пороговые значения $c^0(j)$, $j=1,2,3,4$.

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Алгоритм моделирования значений показателей индивидуального сознания

Алгоритм состоит из 4 шагов. На 0-ом шаге, если $n > 4$, в дополнение к 4 собственным числам моделируем недоминирующие элементы.

Далее, имея полный спектр реализуем модель С.Р.Chalmers-a[5]: $\Lambda_{nn} = \langle (C_{nn}^{(\ell)}, R_{nn}^{(\ell)}) \rangle$, $n=4$, $\ell=1, \dots, k_{\ell}$. Из k_{ℓ} штук матриц $C_{nn}^{(\ell)}$ весов отбираем только те матрицы, у которых выделенные элементы удовлетворяют критерию 2. Получаем уравнения для переменных y_1, y_2, y_3, y_4 :

$$y_{i1} = z_{i1}c_{11} + \dots + z_{i4}c_{41}, y_{i2} = z_{i1}c_{12} + \dots + z_{i4}c_{42}, \\ y_{i3} = z_{i1}c_{13} + \dots + z_{i4}c_{43}, y_{i4} = z_{i1}c_{14} + \dots + z_{i4}c_{44} \quad i=1, \dots, m.$$

Обратная спектральная задача (ОСЗ[11]): $\Lambda_{nn} = \langle (C_{nn}^{(\ell)}, R_{nn}^{(\ell)}) \rangle$, $\ell=1, \dots, k_{\ell}$, реализующая алгоритм из работы [21]. В формулировке ОСЗ применяется геометрический объект-конус, в ПСЗ-гиперэллипсоид. Отличие ПСЗ от ОСЗ в том, что в ОСЗ моделируются i -ые компоненты ($i=1, \dots, n$) всех n собственных векторов, т.е. моделируются строки $c_i = (c_{i1}, \dots, c_{in})$, $i=1, \dots, n$, матрицы C_{nn} (они имеют номер $\ell=1, \dots, k_{\ell} < \infty$). Компоненты вектор-строки c_i интерпретируются как координаты n точек на одной (из бесконечного числа) образующей конуса K_{nn} [21]. В проекции на плоскость, перпендикулярную основанию конуса (на плоскость, проходящую через вершину конуса перпендикулярно основанию конуса). При этом на боковой поверхности конуса получаются 2 прямые - 2 образующих конуса. По Лемме из [21] угол между ними равен $\pi/2$. За одно обращение к программе CORMAT [22] алгоритма моделируются n образующих конуса, а на каждой образующей моделируются n точек с координатами c_{i1}, \dots, c_{in} , $i=1, \dots, n$. Из этих n^2 чисел образуется модельная матрица $C_{66}^{(\ell)}$, у которой мы анализируем только 4 первых столбца. Из матриц $C_{66}^{(\ell)}$ с номером $\ell=1, \dots, k_{\ell} < \infty$, если мы моделируем $k_{\ell}=200$ матриц $C_{nn}^{(\ell)}$. Ее j -ый столбец интерпретируется как вектор-столбец собственного вектора, зависящего от собственного числа λ_j $j=1, n$, $c_j \Lambda_{66} c_j^T = 1$, $c_j = (c_{1j}, \dots, c_{nj})^T$, $j=1, \dots, 6$. Эти равенства показывают зависимость j -го собственного вектора (вектора «весов») от всех собственных чисел. В ОСЗ: $\Lambda_{nn} = \langle (C_{nn}^{(\ell)}, R_{nn}^{(\ell)}) \rangle$, $\ell=1, \dots, k_{\ell}$, компьютерную программу CORMAT решения которой мы применяем ($k_{\ell}=200$), моделируются не n компонент j -ых собственных векторов $c_j = (c_{1j}, \dots, c_{nj})^T$, а i -ые компоненты ($i=1, \dots, n$) всех n собственных векторов, т.е. моделируются строки $c_i = (c_{i1}, \dots, c_{in})$, $i=1, \dots, n$, матрицы C_{nn} . Так как номер компоненты собственного вектора $c_j = (c_{1j}, \dots, c_{nj})^T$ равен номеру z -переменной, то в ОСЗ моделируются последовательно значения весов (c_{11}, \dots, c_{1n}). Сперва моделируются веса (c_{11}, \dots, c_{1n})

с учетом всех значений $\lambda_1, \dots, \lambda_n$ весов, затем моделируются веса (c_{21}, \dots, c_{2n}) с учетом всех значений $\lambda_1, \dots, \lambda_n$ весов, и на n -ом шаге моделируются веса (c_{n1}, \dots, c_{nn}) с учетом всех значений $\lambda_1, \dots, \lambda_n$ весов. Это означает, что на каждом шаге моделирования весов сохраняется соответствие номера i z -переменной к ее смыслу. Программа CORMAT соответствует нашей модели, потебовалась лишь модификация по применению Критериев 1-4. Смысл i -ой z -переменной неявно участвует при нашем моделировании матрицы весов. Аналитику остается лишь выявить названия и смыслы z -переменных, опираясь на внешние источники информации [1-9]. Но это требует логики высокого качества от эксперта. Наши эксперименты показали: последовательность шагов нахождения не совпадает с последовательностью вычисления весов - возможно нахождение сперва смысла z -переменной с большим номером, потом - с меньшим номером.

Применим интерпретации компонент собственных векторов неизвестной корреляционной матрицы с заданным спектром $\Lambda_{nn} = \text{diag}(\lambda_1, \dots, \lambda_n)$, $n=6$. При этом в ОСЗ значения собственных чисел (и в ПСЗ) $\lambda_1, \dots, \lambda_n$ интерпретируются нами здесь и в работах [11-21] как длины полуосей гиперэллипсоида, а компоненты собственных векторов - как косинусы (синусы) углов между i -ой z -переменной и j -ой y -переменной $c_{ij} = \text{cog}(z_i, y_j)$. Необходимо моделировать и анализировать значения парных коэффициентов корреляции Пирсона, как показано ниже, двух видов: $r_{ij} = \text{cog}(z_i, z_j)$, $c_{ij} = \text{cog}(z_i, y_j)$, и одну дисперсию $\lambda_j = \text{cog}(y_j, y_j)$. При этом парный коэффициент корреляции Пирсона r_{ij} служит коэффициентом линейной связи между k -ими значениями i -ой z -переменной и j -ой z -переменной: $z_{ki} = r_{ij} \times z_{kj}$. $k=1, \dots, m$, $i=1, \dots, n$, $j=1, \dots, n$. Эта формула позволяет вычислить значения i -ой z -переменной с неизвестным смыслом через значения j -ой z -переменной с известным смыслом, что облегчает процесс присваивания смыслов всем n z -переменных.

Пример присвоения имен значениям показателя индивидуального сознания

Зафиксируем спектр $\Lambda_{66} = \text{diag}(2.5000, 1.0000, 1.0000, 1.0000, 0.3000, 0.2000)$. Экспертно согласованными значениями являются параметры спектра: Если имеем матрицу R_{nn} или ее спектр Λ_{nn} , то значения их вычисленных f -параметров попадают всегда внутрь своих интервалов изменения [2,6,7]: $f_1(\Lambda_{nn})/n \leq f_2(\Lambda_{nn}) \leq f_1^2(\Lambda_{nn})$, $f_2^2(\Lambda_{nn}) \geq n \times f_2^{(2/n)}(\Lambda_{nn})$, $f_3(\Lambda_{nn}) \times f_3(\Lambda_{nn}) \leq f_3^{(n/2)}(\Lambda_{nn})$, $f_6(\Lambda_{nn}) \geq (n-1) \times f_3(\Lambda_{nn})^{1/(k-1)}$, $0 \leq f_4(\Lambda_{nn}) \leq 1$. будем

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использовать формулы зависимости дисперсии i -го вектора весов от взаимного расположения собственных чисел $\lambda_i, i=1, \dots, n$, друг от друга [11]:

$$\text{var}(C_i) \leq \frac{1}{m} \sum_{j=1}^n \frac{\lambda_j / \lambda_i}{(1 - \lambda_j / \lambda_i)}$$

Эта оценка выведена для спектра Λ_{mn} выборочной корреляционной матрицы R_{mn} многомерной выборки Z_{mn} из многомерного нормального распределения [11].

Задачи задания доминирующих значений и вычисления недоминирующих элементов спектра Λ_{66} неизвестных корреляционных матриц $R^{(l)}_{66}, l=1, \dots, \infty$, с заданными или неизвестными значениями наборов f -параметров видов $(f_3, f_6), (f_1, f_5), (f_3, f_4, f_6), (f_1, f_2, f_5), (f_1, f_2, f_4), (f_1, f_3, f_4, f_6), (c \times f_1, c^2 \times f_2, c^n \times f_5), c > 1, (f_1, f_2, f_4, f_6), (f_1, f_2, f_3, f_4, f_5, f_6)$ рассмотрены и решены в работах [11-17]. Для каждой корреляционной матрицы $R^{(l)}_{mn}, l=1, \dots, \infty$, получены модельные многомерные Λ -выборки $Y^{(l)}_{mn} \in N_s(0, \Lambda)$, многомерные R -выборки $Z^{(t, l)}_{mn} \in N_s(0, R^{(l)})$, $t=1, \dots, k_t, l=1, \dots, k_l$. Случайная n -мерная выборка объема $m > n U^{(l)}_{mn} \in N_s(0, I_{mn})$, номер $t=1, \dots, k_t < \infty$, с выборочной корреляционной матрицей I_{mn} и с неизвестным законом распределения с помощью случайных линейных преобразований превращается в многомерные выборки $Y^{(l)}_{mn} \in N_s(0, \Lambda), Z^{(t, l)}_{mn} \in N_s(0, R^{(l)})$, $t=1, \dots, k_t, l=1, \dots, k_l$. При всех наборах f -параметров спектра Λ локалены гистограммная и модельная адекватности $(R)-(C, \Lambda)-(C, \Lambda, Y)$ -выборок реальным выборкам разного объема и числа n переменных [23-25].

Для нашего спектра $\Lambda_{66} = \text{diag}(2.5000, 1.0000, 1.0000, 1.0000, 0.3000, 0.2000)$ реализуем вариант №3 ОМ ГК: $\Lambda_{66} \Rightarrow (C^{(l)}_{66}, R^{(l)}_{66}, Y^{(l)}_{20,6}, Z^{(t, l)}_{20,6}), t=1, \dots, k_t, l=1, \dots, k_l$. Значения $f_1=6, f_2=9,38, f_3=12.5, f_4=0.916666667, f_5=0.15, f_6=9,333333333$. Значение одного из главных f -параметров спектра $f_4=0.916666667$ свидетельствует о том, что значения дисперсий 4-х факторов отражают 92% информации, содержащихся в 4-х u -переменных или в 6 z -переменных. Восемь процентов (8%), содержащихся в 2-х неучтенных u -переменных, наша модель, наше когнитивное моделирование не использует, из-за ограниченности индивидуального восприятия индивида только 4-мя факторами. Анализ значений других f -параметров аналогичен приведенным в [11-17].

Модельные эксперименты проводились при разных значениях k_t, k_l . Формировались и анализировались виртуальные базы данных [14]. Исследования продолжаются. Здесь не будем анализировать, интерпретировать элементы выборки $Z^{(t, l)}_{20,6}$, их результаты будут опубликованы отдельно. Ограничимся анализом только присвоенной смыслов z -переменным, имеющим умеренную степень ($\text{const}(j)=0.5191, j=1, 2, 3, 4$) своих «весов». Выбор этого критерия связан с нашей возможностью придать смыслы z -переменным, влияющих на 4 доминирующие по величине дисперсий u -переменные.

Рассмотрим матрицу весов $C^{(l)}_{66}$ Таблица 1.

Таблица 1

Матрица весов $C^{(l)}_{66}$

ROW 1	.4971	-.3084	-0.5739	-.2884	-.1500	-.4720
ROW 2	.0736	-.4618	-.0668	.3923	-.6613	.4309
ROW 3	.4481	-.3032	-.0492	.4155	.6819	.2592
ROW 4	.2227	-0.6303	.2150	-0.6420	.1770	.2519
ROW 5	0.5191	.4397	-.0281	-.4220	-.1139	.5876
ROW 6	.4771	-.0953	0.7854	.0093	-.1756	-.3399

$\text{corr}(y_1, z_5) = 0.5191 \geq \text{const}(1)$, корреляция между 1-ой u -переменной и 5-ой z -переменной выражена умеренно: $\text{corr}(y_1, z_5) = 0.5191$, корреляция между 1-ой u -переменной и 5-ой z -переменной, то смысл этой переменной придадим после обсуждения всех выраженных умеренно переменных. Анализ всех «весов» выявил следующую картину. В уравнении для 2-ой переменной y_2 «вес» c_{42} имеет умеренную степень корреляции - $\text{corr}(y_2, z_4) = -0.6303 \geq 0.5191 \geq \text{const}(2)$. В уравнении для 3-ей переменной y_3 веса $c_{13} = -0.5739, c_{63} = -0.7854$ имеют умеренную и более умеренную степени корреляции $-|c_{13}| \geq \text{const}(3), |c_{63}| \geq \text{const}(3)$. В

уравнении для 4-ой u -переменной y_4 вес c_{14} имеет умеренную степень корреляции - $c_{64} = -0.6420, |c_{64}| \geq \text{const}(4)$.

Приступим к присваиванию имен к каждой из выделенных z -переменных. Так как смысл u -переменной y_1 означает «по правде (правильно) поступать», то z -переменную z_5 , (достаточно сильно коррелирующей с u -переменной y_1), при своем смысле «честность». Так как смысл u -переменной y_2 означает «принудить к...», и «вес» - $.7854$ имеет знак, противоположный знаку «веса» $\text{corr}(y_1, z_5) = 0.5191$, то z -переменной z_6 припишем смысл «бывший партократ». Смысл z -переменной z_1 в «весом» -0.5739 припишем

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«проявление командного стиля общения ...». Так как смысл u -переменной u_3 означает «обмануть, чтобы...», то z -переменную z_1 припишем смысл «лицо низкой социальной активности», а z -переменной z_2 -смысл «проявление некомпетентности».

Так как смысл u -переменной u_4 означает «страху нагнать», то z -переменной z_4 припишем смысл «проявление деспотизма».

Целенаправленные чтения текстов работ [1-9] убедили нас в правильности применении когнитивного [20] восприятия ощущений, восприятий, реакций индивида на принуждение, на «свои страхи», на «обмануть, чтобы...». Не учитывались в нашей Анализ проводился с применением языка описания ситуаций показатель– наименование – значение - единица измерения». В этой статье реализованы первые 2 возможности языка описания ситуаций. Реализации двух остальных возможностей «языка» будут описаны в отдельной статье.

Заключение

Наша цель состояла в том, чтобы показать возможности применения способа описания ситуаций «показатель–наименование–значение-единица измерения», когнитивного моделирования взаимосвязей между измеряемыми показателями индивида и скрытыми неизмеряемыми независимыми факторами воздействия на индивиды разработать модель и получить экспертным путем, руководствуясь только цифровыми фактами: $\lambda_1=2.5000$, $\lambda_2=1.0000$, $\lambda_3=1.0000$, $\lambda_4=1.0000$, $\lambda_5=0.3000$, $\lambda_6=0.2000$ и Правилами 1,2,3,4, получить названия заметных показателей, достаточно тесно связанных с скрытыми факторами воздействия на индивида. Мы обращаем внимание на полезность применения аппарата системы объяснений фактов и правил для модуля извлечения знаний из данных, при формулировке содержательных выводов при интерпретации цифровых результатов применения модели главных компонент в плохо формализуемой науке-индивидуальное сознание. Разработанная математическая модель цифровизации показателей индивидуального сознания индивида правдоподобно выявляет части элементов языка описания ситуаций «показатель – наименование – значение - единица

измерения». Когнитивный анализ и когнитивное моделирование демонстрировали эффективность применения Обратной Модели Главных Компонент [11]. Иллюстративный пример и дискуссия по приданию названий 6 коррелированным показателям индивидуального сознания при заданных 4 скрытых факторах индивидуального восприятия служат обоснованием дальнейших исследований по моделированию значений и выбору единиц измерения n коррелированным показателям индивидуального сознания, оценкам их средних и дисперсий.

При этом практические решения по принятию предыдущего значения и последующего предыдущего значения и последующего предыдущего значения и подвергнуты всестороннему анализу. Чтобы осмыслить изучаемые в этой модели процессы необходимо рассмотреть вопросы при переходе от безразмерных значений z -переменных к значениям x^0 -переменных (измеренных значений показателей) с размерностями. Здесь предстоит иметь дело с значениями средних арифметических n зависимых переменных $x^{cp} = (x^{cp}_1, \dots, x^{cp}_n)$, с их стандартными отклонениями, с эластичностями переменной x_j по x -переменным $x_i \neq x_j$, где $x_{ij} = x^0_{ij} - x^{cp}_j$, $i=1, \dots, m$, $j=1, \dots, n$. Это позволит оценивать приращение значения x^0_n при заданном приращении значения одной независимой x^0 -переменной.

Предстоит исследовать обнаруженные новые явления, объекты, проявления их свойств и необходимо разрабатывать алгоритмические методы работы с ними, выходить на новые рубежи знаний «на личностном, индивидуальном уровне» на личностном, индивидуальном уровне [1], так как «массовое сознание остается в «домашних рамках» [1]. Мы надеемся, что данное направление исследований будет способствовать преобразованию индивидуального сознания к открытости и восприимчивости. «Открытость и восприимчивость к лучшим достижениям, а не заведомое отталкивание всего «не своего» – вот залог успеха и один из показателей открытого сознания» [1].

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SECTION 2. Applied mathematics. Mathematical modeling.

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A RATIONAL DESIGN OF A HYDRAULIC PACKET CHOKE

Abstract: The results of computer simulation of non-Newtonian fluid flow (oil) in packet chokes having a different orifice diameter in a plate and distances between the orifice plates are presented in the article. The information about change of pressure, temperature, dynamic viscosity, vorticity and Prandtl number of moving working fluid at distance from an inlet to an outlet of the packet choke is obtained. It is determined that with increasing of the orifice diameter in the plate and distance between the orifice plates of the packet choke, the process of working fluid flow will be the most stable.

Key words: a packet choke, working fluid, pressure, a model, an orifice, viscosity, vorticity.

Language: English

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Introduction

A hydraulic choke is a hydraulic resistance. This device establishes a certain connection between fluid pressure drop on the choke and flow rate through it.

The packet choke consists of the several hydraulic resistances (orifice plates) which are set in a case. Distance between the orifice plates should be $l = 3d...5d$ (where d is an orifice diameter in the plate, mm). The orifice diameter in the plates is taken not less than 0.5 mm. The orifice plate thickness is determined by the formula $\delta = 0.4d...0.5d$. This hydraulic choke has high hydraulic resistance and stable flow characteristics.

Flow is repeatedly narrowed and expanded when fluid flow through the orifice plates of the packet choke. This leads to fluid pressure drop in sections of the packet choke. Herewith, the diameter reduction of the orifice in the plates leads to increasing of fluid pressure at an inlet, and the diameter increasing of the orifice in the plates leads

to increasing of the packet choke length. By means of computer simulation it is possible to determine hydraulic parameters of fluid flow, and thus to choose a rational design of the packet choke.

Materials and methods

Computer simulation of working fluid flow in the packet chokes was performed in the special program Flow Simulation [1].

Three three-dimensional solid models of the packet chokes were created for implementation of computer simulation (the Fig. 1). The packet chokes models had the different internal design. The sections number in each model of the packet choke was taken 8. The orifice plates of the packet chokes were located staggered. Main dimensions of the packet chokes models are presented in the table 1. The constant dimensions of the packet chokes were: the diameters of the inlet and the outlet – 12 mm and a width of each orifice plate – 20 mm. A height of the orifice plate was taken 40 mm.



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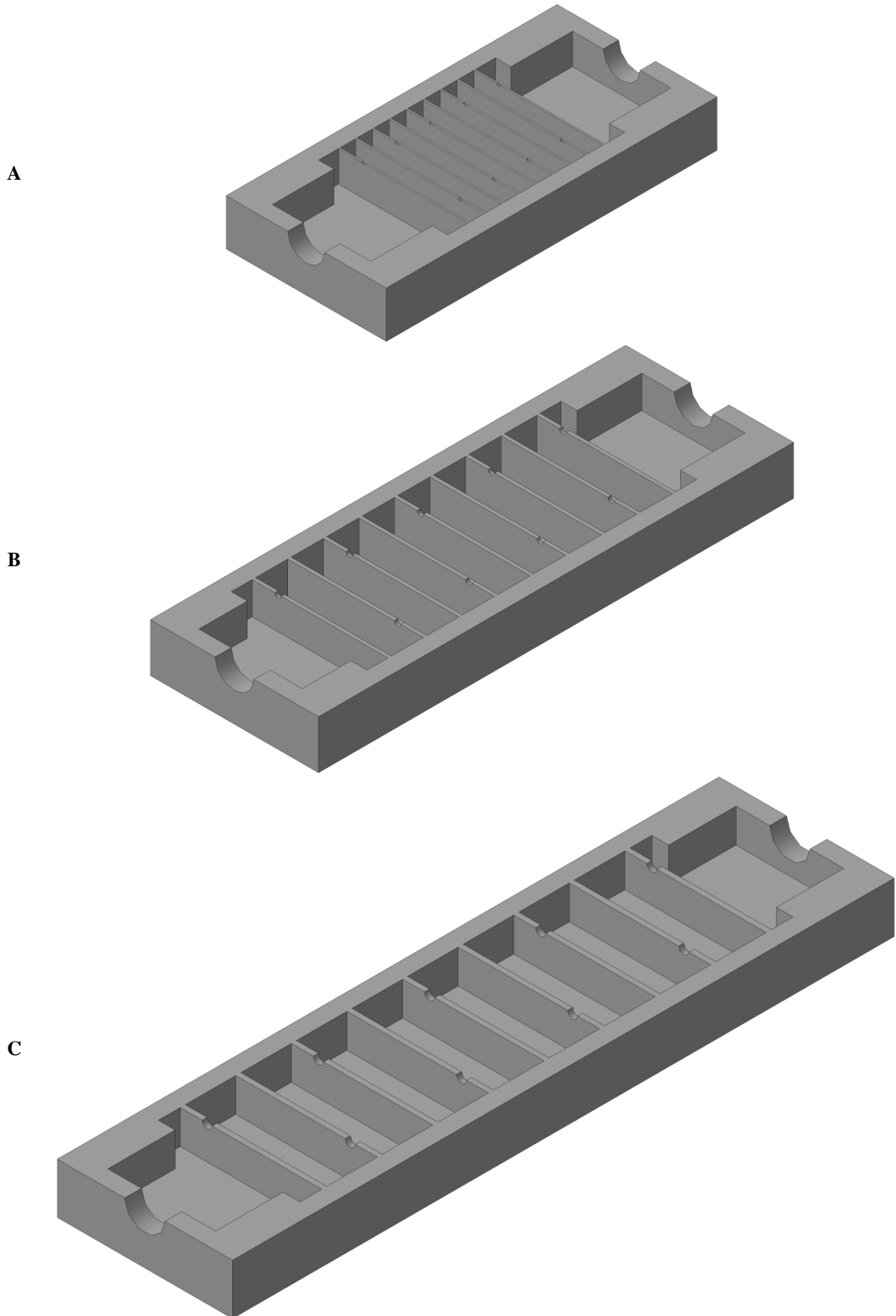


Figure 1 – The first (A), the second (B) and the third (C) solid models of the packet chokes in the longitudinal section.

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Table 1

Main dimensions of the packet chokes models.

Parameter	Value (in mm)		
	The first model	The second model	The third model
Orifice diameter in the plate, d	1	2	3
Distance between orifice plates, l	5	10	15
Orifice plate thickness, s	0.5	1	1.5

Oil (non-Newtonian fluid) was moved under pressure in the sections of the packet chokes models [2 – 4]. Working fluid at temperature of 293.2 K flows in the inlet of the packet choke at a velocity of 0.5 m/s. Working fluid outflows under static pressure of 101325 Pa from the outlet of the packet choke. The following properties were adopted for working

fluid: density – 917.53 kg/m³, specific heat – 1971.8 J/(kg×K), thermal conductivity – 0.17 W/(m×K). Viscosity of working fluid was calculated by power-law model [5 – 6]. Power-law index was taken 1. The dependence of consistency coefficient from temperature is presented in the Fig. 2.

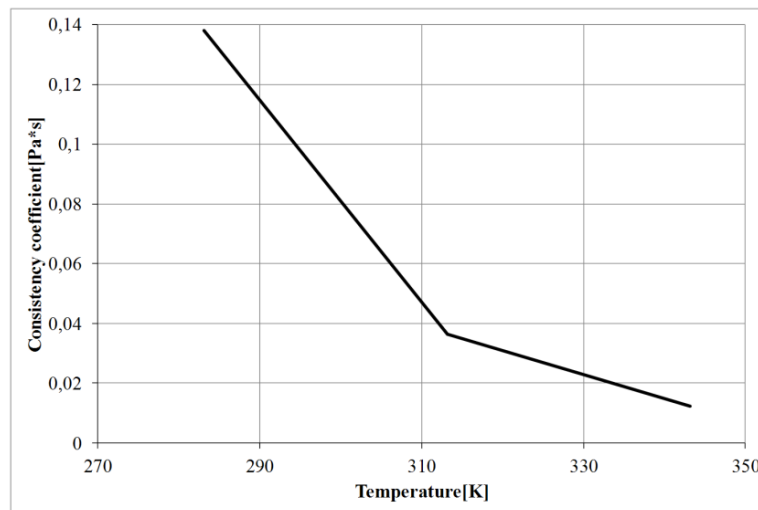


Figure 2 – The dependence of consistency coefficient from temperature.

Iron was accepted by material of the packet choke. Initial temperature of material of the packet choke was taken 293.2 K. The following parameters were set for internal surfaces of the packet choke: walls roughness – 5 μm, wall radiative surface – black body [7], specular coefficient – 0, emissivity coefficient – 1, solar absorptance – 1. The ratio of finite elements of the solid model (the choke) to finite elements of the working fluid model is 1:10. This says about a high quality of the simulation results of working fluid flow in the packet choke.

Results and discussion

The results of computer simulation are presented in a form of color plots characterizing a change of the some hydraulic parameters of working fluid when moving in the packet choke model.

Trajectory of working fluid flow in the packet chokes models is presented by color lines. Working fluid pressure in the models of the packet chokes is presented in the Fig. 3.

Working fluid pressure at the inlet of three models of the packet chokes is different. At that in the first model of the packet choke, working fluid pressure is maximum in value, in the third model is minimum pressure. Working fluid pressure at the inlet decreases with increasing distance between the orifice plates and the orifice diameter in the plates of the packet choke.

The first model of the packet choke is irrational, because for creation of working fluid static pressure at the outlet, high pressure of working fluid at the inlet (approximately 441 MPa) is required. This high pressure contributes to damage of the plates in the design of the packet choke. From the presented models of the packet chokes it is preferable to use the third model, since pressure drop of working fluid from the section to the section is not more than 0.1 MPa.

Working fluid temperature in the models of the packet chokes is presented in the Fig. 4.

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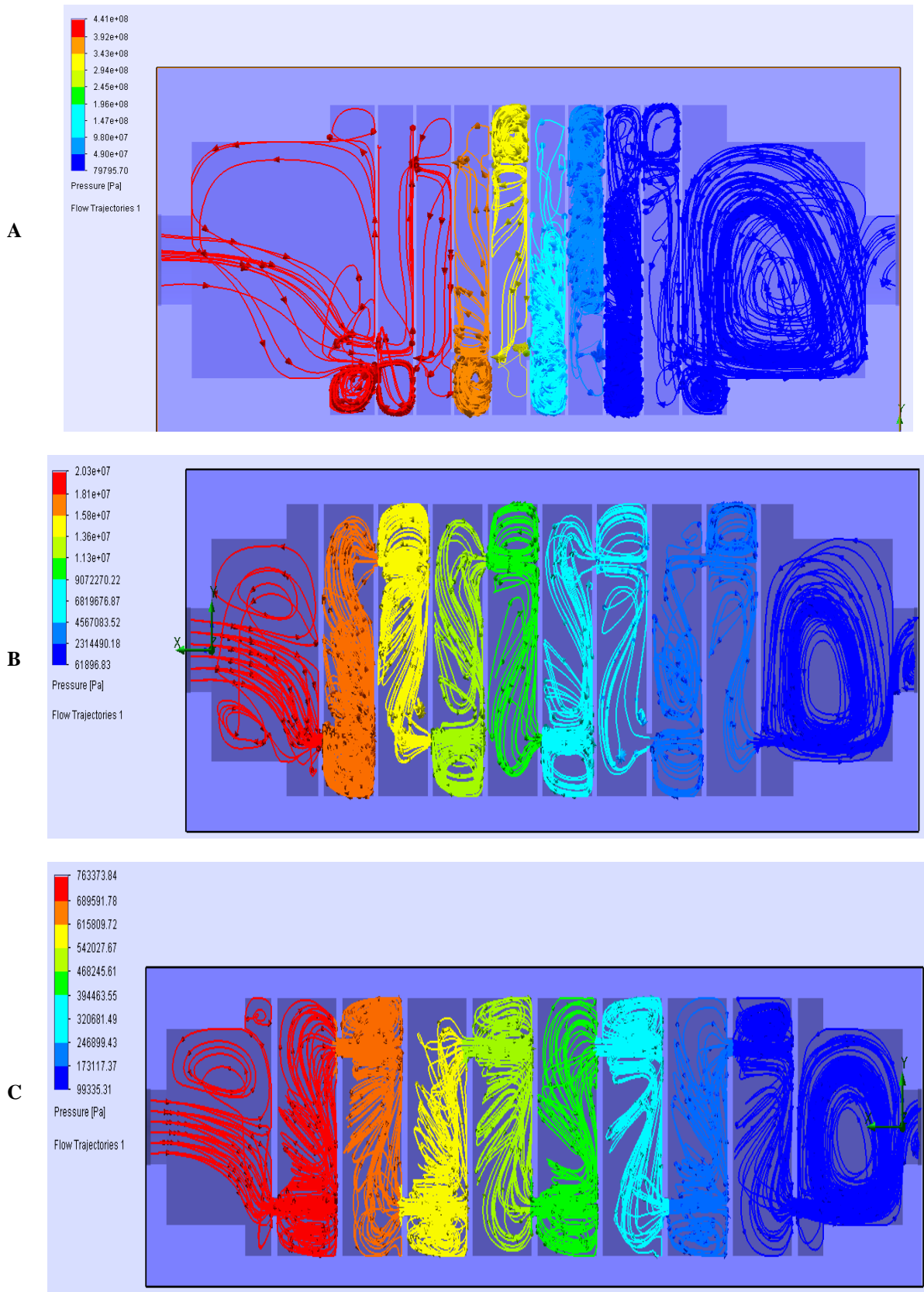


Figure 3 – Working fluid pressure in the first (A), the second (B) and the third (C) models of the packet chokes. The orifice of the packet choke on the left is the inlet (and further), the orifice of the packet choke on the right is the outlet (and further).

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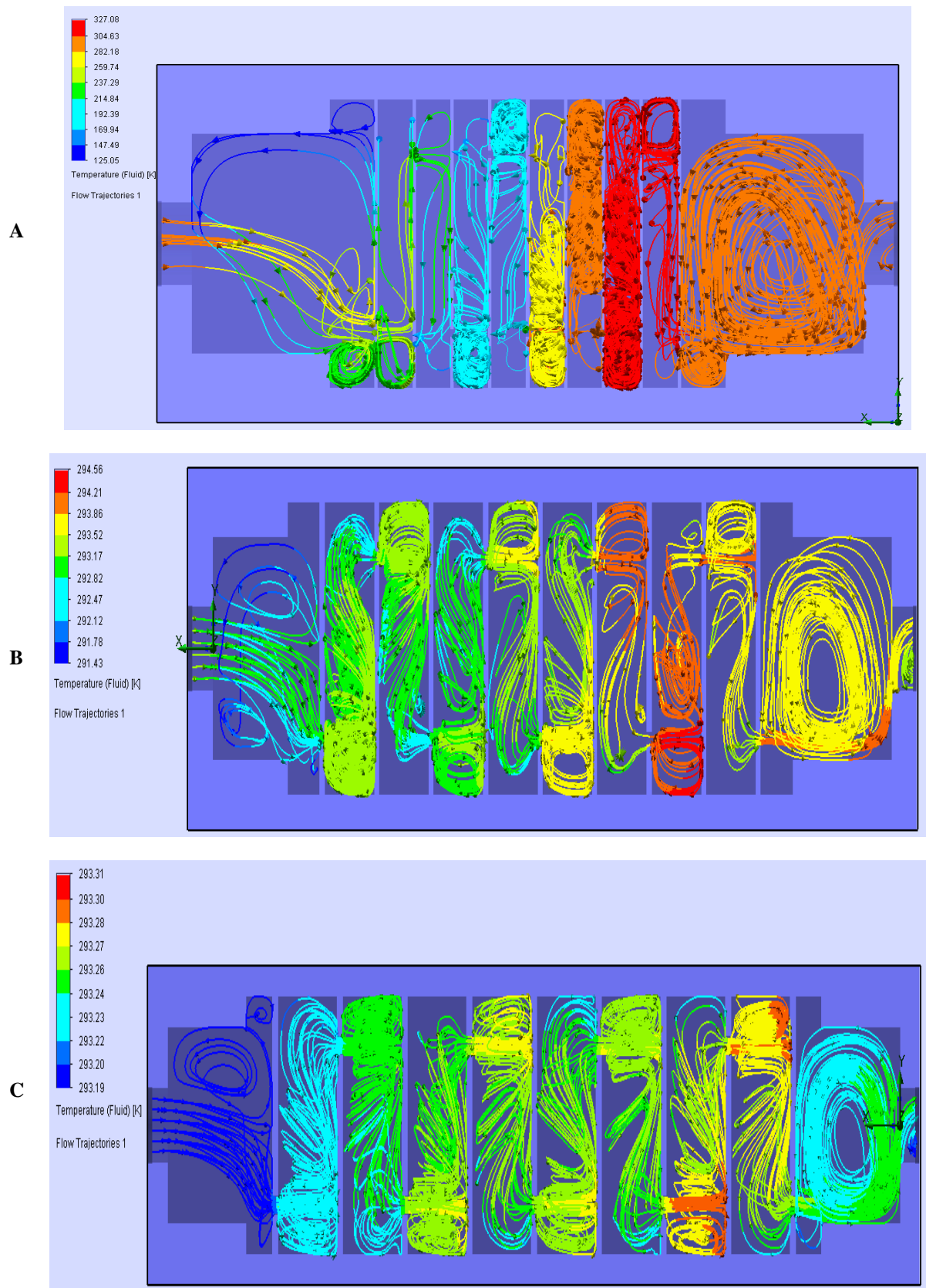


Figure 4 – Working fluid temperature in the first (A), the second (B) and the third (C) models of the packet chokes.

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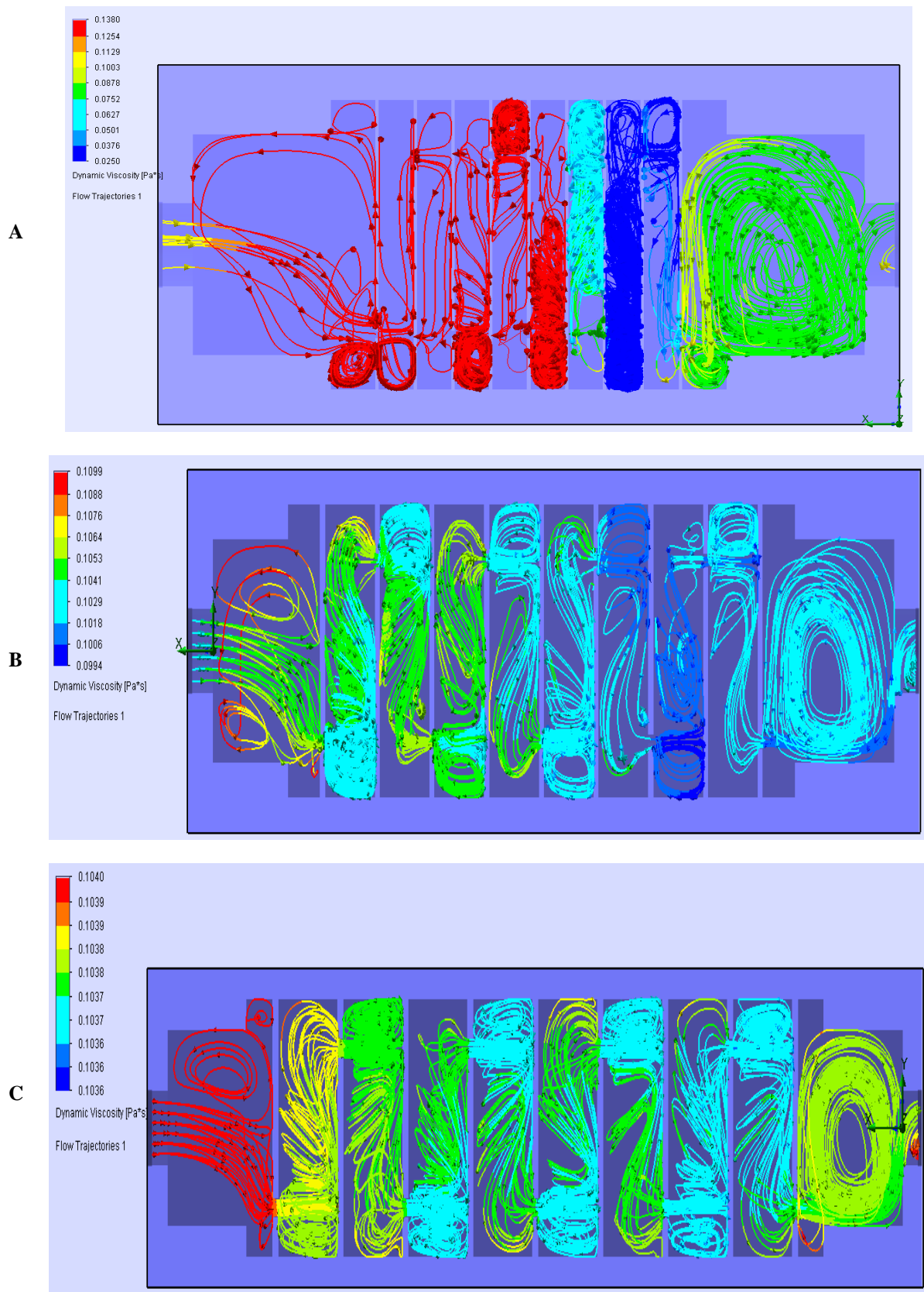


Figure 5 – Dynamic viscosity of working fluid in the first (A), the second (B) and the third (C) models of the packet chokes.

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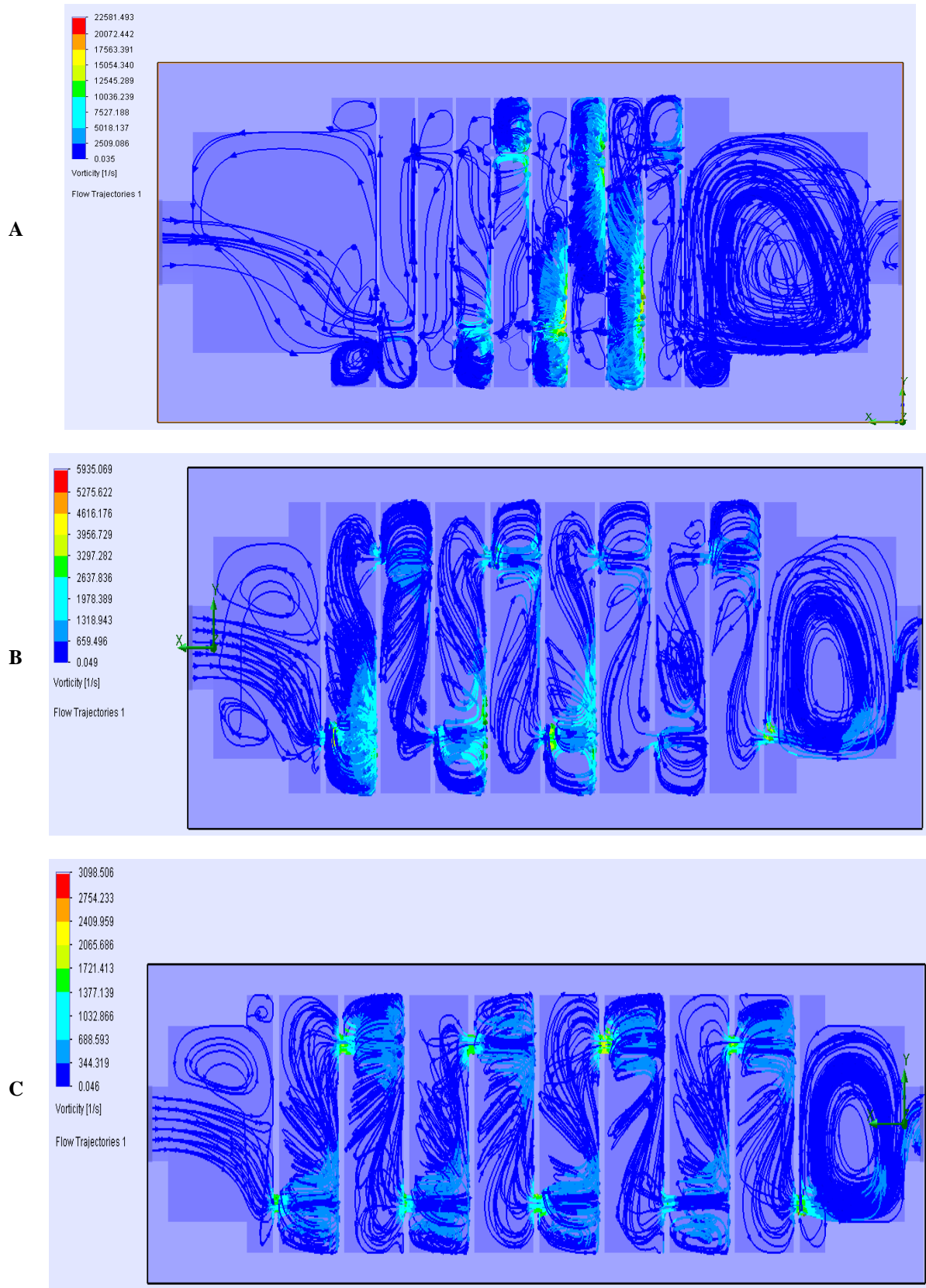


Figure 6 – Working fluid vorticity in the first (A), the second (B) and the third (C) models of the packet chokes.

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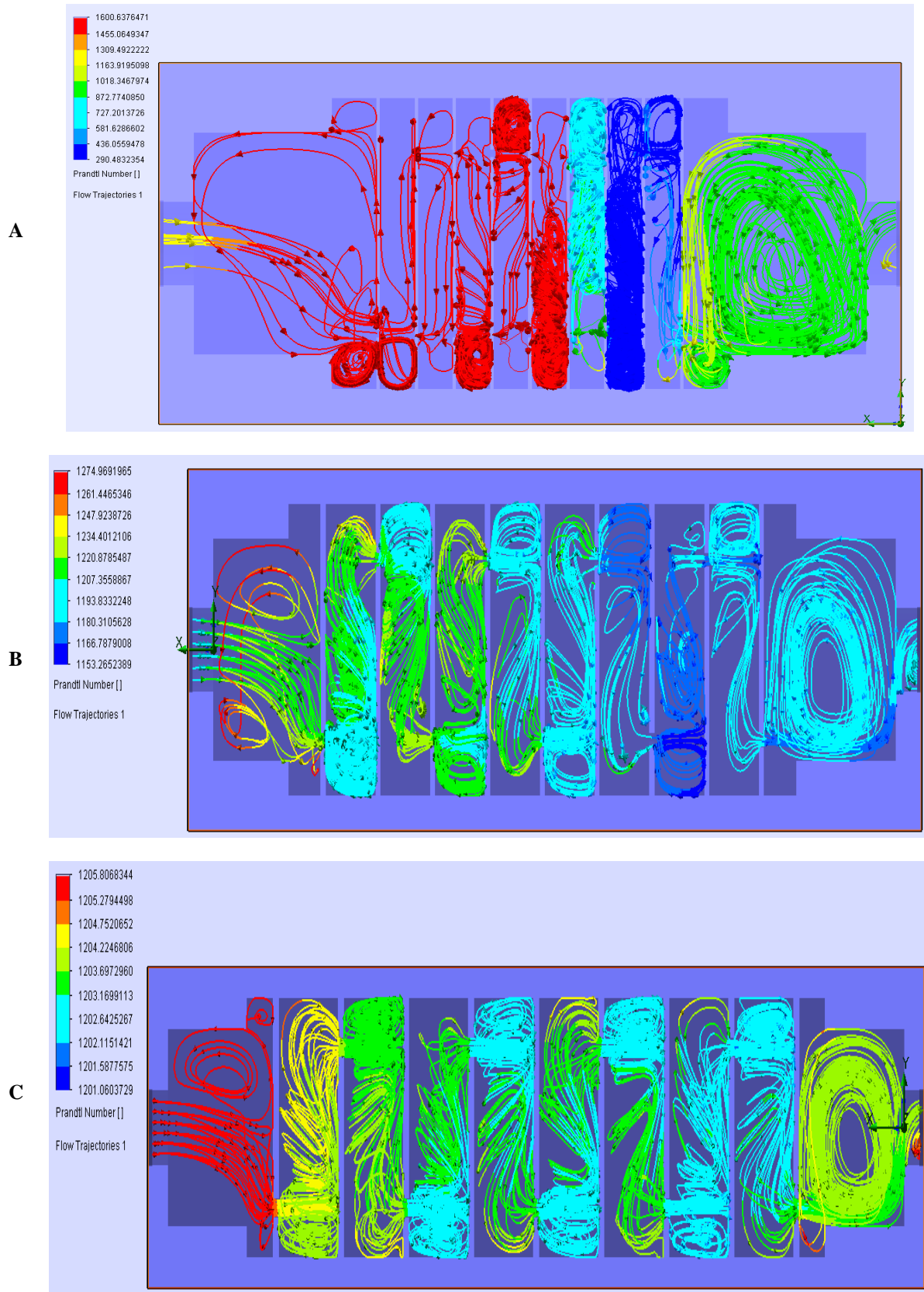


Figure 7 – Prandtl number for working fluid in the first (A), the second (B) and the third (C) models of the packet chokes.

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Working fluid temperature at the inlet differs slightly from working fluid temperature at the outlet, despite temperature changes in the sections of the packet chokes models.

Dynamic viscosity of working fluid in the models of the packet chokes is presented in the Fig. 5.

Dynamic viscosity of working fluid does not change in 70% of the sections volumes of the first model of the packet choke at high pressure, and non-Newtonian fluid has the properties of Newtonian fluid. Flow velocities gradient decreases when working fluid pressure decreases. At movement of working fluid from one section to another section through the small diameter orifice are observed the following changes:

1. Dynamic viscosity of working fluid is more before the orifice;

2. Dynamic viscosity of working fluid is less after the orifice;

3. Dynamic viscosity increases at movement of working fluid from the orifice to the next orifice.

Working fluid vorticity in the models of the packet chokes is presented in the Fig. 6.

Working fluid flow at the inlet is laminar in three models of the packet chokes. Vortices are formed before and after the orifices in the plates of the packet choke. Vortex formation frequency of working fluid flow in the first model of the packet choke is increased in 5 to 7 sections. The orifice diameter in the plates and distance between the plates of the packet choke affect on intensity of vortex flow of working fluid. The more the orifice diameter in the plates and distance between the plates, the less intensity of vortex flow of working fluid.

Changing of Prandtl number [8] for working fluid in the models of the packet chokes is presented in the Fig. 7.

Prandtl number P_r is proportional to dynamic viscosity η and inversely proportional to the thermal diffusivity coefficient $a = \frac{\lambda}{\rho c_p}$.

In the formula, λ is thermal conductivity of working fluid, ρ is density of working fluid, c_p is isobaric specific heat of working fluid.

Let us to find the maximum and minimum values of the thermal diffusivity coefficient in the

conditions of working fluid flow in the first, the second and the third models of the packet chokes.

1. For the first model:

$$\eta_{\max.1\text{mod.}} = 0.138 \text{ Pa}\cdot\text{s}, \quad \eta_{\min.1\text{mod.}} = 0.025 \text{ Pa}\cdot\text{s}, \\ P_{r\max.1\text{mod.}} = 1600, \quad P_{r\min.1\text{mod.}} = 290.$$

$$a_{\max.1\text{mod.}} = \frac{\eta_{\max.1\text{mod.}}}{P_{r\max.1\text{mod.}}} = \frac{0.138}{1600} = 0.8625 \times 10^{-4} \frac{m^2}{s},$$

$$a_{\min.1\text{mod.}} = \frac{\eta_{\min.1\text{mod.}}}{P_{r\min.1\text{mod.}}} = \frac{0.025}{290} = 0.8621 \times 10^{-4} \frac{m^2}{s}.$$

2. For the second model:

$$\eta_{\max.2\text{mod.}} = 0.1099 \text{ Pa}\cdot\text{s}, \quad \eta_{\min.2\text{mod.}} = 0.0994 \text{ Pa}\cdot\text{s}, \\ P_{r\max.2\text{mod.}} = 1274, \quad P_{r\min.2\text{mod.}} = 1153.$$

$$a_{\max.2\text{mod.}} = \frac{\eta_{\max.2\text{mod.}}}{P_{r\max.2\text{mod.}}} = \frac{0.1099}{1274} = 0.8626 \times 10^{-4} \frac{m^2}{s},$$

$$a_{\min.2\text{mod.}} = \frac{\eta_{\min.2\text{mod.}}}{P_{r\min.2\text{mod.}}} = \frac{0.0994}{1153} = 0.8621 \times 10^{-4} \frac{m^2}{s}.$$

3. For the third model:

$$\eta_{\max.3\text{mod.}} = 0.104 \text{ Pa}\cdot\text{s}, \quad \eta_{\min.3\text{mod.}} = 0.1036 \text{ Pa}\cdot\text{s}, \\ P_{r\max.3\text{mod.}} = 1205, \quad P_{r\min.3\text{mod.}} = 1201.$$

$$a_{\max.3\text{mod.}} = \frac{\eta_{\max.3\text{mod.}}}{P_{r\max.3\text{mod.}}} = \frac{0.104}{1205} = 0.8631 \times 10^{-4} \frac{m^2}{s},$$

$$a_{\min.3\text{mod.}} = \frac{\eta_{\min.3\text{mod.}}}{P_{r\min.3\text{mod.}}} = \frac{0.1036}{1201} = 0.8626 \times 10^{-4} \frac{m^2}{s}.$$

The thermal diffusivity coefficient of working fluid in three models of the packet chokes has almost the same value. Therefore, distance between the plates and the orifice diameter will not affect to the thermal diffusivity coefficient.

Conclusion

1. The rational internal design of the packet choke is selected under the condition of minimum pressure drop at the inlet and the outlet. These requirements are performed at movement of working fluid in the third model of the packet choke.

2. Inlet pressure and a cross sectional area of the hydraulic resistances affect on viscosity of non-Newtonian fluid.

3. The thermal diffusivity coefficient for all models of the packet chokes is in a numeric range of $0.8621 \times 10^{-4} - 0.8631 \times 10^{-4}$. Thus, the internal design of the packet choke does not affect to the thermal diffusivity coefficient.

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UDC 004.4

GEOSPATIAL ANALYSIS AND ANDROID DEVELOPMENT FOR CREATING APPLICATIONS WORKING WITH CRIME DATA

Abstract: Article describes the creation of an application for building safe routes using geospatial data analysis methods. Also this article describes the results of predictive algorithms efficiency analysis for the crime rate prediction.

Key words: geospatial analysis, predictive analytics, heatmap, crime analysis, prediction efficiency, software development, Android, Java, Python.

Language: English

Citation: Vasileva II, Kozhevnikov VA, Sabinin OY (2018) GEOSPATIAL ANALYSIS AND ANDROID DEVELOPMENT FOR CREATING APPLICATIONS WORKING WITH CRIME DATA. ISJ Theoretical & Applied Science, 06 (62): 121-126.

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Introduction

Nowadays, more and more people use Android smartphones or tablets to find a path from one point to another. Paper maps gave up their place to the convenience which mobile devices can provide.

Today many countries pay attention to digital cartography, which has become a serious tool for improving the quality of life of citizens. The scope of digital maps is quite wide. This area, called geospatial analysis, includes various types of analyses and predictions, such as traffic analysis, population analysis, geomarketing, social mapping, crime analysis etc.

Geospatial analysis is a big topic that combines parts of data analysis and digital mapping. Geospatial analysis can be very useful for planning the infrastructure of the city.

The combination of the convenience of mobile devices and the capabilities that geospatial analysis provides can significantly improve the lives of citizens.

Motivation

The purpose of this work is to develop a system for building safe routes using geospatial data analysis methods.

As it was mentioned above, there are many people who use their mobile devices to find routes.

After analyzing the situation, it turned out that at the moment there are no applications that build routes taking into account the criminal situation in the city of St. Petersburg. Thus, it was decided to create an application that can use crime data and build routes for St. Petersburg.

The main purpose of this application is to reduce the level of crime in the city by creating an opportunity for each user to build safe routes.

Implementation

The implementation is based on two main parts: data analysis and Android application.

Data analysis includes analysis of crime data for 2017, extraction of features for prediction, predictive analysis of crime rate for 2018 and transformation data into data sets of weighted geo points.

To analyze the crime rate in 2017, criminal news from the website of the Ministry of internal Affairs were used. [1]

To extract features for prediction, we used data on amenities and stores from OpenStreetMap for St. Petersburg and open data on apartments in St. Petersburg. [2; 3]

For predictive analysis the following algorithms were used:

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1. Linear regression is the simplest and most classic linear method for regression. Linear regression finds the parameters that minimize the mean squared error between predictions and the true regression targets on the training set. The mean squared error is the sum of the squared differences between the predictions and the true values. [4, p. 47]

2. Kernelized support vector machines (often just referred to as SVMs) are an extension that allows for more complex models that are not defined simply by hyperplanes in the input space. [4, p. 92]

3. Decision trees are widely used models for classification and regression tasks. Essentially, they learn a hierarchy of if/else questions, leading to a decision. [4, p. 70]

4. Random forest is essentially a collection of decision trees, where each tree is slightly different from the others. The idea behind random forests is that each tree might do a relatively good job of predicting, but will likely overfit on part of the data. If we build many trees, all of which work well and overfit in different ways, we can reduce the amount of overfitting by averaging their results. [4, p. 83]

5. Gradient boosting for regression trees is another ensemble method that combines multiple decision trees to create a more powerful model. The main idea behind gradient boosting is to combine many simple models (in this context known as weak learners), like shallow trees. Each tree can only provide good predictions on part of the data, and so more and more trees are added to iteratively improve performance. [4, p. 88-89]

The result of the complex prediction of these algorithms has been transformed into data sets consisting of weighted geographic points. We also transformed crime data for previous periods into weighted data sets to create an analyzing mode in our Android application.

Data analysis was implemented in Python using the machine learning library "scikit-learn". [5; 6]

Android application is based on Google Maps. It creates a heat map based on the weighted data sets from the previous step and finds paths using the Google API. [7]

Heat maps show the density of point features with a yellow-orange-red color continuum. Google's Geo Developers Blog describes these maps as a representation of "geospatial data on a map by using different colors to represent areas with different concentrations of points – showing overall shape and concentration trends". [8]

The application supports two modes: situation analysis and pathfinding.

In the first mode, the user can select the year on the slider from 2010 to 2019, for which a heat map of criminality will be drawn. (Fig.1) This mode allows the user to analyze the situation with crime in the city in retrospect, in the current moment and in the future, which can be useful for planning the infrastructure of the city.

In the second mode, the user can build a safe route between two points. (Fig.2) In this mode user also can see the crime heat map for 2018 year.

It is also worth mentioning that the heat map is interactive and changes its appearance when user scales the map. (Fig.3)

Android application was implemented in Java with Android development techniques. [9; 10]

The interaction between the user and the application is done through activities.

The Activity class is a crucial component of an Android app, and the way activities are launched and put together is a fundamental part of the platform's application model. [10]

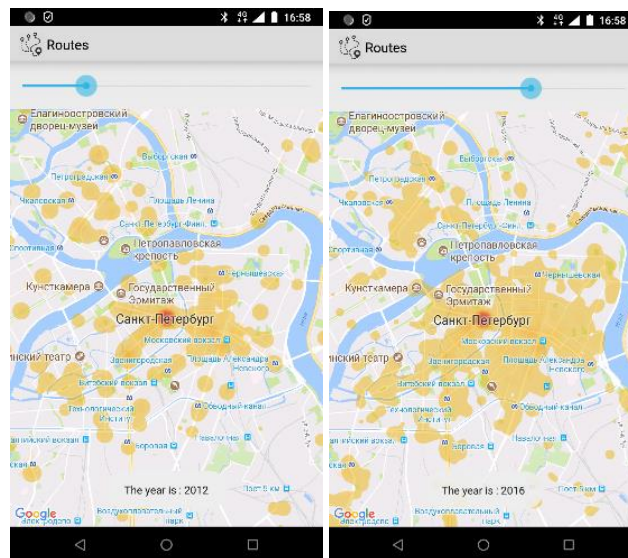


Figure 1 – Situation analysis mode demonstration.

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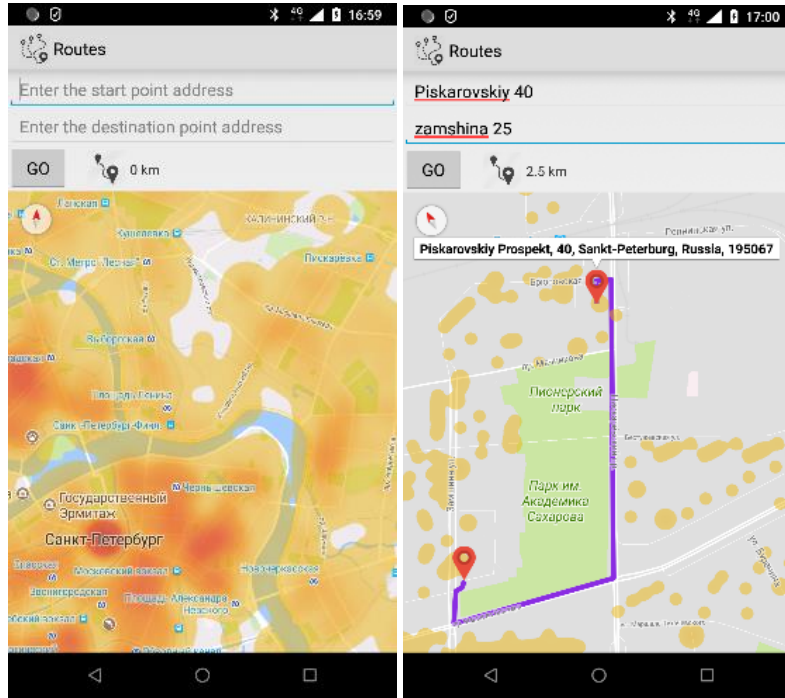


Figure 2 – Pathfinding mode demonstration.

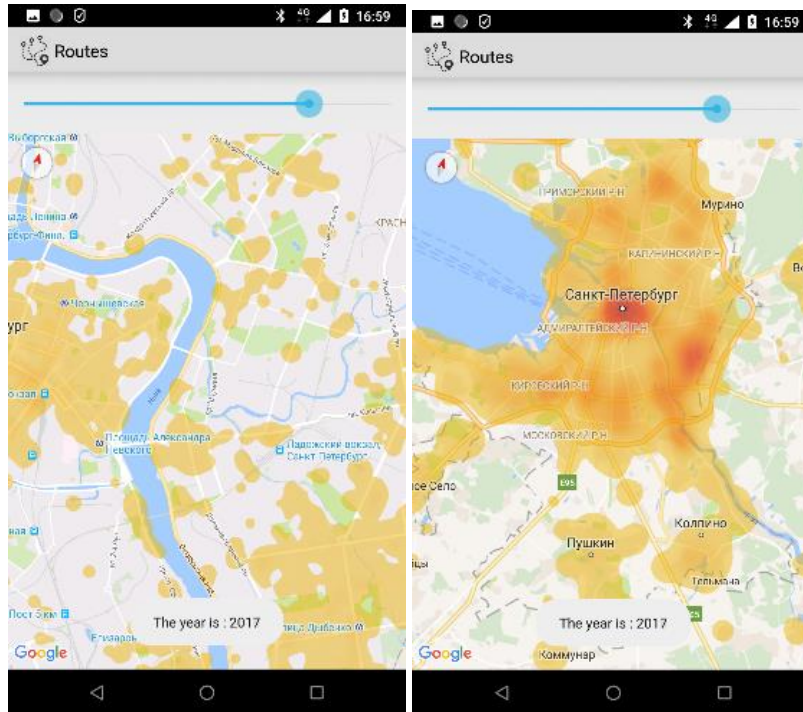


Figure 3 – Heat map behavior demonstration.

Testing

After the application was implemented, the functional testing of the application was carried out. 12 test cases were prepared to test the functionality

of the application. The test cases were launched on 11 devices supporting different versions of the Android operating system. (Table 1)

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Table 1

Devices that have been used for functional testing.

Device name	Android OS version
Smartphone Huawei Honor 8	Android 7.0.0
Smartphone Nokia 6.1	Android 8.1.0
Smartphone Sony Xperia Z Ultra	Android 5.1.1
Smartphone LG K10 LTE	Android 6.0.0
Tablet Nexus 7 (2013)	Android 6.0.1
Smartphone OnePlus 5	Android 8.1.0
Smartphone OnePlus 3	Android 8.0.0
Smartphone Asus ZenFone C	Android 4.4.2
Smartphone LG G4 H819	Android 4.4.2
Smartphone OnePlus One	Android 7.1.2
Smartphone OnePlus 5T	Android 8.1.0

All tests have been successfully passed on all the above devices, it can be assumed that the application is ready to use.

Efficiency of predictive algorithms

The analysis of the effectiveness of predictive algorithms was carried out in order to determine the trend of year selection, the data of which allow predictive algorithms to construct the best prediction for another year, as well as to establish the most effective algorithms that can be used for similar tasks of geospatial data analysis. To analyze the effectiveness of algorithms, the function of determining the quality of the forecast was written. This function is based on the Euclidean distance. The smaller the value of this function, the better the prediction.

The Euclidean distance is the straight-line distance between two points in Euclidean space. With this distance, Euclidean space becomes a metric space. The associated norm is called the Euclidean norm. A generalized term for the Euclidean norm is the L2 norm or L2 distance. [11]

The analysis to determine the trend of year selection was carried out, the result of the complex prediction of the algorithms was evaluated using the described above function based on Euclidean distance. (Table 2)

It was found that for algorithms training it is better to choose crime data of the year preceding the

year for which the prediction is performed. Predictive algorithms trained on crime data from any year better predict crime rates for the next year than any other. The trend was identified for each training year except 2010. In the case of 2010, this trend may not be apparent since the crime data for 2010 are the smallest and most fragmented of the presented data.

The efficiency analysis of the chosen predictive algorithms was carried out, the results of their work were evaluated using the described above function based on Euclidean distance. (Table 3)

It was found that the linear regression and the support vector machine are the most effective algorithms for solving the problem of the crime level prediction. This result can be explained by the fact that additional regularization for linear regression had been added and the fact that the support vector machine is sensitive to noise in data with which it can handle on its own.

Decision trees and random forest showed the worst efficiency among predictive algorithms, which can be explained by the fact that both methods have a high chance of overfitting. They explain well the examples from the training sample, but they work relatively poorly on the data that did not participate in the training.

Table 2

Results of the analysis to determine the trend of year selection.

Training year			
2010		2011	
Predict. year	Euclidian distance	Predict. year	Euclidian distance
2011	157	2012	92
2012	138	2013	94
2013	110	2014	123
2014	105	2015	205
2015	169	2016	224

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2016	186	2017	235
2017	195		X
Training year			
2012		2013	
Predict. year	Euclidian distance	Predict. year	Euclidian distance
2013	101	2014	71
2014	129	2015	144
2015	218	2016	163
2016	239	2017	175
2017	251		X
Training year			
2014		2015	
Predict. year	Euclidian distance	Predict. year	Euclidian distance
2015	106	2016	33
2016	128	2017	43
2017	140		X
Predict. Year – Predictive year			

Table 3

The efficiency analysis of the chosen predictive algorithms.

Year	Lin. reg.	SVM	Grad. boost	Rand. forest	Dec. trees
2010	70	61	107	144	159
2011	86	81	83	104	116
2012	90	96	100	110	114
2013	60	68	69	79	82
2014	105	104	105	108	110
2015	30	33	31	36	39
2016	21	23	21	24	25

Lin. reg. – Linear regression
SVM – Support vector machines
Grad. Boost – Gradient boosting for regression trees
Rand. forest – Random forest
Dec. trees – Decision trees

Practical significance

The created application can be used by any user, and can also be of interest to people involved in planning the infrastructure of the city, planning the placement of police stations in the city. This application can also be adapted to any other data based, for example, not at the level of criminality in the city.

The application can also be considered as a platform for further research on the possibility of applying data analysis methods to geospatial data. The options of such studies can be the use of neural

networks to data analysis problems, the research about tuning of the gradient boosting algorithm.

Conclusion

A ready-to-use Android application was created. This application allows users build safe routes in St. Petersburg and analyze the crime situation in the city by years. In the future, it is planned to add support of other Russian cities and modes such as building unsafe routes to create routes for the policeman patrols.

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SECTION 4. Computer science, computer engineering and automation.

UDC 004.4'2

DEVELOPMENT OF CROSS-PLATFORM UTILITY FOR THE DBA USING A LIBRARY FOR WORKING WITH BOTS

Abstract: This article considers the basic principles of building cross-platform utility for monitoring of the database state. The information about collection of database statistics and development of the library for implementing of bots on platforms of various messengers is analyzed.

Key words: Databases, Data systems.

Language: English

Citation: Kozhevnikov VA, Sabinin OY, Shats JE (2018) DEVELOPMENT OF CROSS-PLATFORM UTILITY FOR THE DBA USING A LIBRARY FOR WORKING WITH BOTS. ISJ Theoretical & Applied Science, 06 (62): 127-131.

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1 Introduction

At the present time there are many problems faced by administrators of databases (DBs) and database management systems (DBMS). One of the main problems is the problem of data security. For DBMS, which store and manage the data of enterprises, the task of ensuring safety is paramount.

By conducting a set of measures aimed at data protection, database administrators (DBAs) try to protect them as much as possible and to limit the scope of ordinary users, but for various reasons they can still create a wide variety of issues.

The article discusses the creation of a database administrator utility, based on a messaging bot, the main task of which is to notify the administrator about attempts to connect to the database and change it.

2 Motivation

Any productional database is constantly changing, both in terms of internal state (addition and modification of data), and in terms of external conditions associated, for example, with the development of software to meet new requirements. The qualitative work of the database is critically dependent on correct and timely diagnosis. It is important not only to know all the information about

the system, but also to learn about the changes as quickly as possible. You must constantly monitor the operation of the database to ensure that it is working correctly and it is not suspended by running a complex task that reduces performance. The database administrator should receive notifications about:

- How the database currently works - in general and in comparison, with other periods;
- Which requests are most heavily burdened by the server (CPU, memory, storage systems);
- How many requests and which ones have been finished, at what time and by which users
- etc.

3 Implementation

It is proposed to create a bot based on instant messenger bot library, which will allow the DBA to be constantly able to check the status of the system and be aware of its changes due to a set of commands and push notifications. This solution seems to be the most correct, since manual testing takes a lot of time, while notification of emergency situations (using push technology [1]) and the ability to quickly learn about operations can significantly reduce time costs. It should also be noted that a lot of organizations use bots, and today they are available on any platform, whether it's a desktop computer, a mobile phone or a web browser.



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As messengers for the implementation of the utility, were selected:

- Slack, the most popular corporate messenger; [2]
- Facebook Messenger, the most popular messenger around the world; [3]
- Telegram, the best platform for creating bots [4].

Since the implementation of such functionality for different DBMS is a laborious process, within this article it was decided to implement the support of only one of them – PostgreSQL, as this DBMS is free, advanced, open and rapidly gaining popularity, replacing competitors (including powerful commercial DBMSs such as Oracle, MS SQL Server, DB2, etc.). [5; 6]

The Bot API consists of several modules:

- Bot Library - a library for interacting with various messengers (Facebook Messenger, Telegram, Slack);

- Pg Log Module - module for working with PostgreSQL log-files. It takes information about the actions that occur with the database from the file, analyzes it for error messages to issue a notification to the administrator as soon as possible about what is happening;

- Pg Stats Module - a module for working with statistics, which provides PostgreSQL using the pg_stat views. This module makes queries to the extensions pg_stat_activity and pg_stat_statements and sends data to end users using the Bot Library.

The component scheme of the program is shown in Fig.1.

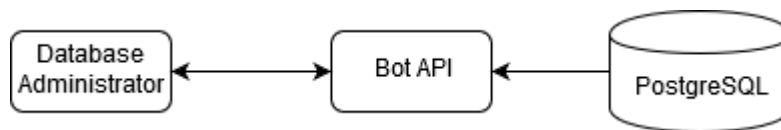


Fig. 1. Component scheme

3.1 Collecting database statistics

In PostgreSQL DBMS, there are several ways to collect information about the database [7], which we will use to send to the administrator through the bot. The main source of this information is the pg_stat_statements extension. It is a set of procedures for obtaining various statistics about the queries that the server processes. In order to obtain and process statistics, this module uses a pg_stat_statements view and auxiliary functions Pg_stat_statements_reset and pg_stat_statements. Based on the obtained statistics the administrator can perform request monitoring — look at the statistics

on time. This is extremely useful for finding the causes of various problems and for understanding what is happening on the database server in general.

While using pg_stat_statements extension the administrator receives the grouped statistics not for each query but for a group of queries identical in terms of PostgreSQL. Besides query information with help of this set of views you can learn about the number and time of reading and writing blocks on the disk (Table 1 [8]). All counters keep statistics from the start or from the moment they are reset by the database administrator.

Table 1.

Variables that contain information about the database

Name	Description
userid and dbid	OID of user and database who executed the statement
queryid	Internal hash code, computed from the statement's parse tree
query	Text of a representative statement
calls	Number of times executed
total_time	Total time spent in the statement, in milliseconds
min_time, max_time and mean_time	Minimum, maximum and mean time spent in the statement, in milliseconds
stddev_time	Population standard deviation of time spent in the statement, in milliseconds
rows	Total number of rows retrieved or affected by the statement
shared_blks_hit, shared_blks_read, shared_blks_dirtied and	Total number of shared block cache, read, dirtied and written hits by the statement

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shared blks written	
local_blks_hit, local_blks_read, local_blks_dirtied and local blks written	Total number of local block cache, read, dirtied and written hits by the statement
temp_blks_read and temp blks written	Total number of temp blocks read and written by the statement
blk_read_time and blk_write_time	Total time the statement spent reading and writing blocks, in milliseconds

It should be mentioned that only completed queries fall in `pg_stat_statements`. That is, if the query runs for a long time and is still not finished, it will be visible only in the `pg_stat_activity` view.

Also, information about database users and their transactions can be obtained from PostgreSQL

log-files (Table 2 [9]). In order to convert information and output it to user, log-files should be searched to find queries that are of interest to the administrator (user of the utility).

Table 2.

Log-messages PostgreSQL

Severity	Usage
DEBUG1..DEBUG5	Provides successively-more-detailed information for use by developers.
INFO	Provides information implicitly requested by the user, e.g., output from <code>VACUUM VERBOSE</code> .
NOTICE	Provides information that might be helpful to users, e.g., notice of truncation of long identifiers.
WARNING	Provides warnings of likely problems, e.g., <code>COMMIT</code> outside a transaction block.
ERROR	Reports an error that caused the current command to abort.
LOG	Reports information of interest to administrators, e.g., checkpoint activity.
FATAL	Reports an error that caused the current session to abort.
PANIC	Reports an error that caused all database sessions to abort.

3.2 Development of the Bot Library module

At the core of the library programming for working with bots is the understanding that the web server installs the so-called webhooks – the addresses to which the messenger server will send information about events in the chat with the users. In fact, the server receives a message and returns the response that the developer has written to user. Therefore, it is possible to consider that the most part of the bot's software interface is about to receive and send information in JSON format to special addresses on the server of the messenger.

To develop the module, it was decided to use the Java language because it is one of the most popular programming languages [10] and its library standard has everything necessary to implement the interaction with messengers [11]. Using only standard classes and methods involves the need to write a lot of repetitive low-level code, so it is more convenient to use libraries that simplify interaction with messengers. In order to do this a set of libraries which is the part of the Bot library was implemented.

To ensure that the libraries that were written can be used in other projects you should use the

framework to automate the assembly (such as Maven or Gradle) to connect external dependencies from repositories such as Maven Repository [12]. That is why this approach was used to conveniently connect the implemented library.

Once the libraries were created and built, the main task was to merge them into the Bot Library in order to developer could immediately transmit his bot to multiple platforms [11].

3.3 Analysis and testing

On average, to get information about the status of the database, the administrator is forced to: resort to either using a paid software package, or manually to view log-files and make requests for views and packages.

Due to the implemented solution, many administrators can have a significant increase in productivity.

To check how utility is running, there was created a database that stores data to execute test queries for receiving notifications. It was decided to use Open Server as a server and the software supplied with it, which provides a graphical interface

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to operate with database – PgAdmin that improves the process of setting up the environment for development. The number of transactions were executed by the premade users, also some errors were emulated for checking push notifications. As an illustration, in Fig. 2 you can see the administrator's

query to search executed "select" statements and the result of this search on different platforms.

Therefore, due to receiving notifications or requests to the bot the administrator can have up-to-date information about the status of the database, users, executed scripts, errors, etc.

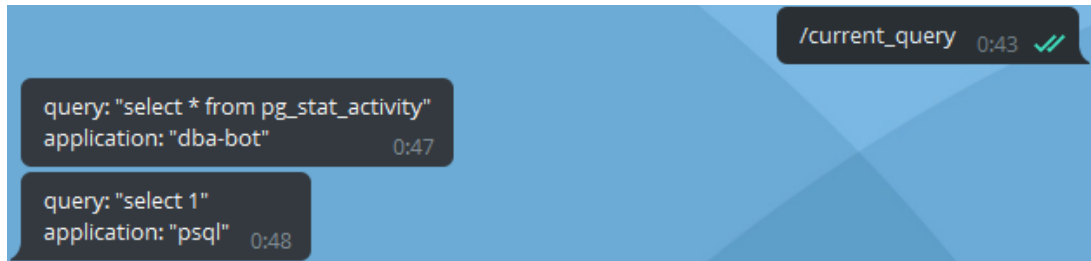


Fig. 2. Checking completed database requests on Slack platforms.

4 Conclusion

Based on methods of construction that were offered in article the utility allows DBA to quickly, easily search information about the status of the database, usage statistics, and via push notifications instantly receive information about critical situations. The architecture offered above has an important advantage – its cross-platform that gives you a

possibility to use the implemented system on a wide range of devices (clients on the desktop computer, the web browser, the mobile phone).

The implemented library allows users to create basis bots of any content on several platforms at once that increases development speed.

In the future, the authors plan is to improve the created products by adding new messengers, graphs of impact on server load and other features.

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SECTION 20. Medicine

FEATURES OF EMOTIONAL ORIENTATION AND ASSESSMENT OF AGGRESSIVE BEHAVIOUR AT STUDENTS OF VARIOUS SPECIALTIES

Abstract: Features of emotional orientation and level of aggression at the students studying at different faculties taking into account sex are considered. Irrespective of specialization, investigated praxic and romantic types of emotions are conducting at the majority. Besides, for persons of a medical and legal profile (girls) one of the leading positions the altruistic orientation occupies also them. The high level of the common aggression on five scales (verbal, physical, object, emotional and self-aggressions) is more often observed among the examined students of faculties of architecture, design and construction and the international relations that speaks about lower adaptive opportunities at this contingent.

Key words: students, emotional orientation, aggression, young men, girls.

Language: Russian

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ОСОБЕННОСТИ ЭМОЦИОНАЛЬНОЙ НАПРАВЛЕННОСТИ И ОЦЕНКА АГРЕССИВНОГО ПОВЕДЕНИЯ У СТУДЕНТОВ РАЗЛИЧНЫХ СПЕЦИАЛЬНОСТЕЙ

Аннотация: Рассмотрены особенности эмоциональной направленности и уровня агрессии у студентов, обучающихся на разных факультетах, с учетом половой принадлежности. Независимо от специализации, ведущими у большинства исследуемых являются практические и романтические виды эмоций. Кроме того, для лиц медицинского и юридического профиля (девушек) одну из лидирующих позиций занимает также их альтруистическая направленность. Высокий уровень общей агрессии по пяти шкалам (вербальной, физической, предметной, эмоциональной и самоагрессии) чаще наблюдается среди обследованных студентов факультетов архитектуры, дизайна и строительства и международных отношений, что говорит о более низких адаптивных возможностях у данного контингента.

Ключевые слова: студенты, эмоциональная направленность, агрессия, юноши, девушки.

Введение.

Многие исследователи на протяжении ряда последних лет уделяют внимание изучению эмоциональной сферы представителей студенческого контингента [1, с. 321-322; 2, с. 156; 3, с. 52-53], поскольку современный процесс обучения характеризуется новыми подходами в образовательной сфере, усиленным ростом учебной нагрузки, применением новых компьютерных технологий, что сопровождается функциональными изменениями в деятельности многих систем организма [4, с. 2829], в том числе

значительным психоэмоциональным напряжением.

Эмоции относятся к фундаментальным свойствам психики и являются одним из основных компонентов в структуре личности. Доказано, что эмоциональная направленность влияет на общую структуру эмоциональной жизни человека, на формирование его склонностей и предпочтений, профессиональной идентичности, восприятие и мышление, представление о счастье [5, с. 15].

Исследование агрессивного поведения студентов является одним из актуальных



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направлений современных исследований и необходимо для обнаружения причин его возникновения с целью профилактики проявлений агрессии, а также создания комфортной среды обучения в вузе [6, с. 13], поскольку это неадекватное, деструктивное поведение по отношению к другим личностям, противоречащее общепринятым нормам в обществе [7, с. 5-9, 30]. Кроме того, степень проявления агрессии отражает адаптированность человека в окружающей среде. [8, с. 242].

Цель исследования.

Изучение особенностей эмоциональной направленности и оценка агрессивного поведения у студентов различных специальностей.

Материалы и методы.

Исследования выполнялись в Лаборатории оптимизации учебного процесса кафедры нормальной физиологии Кыргызско-Российского Славянского университета. Обследовано 195 студентов младших курсов в возрасте 18-20 лет. Все исследуемые не имели отклонений в состоянии здоровья и были разделены на следующие группы в зависимости от факультета, на котором они обучаются: 1) медицинский (контроль) – 50; 2) юридический – 51; 3) факультет архитектуры, дизайна и строительства (ФАДиС) – 50; 4) факультет международных отношений (ФМО) – 44. У всех испытуемых определяли общую эмоциональную направленность личности по Б.И. Додонову, согласно которой выделяются следующие её типы: 1) альтруистическая – потребность отдавать, делиться, содействовать, помогать; 2) коммуникативная – потребность в общении; 3) практическая – потребность активно действовать, достигать поставленной цели, добиваться желаемых результатов; 4) гностическая – потребность в получении знаний о новом, неизвестном; 5) романтическая – стремление к необычному, таинственному; 6) пугническая – потребность рисковать, преодолевать опасности; 7) эстетическая – потребность в восприятии прекрасного; 8) глорическая – потребность в славе, переживании успеха на виду у других людей, известности; 9) акизитивная – потребность в накоплении (коллекционировании)

вещей, выходящая за пределы практической нужды в них; 10) гедонистическая – удовлетворение потребности в телесном и душевном комфорте. [9, с. 58-59].

Кроме того проведена оценка уровня агрессии с использованием опросника Л.Г. Почебуг, применяющегося для диагностики агрессивного поведения [10, с. 383-385] по 5 шкалам:

1. вербальная агрессия (ВА) – человек вербально выражает свое агрессивное отношение к другому человеку, использует словесные оскорбления;

2. физическая агрессия (ФА) – человек выражает свою агрессию по отношению к другому с применением физической силы;

3. предметная агрессия (ПА) – человек срывает свою агрессию на окружающих его предметах;

4. эмоциональная агрессия (ЭА) – у человека возникает эмоциональное отчуждение при общении с другим человеком, сопровождаемое подозрительностью, враждебностью, неприязнью или недоброжелательностью по отношению к нему;

5. самоагрессия (СА) – человек не находится в мире и согласии с собой; у него отсутствуют или ослаблены механизмы психологической защиты, он оказывается беззащитным в агрессивной среде.

Результаты и обсуждение.

В ходе исследования эмоциональной направленности представителей медицинского профиля наибольшие баллы выявлены: у юношей по шкалам практического (6,3±0,58), гностического (5,67±0,49) и альтруистического (5,05±0,57) видов эмоций (табл. 1); а у девушек (табл. 2) – практического (6,97±0,45), романтического (6,07±0,62), альтруистического (5,7±0,5). Студенты юридического факультета демонстрируют максимальные значения у лиц мужского пола (табл. 1) по шкалам практического (6,3±0,7), романтического (6,0±0,7), гностического типов (4,8±0,9), в то время как у женского (табл. 2) – практического (5,1±0,5), романтического (4,5±0,7), альтруистического (4,3±0,5).

Таблица 1

Эмоциональная направленность у юношей, обучающихся на разных факультетах

Показатель в баллах	Медицинский n= 21	ФАДИС n=19	Юридический n=19	ФМО n=21
Альтруистическая	5,1±0,6*	3,1±0,8	4,2±0,8	4,6±0,7
Коммуникативная	3,1±1	2,6±0,7	3,4±0,8	3,5±0,6
Глорическая	3,8±0,8	2,2±0,6	2,5±1,1	4,3±0,9
Практическая	6,3±0,6	5±0,6	6,3±0,7	5,9±0,7



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Пугническая	3,8±0,9	2,6±0,6	4,5±0,8	5,8±0,8
Романтическая	5±1	6,1±0,8	6,0±0,7	5,5±0,7
Гностическая	5,7±0,5*	4±0,7	4,8±0,9	5,2±0,8
Эстетическая	2,9±0,6	3,8±0,5	2,8±0,8	4,8±0,8
Гедонистическая	3,3±0,6	4±0,9	3,3±0,8	3,4±0,8
Акзигитивная	4,8±1*	-2±1	-0,8±0,8	2,4±0,7*

Примечание: показатель статистически достоверен при: * P<0,05.

Анализ результатов обследуемых ФАДиСа показал (табл. 1), что среди юношей доминируют романтическая (6,1±0,8), практическая (4,95±0,63), гедонистическая (4,0±0,86) направленность; а у девушек (табл. 2) – романтического (6,58±0,58), гедонистического (6,52±0,44), эстетического характера (5,68±0,6).

Для обучающихся на ФМО ведущими эмоциями оказались: у мужского пола (табл. 1) – практического (5,9±0,7), пугнического (5,8±0,8), романтического типов (5,5±0,7), а у женского (табл. 2) – романтического (6,5±0,6), практического (6±0,6) и коммуникативного (5,8±0,5).

Таблица 2

Эмоциональная направленность у девушек, обучающихся на разных факультетах

Показатель в баллах	Медицинский n= 29	ФАДИС n=31	Юридический n=32	ФМО n=23
Альтруистическая	5,7±0,5	4,6±0,6	4,3±0,5	5,1±0,4
Коммуникативная	4,9±0,6	4,9±0,7	3,6±0,4	5,8±0,5
Глорическая	2,6±0,7	2,9±0,6	3,1±0,6	4,7±0,7*
Практическая	7±0,5*	4,9±0,5	5,1±0,5*	6±0,6
Пугническая	2,6±0,8	1,6±0,7	3,8±0,5	5±0,7*
Романтическая	6,1±0,6	6,6±0,6	4,5±0,7	6,5±0,6
Гностическая	5,7±0,5	4,9±0,5	3,1±0,6*	5,7±0,6
Эстетическая	5,6±0,6	5,9±0,6	4±0,7	4,1±0,6
Гедонистическая	3,8±0,7*	6,5±0,4	3,6±0,6	5,6±0,5*
Акзигитивная	1,1±0,7	2,5±0,8	1,4±0,7	2,3±0,7

Примечание: показатель статистически достоверен при: * P<0,05.

Оценивая вербальную агрессию, стоит отметить, что чаще всего её высокие значения встречаются у обследуемых ФМО (57%) и архитекторов (50%), в остальных группах таковых лиц значительно меньше. По случаям максимальных параметров физической и предметной агрессии лидирующую позицию занимают также студенты ФМО (51% и 34%

соответственно). При рассмотрении показателей эмоциональной агрессии обнаружено, что первую ступень по частоте встречаемости ее высоких значений занимают архитекторы, далее расположились юристы, представители ФМО и медики. Высокий уровень самоагрессии чаще всего регистрируется среди архитекторов (58%).

Таблица 3

Уровень агрессии у юношей, обучающихся на разных факультетах

Показатель в баллах	Медицинский n= 21	ФАДИС n=19	Юридический n=19	ФМО n=21
Вербальная	4,3±0,3	3,8±0,4	3,7±0,4	4,4±0,3
Физическая	5,1±0,4	4,1±0,5	4,7±0,4	5,4±0,3
Предметная	3,3±0,4	3,5±0,5	2,7±0,4	3,8±0,5
Эмоциональная	2,2±0,3	3,2±0,4*	1,9±0,5	2,6±0,3
Самоагрессия	3±0,4	4,4±0,4*	3,8±0,5	3,9±0,5
Общая	17,5±1	18,9±1,4	16,5±0,8	20±1,3

Примечание: показатель статистически достоверен при: * P<0,05.

Показатели вербальной, физической, предметной и общей агрессии, выраженные в баллах, в группах юношей достоверно не

отличаются. Однако уровень эмоциональной и самоагрессии у представителей ФАДиСа выше, чем у исследуемых медицинского профиля (табл.

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3). Что касается девушек (табл. 4), то значения вербальной и общей агрессии у будущих врачей достоверно ниже, чем у студенток ФАДиСа и ФМО, а физической и предметной – у всех лиц

примерно одинаковы. Показатели эмоциональной агрессии также выше у представительниц ФАДиСа (табл. 4).

Таблица 4

Уровень агрессии у девушек, обучающихся на разных факультетах

Показатель в баллах	Медицинский n= 29	ФАДИС n=31	Юридический n=32	ФМО n=23
Вербальная	3,3±0,4	4,4±0,3*	3,9±0,3	4,7±0,4*
Физическая	2,5±0,4	3,1±0,3	3±0,3	3,8±0,4
Предметная	3,4±0,3	3,8±0,3	3,9±0,3	4±0,3
Эмоциональная	2,5±0,3	3,6±0,3*	3,3±0,3	3,2±0,3
Самоагрессия	4±0,4	5 ±0,4	3,8±0,3	3,5±0,4
Общая	15,5±1,2	19,8±1*	17,9±0,8	19,2±0,3

Примечание: показатель статистически достоверен при: *P<0,05.

Выводы.

Таким образом, анализ эмоциональной направленности говорит о том, что, независимо от специализации, ведущими у большинства студентов оказались практические и романтические виды эмоций, демонстрирующие потребность в достижении поставленной цели и желаемых результатов, активной деятельности, стремлении к необычному и таинственному.

Кроме того, для лиц медицинского профиля и юристов (девушек) одну из лидирующих позиций занимает также альтруистическая направленность, то есть содействие и помощь другим людям. Высокий уровень общей агрессии, отражающий низкие адаптивные возможности, чаще наблюдается среди обследуемых ФАДиСа и ФМО.

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SECTION 29. Literatute. Folklore. Translation Studies.

BABAJAN SANOIY'S WORKS IN THE KHOREZM SUFISTIC LITERATURE

Abstract: This article is devoted to difficult to have absolute imagination about literary environment of Khorezm without investigating traditions of translation school in this land.

This article considers not only short information about activity of Sanoi, but also explore his works related to Sufism and irfon. Such as "Kanz ul- Maorif" and "Khadikai azhor" as well as his translational publication.

Key words: Munis, Ogahiy, Feruz, Babajan Sanoiy (writer and translator), Khorezm scholar Sufistic and irfonic poet, "Kanz ul-Maorif" (Treasures of knowledge), "Khadikai azhar and djavohir ul-asror" (Garden of flowers and diamond of secrets), "Haft keshvar" (Seven country).

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Introduction

Works of fiction gives chance to understand the developing process of especial, unique philosophical, irfanic, spiritual and divine light soul. "Spirituality- power and strength of each person, nation, society, country and spirituality is inner forces which encourage people to spiritual purification and sublimation. It beautify inward world of people and awaken their faith" said the first President of Republic of Uzbekistan I.A.Karimov.

Undoubtedly, investigation of depiction of nations which form and prettify people's character, broaden their horizons in national literature may has great impact not only sphere of literature but also development of fictional products. There by, research of activity and literary heritage of foreign oriental writers their may of thinking as well as factors of advancement is tantamount to have comprehension about their spirituality and cultural feature.

Obviously, Islam and Sufism are part and parcel of life of nations of Central Asia. It can be easily seen that ideas of Sufism deeply rooted in everyday life and minds of people as content and gist of classic literature is full of moral ethic norms. Moreover, traditions of Uzbek people are tremendously knotted with customs of Sufis.

Materials and Methods

Progress of country and evolution of society have been always connected with science, culture and mentality.

If we look at backbone of Sufism it is apparent that there are philosophy, ethics, religion and etc. Sufism is marrow of spirituality of our nation, insomuch as nations such as "spirituality" and "spiritual" are conception of Sufis. Sufism is one of the main parts of Islamic spirituality. At present the ideas of Sufism and knowledge of Sufism have their influence on all the Muslim territories. Studying the theory and practice of Sufism includes a 12-year heritage and practice [7].

It includes understanding of the world, social and everyday life as well as attitude to earth and universe, time and place, moment and eternity. Here at it is impossible to imagine Sufism separately from development.

Literary relationships and influences are variorum and comprehensive phenomenon. Each writer has his own special method and trusted role model, person to rely on and accept as a teacher. Yet, it does not mean that his aspiration and inspiration depend only on his role model so that others have no impact on him. Writer might be influenced by the literature of either period or creative direction, even talented person who lived a long ago.



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Admittedly, the end of the 18th beginning of 20th century, period when Translation school of Khorezm functioned was fruitful and productive. In this period were written well over 150 works in Arabic, Persian, Azerbaijani and Turkish languages and became invaluable heritage of Uzbek nation. Sufistic- irfanic fictions and non-fictions constitute certain quantity of them.

For instance, with the initiative of Feruz, Najmiddin Doya's (apprentice of Najmiddin Kubra) book "Sayr ul-ibad min al-maad" which was dedicated to theory of Sufism was translated into Uzbek.

Other than that, Munis, Ogahiy, Feruz and other poets also included irfanic themes in their texts so, Bobodjon Sanoiy was nurtured and evolved as a poet and litterateur in this ambiance.

Babajan Sanoiy translated from Persian into Uzbek works called "Haft keshvar", "Mehr and Moh", "Rano and Zebo" which were strongly related to Sufism. What is more, he put pen to paper in wrote "Khadikai azhar and djavohir ul-asror" (Garden of flowers and diamond of secrets), "Kanz ul-Maorif" (Treasures of knowledge), "Dostonhoi manzum" (Poetic stories) and fostered development of sufistic literature in this land. N. Kamilov's doctoral thesis carried out the research of his several translations [3.p.142-143]. Babajan and several other writers of Khorezm were mentioned in A. Nasirov's catalogue (they are kept in the Institute of Oriental Studies of the Academy of Science of the Republic of Uzbekistan). The author of the book, Bobojon Sanoiy's first creative heritage was learnt by Dr. Najmiddin Kamilov [4.p.142-143], Doctor of Philological Sciences. There is a special page [4.p.133-165] which is devoted to this writer in his monograph, 1988. The thirty-page chapter entitled "Ibn Sina and Babajan Sanayi", gives you a brief overview in the works of Hadji azhar and Kanz ul-maarif on page 7 and the rest of the chapter[4.141-165] is devoted to his translation work.

According to statement of Sanoiy, he was passionate mainly about philosophy and sapience (wisdom). Sanoiy meticulously studied Abu Ali ibn Sino, Umar Khayam, Abu Nasr Farobiy's masterpieces and strived to deliver difficult and challenging text in an easy and understandable way to people. His "Khadikai azhar" and "Kanz ul-Maorif" were written simultaneously in 1859 with book of Fakhriy Hirotiy "Haft keshvar" (Seven countries). Fakhr bin Amir Hiravi, the 16th Century writer, is the largest of the Sanya translations, and there are several manuscripts of this epic[2].

"Khadikai azhar" is devoted to find gist (role) of individual. When Sanoiy explains person as a phenomenon of nature he relies on natural-philosophical notions, while speaking about role of

person in nature and his or her character he leans on sufistic doctrine.

"Khadikai azhar" (Garden of flowers) is autographic manuscript. It is written in the blend of nazmu-nasr and purely in Uzbek. Furthermore, destined to investigate main issue of knowledge – self-actualization. In the content of book written that from his early ages Bobodjon Sanoiy was curious about the thoughts of Abu Nasr Farobiy, Abu Ali ibn Sino and Zayniddin Muhammad Gazzoliy, subsequently, studied ins and outs of philosophy and sapience. As regards his opinion about knowledge, if each science does not serve for the truth achievement then they continue to be fruitless. Therefore, in obtaining knowledge whether in religious or temporal sphere, firstly, individuals should have imagination about benefits and merits of that study. The most importantly, person seeking for knowledge should have his own attitude to life as well as must be owner of perfection. If person is morally undeveloped, there is a highly likelihood that his knowledge will be more detrimental rather than advantageous. Following statement might be evaluated as a conclusion of his opinions about knowledge: The main idea of "Khadikai azhar and djavohir ul-asror" is that people should identify and control their desires. Should be noted that question of desire was, is and will be in the center of dispute of philosophers and scholars. Interestingly, despite impeccable and entirely accepted notion about it, there are various opinions according to author's belief and outlook to life.

In "Kanz ul-Maorif" sufistic understanding of human nature is one of preponderate opinions. There is explained the stages of reclusion:

- approach to God
- soul temper
- reaching knowledge and truth.

In introduction of his book society is criticized severely. He says: "There are that much ill-natured people that sometimes it seems that doomsday is really near. People are losing their human features and have no clue of helping others. They are like wild animals striking at each other and do not worth to carry name "human being" on their shoulder".

In Babajan's works, we find a number of lines written with regret, because many of his dreams have not come true. He lived far away from the King's palace and was imâm in the mosque of the Bakcha neighborhood in Khiva, and he did not think he was happy. He could not tolerate compromise with the spiritual poor, so he felt like strangers in that era. Numerous works have been done in the area of studying our national heritage, but still unspecified areas and sources of this rich heritage are still insufficient. Thousands of precious manuscripts are waiting for their researchers in various bookshelves

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[1.142-143.]. The works of Kanz ul-maorif (“The Treasures of Education”) and “Hadjai azhar” (“The Garden of Flowers”) belonging to Babajan Sanayi, are of great significance in the study of Sufism Teaching and Sufism History in Khorezm. Both of these books are autographs and a single copy that saving the main Fund in the Institute of Oriental Studies of the Academy of Sciences of Uzbekistan.

Uzbekistan Academy of Sciences in Oriental Studies institute manuscripts fund under the number 891 / III the author of the coming Kanz ul-maorif (Treasure of Knowledge) according to the content, it had to be eleven chapters. But there is the text of the sympathetic text. Theoretical part of the work is written in prosaic, and stories are explained in poetry.

Babajan Sanoah, who is interested in the spiritual aspirations of the nation, he was going on interpreter. In his opinion that interpreter is not only the kings, it’s the opportunity for serving to his people which it’s the style sharp thoughts and dreams were explained. “The weekly” (Seven countries)[2], “Mehr and Moh”, “Ra’no and Zebo” were translated as his as like dreams by him.

The biggest translation of Sano's work is “Haft menvar” (“Seven countries”) Fahri bin Amir, the author of which was the creator of the 16th century. In his time, the writer, Khairavi, wrote that Navoi's

“Majolis un-nafois” translated into Persian. Poetic poem “Haft menvar” is devoted to and ethical conscience that Sano’s socio-philosophical views to human, its moral and ethical conscience, on the role and place in society was explained in his translation. “It is important to give meaning not only a word. So, word-by-word to avoid the translation. Sometimes it is literally translated there is also a possibility that original work is moved on literally translated text” [8.73].

Babajan Sanoiy devoted to his life to realize this ambition. He deeply believed that it is possible to enlighten and change people, direct them to way of goodness, kindness and genialness as well. He fought for development and formation of moral ethic norms and priceless features of nation, which can be realized by the help of fiction.

Babajan Sanoiy’s poetic works are used scientific work at the first time and its unique poet’s reputation was re-established. The author’s the poetry divan is not known in the literature. Again, his masterpieces of the prose are full of artistic-aesthetic requirements has been proven. Lyric images, epic scales, plot and the perfection in the composition is appropriate and the use of image tools the fact that sensuousness ensures that it is a good foundation for these conclusions.

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FIBROUS SORBENTS FOR GATHERING OF OIL AND PETROLEUM PRODUCTS

Abstract: A review of scientific and technical literature on mitigation of oil and petroleum products spill impact, and the results of personal studies by the authors on creation of sorbing materials for collecting and extraction of petroleum products from the surface of soils and water bodies are presented. Special attention is paid to the polymer fibrous sorbents produced by melt blowing in view of their acceptable indicators by efficiency vs price criterion.

Key words: oil and petroleum products, emergency spills, ecological aftermath, sorbents, melt blowing technology.

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INTRODUCTION

Oil and petroleum products (PeP) spills on the surface of water bodies and soils are one of the most dangerous types of man-made environmental disasters. Spilled toxic substances destroy animals and plants and make the contaminated areas uninhabitable for many years. Ecological consequences of oil spills are very difficult to estimate as oil contamination disrupts many natural processes and interrelations, significantly changes the habitability conditions of all types of living organisms and is accumulated in the biomass.

Oil is a long-term decaying product and, when a man-made disaster happens in water areas, it spreads very quickly over the water surface forming a dense layer of oil film which obstructs the access of air and light. The International Petroleum Industry Environmental Conservation Association states that such disasters do not result in immediate mass mortality in fishes, reptiles, animals and plants. However, in the medium- and long-term perspective

the influence of oil spills is extremely negative. The effect of spills is the most severe for the organisms living in the coastal waters, especially the ones living on the seabed or on the surface.

Modern technologies for fighting large-scale oil spills are not always effective. Floating booms, special oil collecting vessels, sorbents, chemicals capable to "decompose" the oil or turn it into a gel (to make the collection process easier) are used. However, certain chemical agents applied for fighting such disasters are extremely toxic themselves. Nowadays, active developments are carried out in the area of creating new synthetic sorbents which meet (to a maximum degree) the integrated "price vs efficiency" criterion. Besides, the equipment allowing to carry out effective gathering of petroleum products from water surface and to directly separate (at site) water from oil is being developed.



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1. PETROLEUM PRODUCTS GATHERING METHODS

Various methods are used to gather and extract oil and PeP from the water surface. They can be conventionally divided into mechanical, thermal, physical-chemical and microbiological methods (Fig. 1).

Thermal method which is based on oil layer burning out is used when the layer thickness is sufficient and immediately after contamination before the emulsions with water are formed. As a rule, it is combined with other methods for spill elimination. Burning of spilled oil is the oldest way of cleaning the water surface.

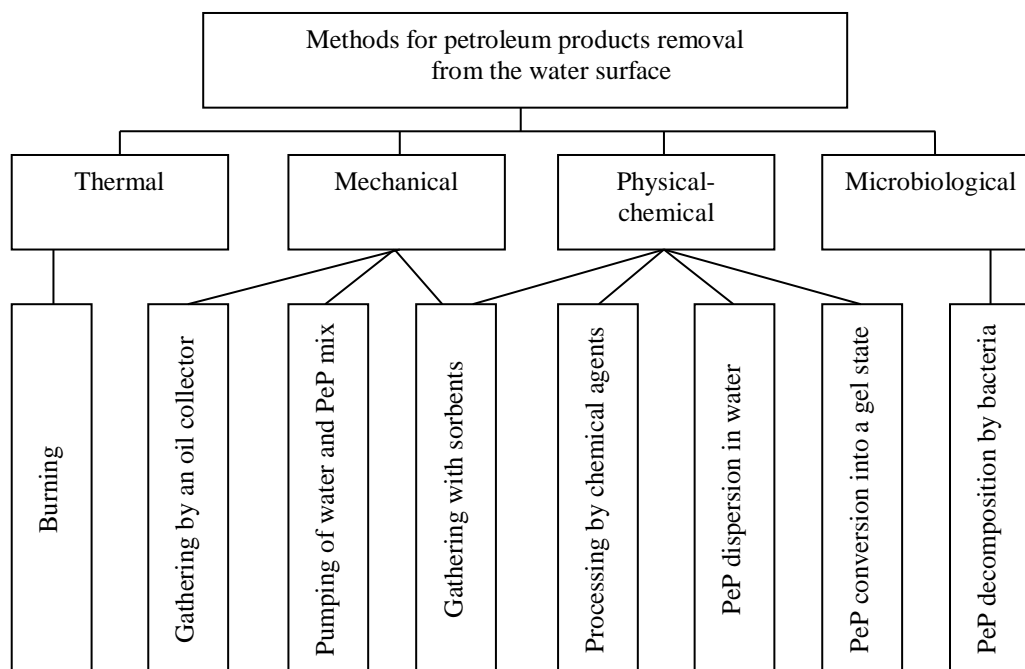


Figure 1 – Classification of methods for petroleum products gathering and extraction from the water surface [1-6]

The most obvious disadvantage of using this method of contamination elimination is that it forms huge clouds of soot and other (much more toxic) compounds resulting in heavy pollution of the air environment around the oil spill. Another limitation of this method is that it does not provide for complete cleaning of the surface from heavy petroleum products, and sometimes it is even impossible to start a fire on a thin film of petroleum products [7].

Mechanical method is the most rational way to remove petroleum products from the surface of not only reservoirs, but water streams as well. Mechanical gathering and pumping of oil and petroleum products is made by oil-collecting devices or directly by pumps from natural or artificial cavitations of the ground surface, wells or trenches (oil traps). This is the most effective way to remove the dissolved light hydrocarbons.

Physical-chemical methods using dispersants and sorbents are viewed to be effective when mechanical gathering of petroleum products is impossible, for example, when film thickness is small or when the spilled petroleum products pose

real threats to the most ecologically vulnerable areas [8].

Biochemical treatment of the water surface to remove spilled oil is still not widespread due to poor biodegradability of oil components and long duration of decomposition process (up to 6 months) [9-11]. However, this trend has gained momentum in recent years [12]. Nowadays, the microbiological method for elimination of large-scale contamination of soils and water bodies with oil is used in combination with mechanical gathering and physico-chemical methods of hydrocarbons localization when the film thickness is not less than 0.1 mm. At the same time microorganisms are capable to utilize the emulsified and dissolved petroleum products. Long duration of biological degradation process is the limitation to the application of microbial neutralization of the oil-contaminated environments. The main advantages of microbiological destruction over other methods are better treatment, ecological safety, relatively low costs, possibility to continuously process the "chronic" pollutions and possibility to use it in the areas that are difficult to access.

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Assessment of the existing methods allows to identify the most perspective directions. This is, first of all, PeP extraction using sorbents. The use of sorbing materials is the most effective way to eliminate the effects of oil contamination. For the oil film with thickness of less than 1-2 mm or a shallow water body, sorbents allow to clean the water surface from oil in a very short time at low cost. Quality of sorbents is determined, mainly, by their sorbent capacity with respect to oil, degree of hydrophobicity, floatability (both in the initial state and after sorption of petroleum products), possibility of oil desorption, regeneration and disposal of sorbent, technological effectiveness of their production and application.

2. SORBENTS FOR GATHERING OF OIL AND PETROLEUM PRODUCTS FROM THE SURFACE OF WATER BODIES

Materials used for gathering of oil and petroleum products from the surface of water bodies are commonly referred to as oil sorbents, as well as oil collectors and oil absorbers. Three main indicators are used to determine the quality of oil sorbents: oil absorption, water absorption and floatability. Efficiency of sorbents for oil gathering is estimated, first of all, by the value of oil absorption (oil capacity). High water absorption can be eliminated practically for all materials by additional hydrophobicity. Materials with low floatability can be effectively used in products with the reinforcing shell – booms, mats, napkins, etc. Various raw materials are used for oil sorbents production.

Materials capable to absorb and retain oil and PEP on its surface are increasingly applied in the worldwide practice to remove petroleum products from water. These materials can be classified by different categories, in particular: natural and synthetic, mineral and organic, natural and modified [13].

Different types of clays, diatomite rocks (mainly, friable diatomaceous earth), sand, zeolites, tuffs, pumice stone, etc. refer to *inorganic sorbents* for absorption of oil and its components [14-16]. Clay and diatomites constitute the majority of products in the sorbents' market due to their low cost and possibility of large-scale production. Sand used as a filling material for combating small spills of oil and petroleum products can also be related to this category. However, quality of inorganic sorbents is not at the high level from the point of view of ecological safety. First of all, their oil capacity is low (70-150%) and they are not good at retaining light fractions, such as gasoline, kerosene, diesel fuel. When eliminating oil spills on water, the inorganic sorbents go down together with oil without addressing the problems of water treatment to remove pollutants. Finally, washing of these sorbents

with extractive agents or water with SAS, as well as their burning-out are virtually the only methods of their disposal [17].

Besides, the materials produced by processing rocks and sedimentary rocks (expanded perlite, expanded-clay aggregate, basalt cotton wool) are related to mineral sorbents [16]. In order to achieve the required hydrophobicity properties at the surface of such sorbents, they are often processed with chemical agents: silicone fluids, vapors of mineral oils and paraffins, organic amines with aliphatic or aromatic hydrocarbon chain. However, when using the non-modified mineral sorbents there is a danger that their particles will sink together with the absorbed oil, and decomposition of the sunken oil is extremely slow and has negative impacts on the flora and fauna of water bodies [1, 18].

Natural organic and organo-mineral sorbents are a promising type of sorbents for oil pollution elimination. Wood chips, sawdust, modified peat, dried grain products, wool, waste paper are the most frequently used materials. Wool is one of the best natural sorbents which is comparable in its oil capacity to the modified peat. It can absorb up to 8-10 kg of oil per kilogram of its mass; at the same time, natural elasticity of wool allows to squeeze out much of the light fractions of oil. However, after several such squeezings the wool turns into the bituminous felt and becomes unsuitable for use. Because of its high price, insufficient quantity and strict requirements to storage (wool is very attractive to rodents, insects and undergoes biochemical transformations) the wool cannot be considered as a promising large-scale oil sorbent at all. Besides, natural organic sorbents are significantly inferior to inorganic and synthetic sorbents on sorbing capacity. However, their application is linked with the need to deliver them in large quantities to the place of localization which affects both the final costs and the time for starting the activities. Their limited floatability (which is considerably inferior to floatability of inorganic and synthetic sorbents) is also an important factor.

The synthetic sorbing materials are mostly produced based on carbamide formaldehyde resins, polyvinyl chloride, nylon, lavsan, Nitron, polypropylene, as well as the natural and synthetic latexes, rubber resins and rubbers made in the form of powder, fibrous material, various foam plastics [19-25]. Hydrophobization is used to increase floatability and oil capacity of this type of sorbents. Some existing methods of hydrophobization for fibrous materials are rather difficult to perform, technological process requires significant amounts of flammable solvents, thus increasing fire and explosion hazards of the processes. Runoff of the part of absorbed petroleum products (sometimes - up to 60-70%) when the sorbent is extracted from the



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water surface is a significant drawback of the majority of fibrous sorbents [26-29].

Synthetic oil sorbents are used in the countries with the advanced petrochemical industry (USA, EU countries, Japan). Most commonly, they are made of the polypropylene fibers which are formed into non-woven rolled fabrics of different thickness. Besides, polyurethane in the spongy or granulated form, formed polyethylene with polymer fillers and other types of plastics are used. At the same time, their application in the form of high-dispersed powders to increase efficiency of the use on thin films is inadmissible due to the risk of cancerogenic diseases. On the other hand, the use of different synthetic materials which have (along with the large pore volume) a rigid three-dimensional lattice pattern is of great interest for wastewater treatment. Polyurethane foam (PPU) polyfoams possess rather high sorption properties [21, 30, 31]. Their oil capacity is 6-8 kg/kg. One of their drawbacks is that polyurethane polyfoams absorb water in the conditions of increased salinity.

Actually, sorbents, both natural and synthetic (e.g. perlite, vermiculite, zeolite) can absorb in their porous structure only up to 0.2-0.3 g of oil per 1 g of sorbent, however, owing to adhesion the amount of oil retained at the sorbents increases manifoldly. The sorbents can be modified to improve their adhesive properties. So, the perlite treated with organosilicon compounds collects up to 6-9 g/g of oil. One gram of hydrophobized basalt fiber is capable to retain up to 50-60 g of light petroleum products. Heavy sorbents, such as zeolite and vermiculite, can be used for oil sinkage, while the light ones – for formation (on the surface of water and soil) of an oil-saturated

sorbent layer with subsequent removal of this layer and its concentration in the places of oil disposal and destruction.

Sorbents based on different wastes of agricultural and wood-processing industries are represented by various products. They are produced on the basis of sawdust, buckwheat peel and many other crops, peat and other vegetable-based materials [32-37]. All these sorbents possess rather high oil capacity (3-5 kg/kg and higher), they are inexpensive and have a large source of raw materials. However, their main components are cellulose and lignine which impart the surfaces with strong hydrophilic properties. Therefore, sorbents, which possess the extended surface, easily and quickly absorb oil and petroleum products; at the same time, they absorb moisture even better which has an adverse effect on the oil capacity. Thus, it is necessary to impregnate the adsorbent after its deep drying with waterproofing compounds. Hydrophobization of the surface by reactant or physico-chemical treatment considerably improves technological parameters but makes the sorbent more expensive. The time of protective action of coatings, and, therefore, the sorbent shelf life is usually limited to less than two years. Sufficiently complete regeneration of the exhausted sorbents of this type is difficult, as squeezing (which allows to perform regeneration at 70-85%) breaks the sorbent structure and application of thermal methods is limited to the material thermal stability (usually 250-300 °C).

Properties of some materials which are used at gathering of oil or form the basis for producing oil sorbents are given in Table 1 [38].

Table 1

Properties of different materials for gathering oil

Material	Oil absorption, g/g	Water-absorption, g/g	Oil press ratio, %
<i>Natural organic materials</i>			
Wheat straw (broken grain)	4.1	4.3	36
Broken cane: - leaves	6.1	4.6	31
- stalks	2.7	3.9	17
Buckwheat peel	3.0-3.5	2.2	44
Aspen / pine bark	0.5/0.3	0.8/0.8	25/0
Sawdust	1.7	4.3	10-20
Lignin hydrolised	1.5-3.0	4.1	25
Wastes of cottonwool production	8.3	0.26	60
Peat	17.7	24.3	74
Dry moss	3.5-5.8	3.1-3.5	-
Wool	8.0-10.0	4.5	87
Crushed brown coal	1-2	0.2	-
Macroporous technical carbon	4.0-4.5	0-1.0	10-81
<i>Synthetic organic materials</i>			
Expanded polystyrene: - granules	9.3	4.5	0
- fiber	7.0-12.0	6.0-11.5	80-90

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Polypropylene: - granules	1.6	0.8	0
- fiber	12-40	1-6	40-80
Shredded tires	3.6	7.2	55
Rubber crumb	5.1	0.3	0
Carbamide-formaldehyde resin:			
- pieces	23.3	0.1	0
- powder	39.6	0.1	60
Phenol formaldehyde resin (powder)	4.4	14.5	0
Foam plastic: - sheet	14.5-35.2	1.3-25.9	75-85
- granulated	36.9	30.7	-
Polyester batting	46.3	42-52	94
Lavsan (fiber)	4.7-14.1	4.3-13.9	60-82
<i>Inorganic materials</i>			
Foamed nickel	2.9	3.0	0
Fiber glass	5.4	1.7	60
Modified graphite	40.0-60.0	0.5-10.0	10-65
Perlite	5.0 - 7.0	0.5	0
Modified basalt fiber	37	0.5	27

3. SORBENTS BASED ON FIBROUS-POROUS POLYMER MATERIALS

Fibrous materials represent a system of chaotically arranged thin threads which are freely distributed in space. As a rule, their structure is not spatially oriented, thus allowing the pollutions to contact a large surface per time unit. Cotton wool, felt, fabrics, polyester batting, basalt fiber, etc. are typical fibrous materials for oil collection. In the course of oil absorption, the sorbent fibers are capable to move apart, thus creating a specific sorbent-PEP structure which (after gathering is completed) starts to gradually compress by gravity and to strain off up to 20-25% of the collected petroleum product. According to the data in Table 1, all fibrous sorbents are characterized by high ratio of the absorbed oil squeezing. Some absorbers with fibrous structure demonstrate a rather high water absorption (polyester batting, sheet foam plastic with thickness of 18 mm) which is caused by low hydrophobicity of the surface. This disadvantage can be eliminated by introduction of special hydrophobization additives.

Emergency cleaning of water bodies is an important practical application of fibrous melt-blown materials (i.e. the ones produced by pneumoextrusion method) [39, 40]. Oil-retaining capacity of such materials (which is defined by the nature and structural parameters of fibrous matrix) reaches 10 g/g and more. The melt-blown sorbents made in the form of rolls, mats, floating pillows serve as a means to remove oil from the water surface, protect the water body coasts and gather the petroleum products which have spilled onto the soil up to several hundred square meters. High degree of extraction of the emulsified petroleum oil (60-90%) is observed even in the tough dynamic modes of filtering the oil-contaminated water through the melt-blown material.

Oil trapping occurs not only due to their adsorption on the surface of fibers, but also by retaining the coagulating microdrops in the material pore space. Melt-blown sorbents are produced by using granulated polyethylene, polypropylene, polyethylene terephthalate, as well as secondary thermoplastics (product of recycling the plastic vessels, utensils, packages, etc.).

3.1. Melt blowing technology

The melt blowing technological process (Fig. 2) traditionally includes operations on processing the granulated thermoplastic polymer in an extruder, dispersion of the melt being formed with a flow of compressed gas and application of the fiber-porous layer onto the rotating substrate (drum). The fibers generator, manipulator and the mechanism for material removal are the main technological nodes used at melt blowing. The fibers generator which includes an extruder and a pneumatic spraying head is intended for processing the granulate into the melt, forming the fibers out of it and transferring them to the forming substrate. The manipulator ensures rotary and reciprocating movement of the substrate which is required to produce fiber-porous products of the given configuration. Usually, melt blowing is exercised under temperature ranges which ensure the melt viscosity at the extrusion head outlet corresponding to the melt flow index of not less than 20 g/10 min. This value is used as a criterion to establish distribution of temperatures along the extruder zones [41]. The most important operation is the dispersion (spraying) of the melt and fiber drawing with the gas flow. When the temperature conditions are stabilized, the spraying is controlled by adjusting the temperature and compressed air pressure. External electrization may be applied to the fibers being created.

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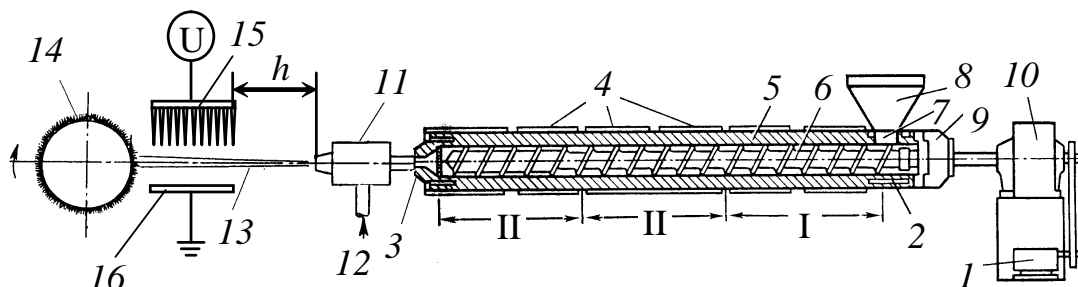


Figure 2 – Diagram of the melt blowing technological process: 1 – engine; 2 – channel for bunker zone cooling; 3 – channel for the melt discharge to the profiling head; 4 – cylinder heaters; 5 – cylinder; 6 – screw; 7 – filling hopper; 8 – bunker; 9 – thrust bearing; 10 – reduction gear; 11 – spraying head; 12 – compressed air branch pipe; 13 – gas-polymer flow; 14 – shape-generating mandrel. Zones of screw: I – feeding (loading); II – compression (plasticization); III – squeezing (dosing). Electrization zone: 15 – high-voltage electrode; 16 – grounding electrode

Polymer fibrous materials (PFM) represent a set of the polymer fibers which are cohesively bonded in the places of contact and which form a fiber mass. Availability of the cohesive bond between the fibers release from the need to use additional processes (needlepunching, cross-linking, etc.) in PFM production. The melt blowing technology allows to

impart the sorbing elements with shape stability and structural definiteness.

Density and diameter of fibers are the main PFM parameters which define their sorption characteristics. The material density can be adjusted within the range of 0.05 – 0.5 g/cm³, while the diameter of fibers – 5 to 500 microns (Fig. 3).

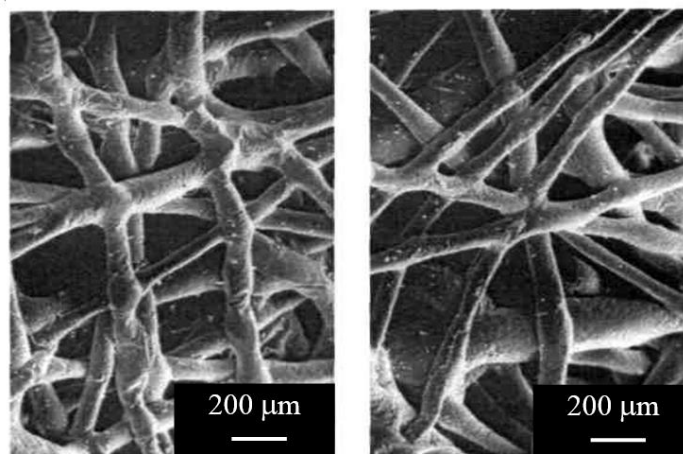


Figure 3 – Electron microscopic images of different areas of cross-sections of polymer fibrous melt-blown material

In certain cases, parameters of filter-adsorption treatment are determined by the nature of PFM fibrous matrix. For example, melt-blown materials consisting of thin lipophilic fibers (polyethylene, polypropylene) are excellent oil adsorbents [42]. High adsorptive capacity, adjustable distribution of fibers diametrically and by stacking density, large volume of cavities between fibers, permeability for liquids and gases are their characteristic features. Oil-retaining capacity of sorbents made of PFM in static conditions reaches 10 kg of oil per one kilogram of adsorbent, which considerably exceeds the same parameter of composite materials intended to gather petroleum products [43]. PFM made in the

form of rolls, hoses and floating pillows serve as a means to remove oil from the water surface, protect the water body coasts and gather the petroleum products which have spilled in emergency situations at the enterprises and during transportation [44].

Adsorption capacity of prototypes of melt-blown PFM based on polyolefins is as good as (and sometimes exceeds) the foreign composite non-woven fabrics specifically intended to collect petroleum products. So, the melt blowing technology was used to produce the material based on thermoplastic polymer which consists of chaotically arranged fibers with a diameter of 5-20 microns and density of 0.01-0.2 g/cm³ [45]. Absorption and

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retention of liquids in it occurs due to the capillaries formed by the fibers twisted in bundles and clusters. Content of such capillaries in the material reaches 60 %, while the remaining 40 % of fibers create the material base. Optimum absorbing ability of the material is created when the capillaries content in it is from 30% to 60%. This material is capable to absorb the amount of liquid which is 40-50 times greater than its own weight.

3.1. PFM modification with disperse sorbents

Fibers modification with porous adsorbents allows to increase the PFM adsorptive capacity. The specific feature of such PFM structure is that the adsorbent particles are adhesively fixed to the fiber surface (Fig. 4).

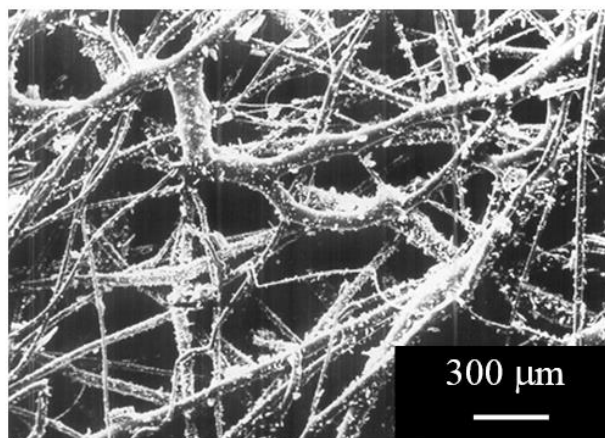


Figure 4 – Electron microscopic images of PFM based on high pressure polyethylene modified with activated charcoal particles (14 wt.%).

It is inexpedient to process the dispersed adsorbents together with a polymer, since porous particles are encapsulated by the binders and lose their adsorptive capacity. If (at PFM forming) the particles are injected into the gas-polymer flow, then they come into adhesive contact with the fibers in viscous-flow state and (at hardening) are firmly fixed on the surface of fibers. This technology provides for the possibility to obtain materials with high adsorptive characteristics. Thus, PFM containing 11-14 wt. % of activated charcoal is three orders of magnitude higher than the one of the unmodified analog, and these PFM contain a considerable amount of sorption-active micro- and mesopores [39, page 163].

On the surface of PFM fibers (which are in viscous-flow state) it is also possible to adhesively fix the solid particles of mineral sorbent (for which purpose the modified bentonite clay is used) [46].

Polypropylene (PP) with filler (silicon dioxide SiO_2 , dispersion – 5-10 microns) with 8-16% concentration in the fiber and bentonite clay particles (adhesively fixed to the particles of bentonite clay) with dispersion of 5-10 microns in the amount of 4-21 wt. % which are modified by soap stocks of fatty acids were used for producing specimens. The disperse filler was preliminary processed in the corona discharge field (intensity – 8-21 kV/cm). As a result of polarization, an electret charge with the effective area density of $\sigma_{\text{eff}} = 0.2\text{-}0.3 \text{ nC/cm}^2$ is formed on the material fibers.

To assess the sorption capacity of the produced PFM, an emulsion of oil in water (0.6%) had been created which was then passed through the developed multilayer PFM. The mass of emulsion was determined by weighing before and after filtration and, on this basis, the sorption capacity of the material was calculated (Fig. 5).

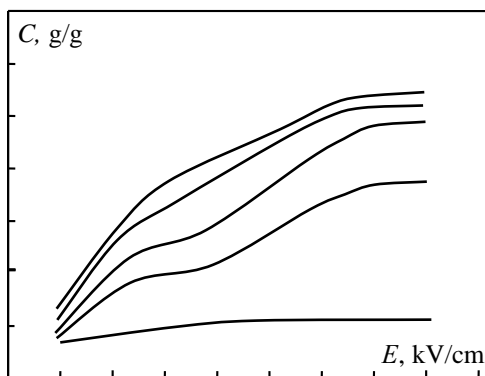


Figure 5 – The dependence diagram of oil sorption capacity (C , g/g) of the combined PFM versus corona discharge field intensity at various contents of filler (SiO_2) and clay (wt. %/wt. %):
 1 – 8/4; 2 – 10/5; 3 – 12/10; 4 – 15/20; 5 – 16/21

As the result of the research it was established that combination of the disperse filler encapsulated in the fibers in the form of silicon dioxide SiO_2 particles treated in the corona discharge and the particles of the modified bentonite clay applied on the surface of fibers significantly increases the efficiency of sorption of the oil dispersed in water. The largest sorption capacity was demonstrated by two PFM specimens made of PP with filler (silicon dioxide SiO_2 , concentration in the fiber – 15-16%) polarized in the corona discharge field with intensity of 18 kV/cm and the particles of the modified bentonite clay which are adhesively fixed on fibers in the amount of 20-21 wt.% (curves 4 and 5 in Fig. 5).

Apparently, this is because of the fact that bipolar electret charge acquired by the fibers contributes to better wetting of the fiber surface due to deformation of solvation shells and disorientation of water dipole molecules. This results in improvement of hydrophobic properties of polymer fibers. Further increase in the amount of the applied fillers leads to an increase in sorbent weight and decreases its sorption capacity due to porosity reduction.

Thus, by using the additivity of properties, an effective combined sorbent [47] can be produced which summates the sorption properties of the modified polymer fibrous material and solid particles of bentonite clays adhesively fixed on the fiber surfaces.

4 THE USE OF SECONDARY POLYMERS TO PRODUCE FIBROUS SORBENTS

The repeated use of sorbents is possible only when gathering pure fractions of oil. Most often, after two-three regeneration cycles the sorbent capacity considerably decreases as its pores become clogged with dirt and heavy fractions and the structure of fibrous sorbent can be deformed. Change in the physical-chemical properties of the spilled oil

as a result of its evaporation, oxidation, emulsification and other processes may be another reason for sorption deterioration. The increased content of gas, light fractions and emulsified water in oil often results in an increase in consumption of sorbent for the oil removal from the water surface.

Secondary raw materials can be used for sorbents production; in this case, such important quality indicator as retaining capacity of the sorbents made of secondary polymers may be even higher than the one of the sorbents made of primary raw materials.

The melt flow index (MFI) of the secondary polymer raw materials is very important for producing non-woven fibrous materials. Raw materials with low MFI values are used to produce coarse-fibered materials with high MFI values. Usually, these materials have low strength characteristics. Insignificant MFI reduction due to an increase in the gel fraction content is observed in the secondary polyethylene. At repeated processing of polypropylene, MFI goes up at the increase in the number of cycles; besides, at low processing temperatures (up to 220 °C) slow MFI growth is observed at the increase in number of processing cycles. When the processing temperatures exceed 250 °C, a drastic rise in MFI is observed (14-fold increase after 5 processing cycles at $T = 290^\circ\text{C}$) [48]. Sorption capacity of non-woven fabrics produced from the secondary PP (wastes of polypropylene bags) and used as sorbents is not worse than that of the materials made of primary PP. At the same time, retaining capacity of a sorbent produced from secondary PP is even better (up to 15%) than that of the materials made of primary raw materials.

One of the most important advantages of the sorbents produced from fibrous materials is their high regenerative capability without considerable loss in sorption capacity at subsequent applications. Figure 6 shows the change in sorption capacity of PFM specimens produced from wastes of secondary

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thermoplastics depending on the number of regeneration cycles [49]. It can be seen that at

repeated use their sorption ability remains at the level of 50-70% of the initial value.

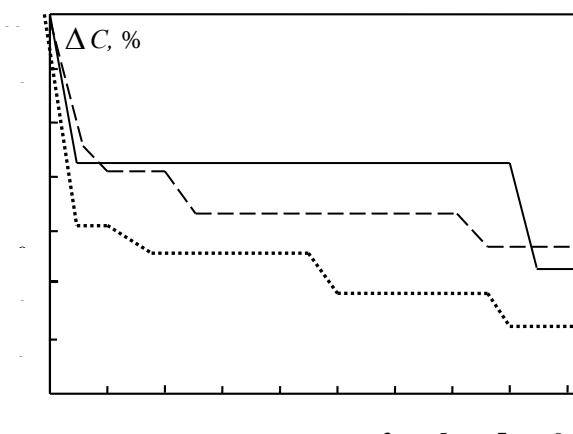


Figure 6 – Change in oil capacity (ΔC , %) of PFM produced from wastes of secondary thermoplastics at repeated (n) use: 1 – fibers from disposable medical syringes (polypropylene); 2 – fibers from plastic bottles (polyethyleneterephthalate); 3 – fibers from a mix of the used disposable syringe bodies and plungers (polyethylene and polypropylene)

Conclusion

It has been experimentally proven that melt-blown materials of different types possess the oil-retaining capacity in static conditions up to 50 g/g and degree of extraction (from the water) of the emulsified oily substances up to 100%, which exceeds the properties of the majority of the known sorption materials applied both for filtering and gathering of the spilled petroleum products. The studied patterns allow outlining a perspective to increase the efficiency of polymer fibrous materials as sorbents for oil and petroleum products. The regulation of structural parameters of the fibrous materials produced by the melt blowing method, along with modification of polymer fibers in physical fields and introduction of target additives that will allow obtaining new highly efficient sorbents for gathering of oil and petroleum products may become a very promising direction.

The idea of modifying PFM in electric and magnetic fields is based on the existing technological possibility to impart the melt-blown materials with a

number of additional properties, in particular, electret and magnetic ones. The field of electret charge contributes to electrostatic capture of the particles of contaminants and drops of oil emulsions, facilitates separation of organic liquids into polar and non-polar components and settling of pollutants, increases the system lipophilicity. The magnetic field generates the hydrodynamic pressure which breaks the solvate layers of drops of organic liquids and facilitates their coagulation. Oils and petroleum products trapping occurs not only by their adsorption on the surface of fibers, but also due to electrocapillary and magnetocapillary phenomena stimulated by the physical fields. Phase separation takes place as the result of disturbance in kinetic stability of water emulsions of organic substances and is accompanied with irreversible coagulation of drops and their strong retention in the pores of the sorption material. Therefore, it is necessary not only to take electric and magnetic effects into consideration, but also to initiate and apply them (in a targeted way) at development and creation of new sorbents.

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SECTION 8. Architecture and construction.

KNOWLEDGE AND ANALYSIS OF THE OPRC MANAGEMENT IN GEORGIA

Abstract: The work is considered effective management of road Infrastructure building, monitoring and analyze in Georgia. By these methods are possible deliberate and effective spending of funds attracted to road construction. By geographic information systems is possible detailed monitoring of these processes.

Key words: Georgia, road, economic growth, the management and conservation of road assets, geographic information system, traffic control.

Language: English

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INTRODUCTION

Since 2005 Georgia has revised regulations and legislation on many aspects of transport-related infrastructure and services to facilitate rapid development of its transport sector. Increased economic activity, following these reforms, has led to more intensive use of the sector, particularly for international links, and the sector's contribution to gross domestic product has been growing about 10% annually.

The road network is about 22,000 km and the annual capital investment in all modes of transport reached \$362 million in 2011, including \$131 million of foreign direct investment. Much of this has gone into improving Georgia's international roads, following attempts to make Georgia's transport system an integral part of the Transport Corridor Europe-Caucasus-Asia and the Central Asia Regional Economic Cooperation corridors and a regional logistics hub. Improvement of the East-West Highway (EWH) remains the priority for public investment. Placing EWH improvement at the top of the investment list is justified because it is the fastest and shortest surface transport link between the east and west of the country, and is important for the cohesiveness and security of the country. It is also the only alternative to the railway.

Responsibility for road infrastructure policy and planning in Georgia lies with the RDMRDI, while management of the National/Regional roads and local roads is the responsibility of the RD and the Municipalities. While the Roads Department of MRDI builds and operates roads classified as international and secondary, since 2007 local authorities are responsible for the other roads in the network, which are classified as local roads. The Roads Department is responsible for planning, designing, constructing, and maintaining secondary and international roads. Most of its work, except some planning

and programming work, is outsourced to national and international private companies. It has evolved into a contract administrator and manager of the network. Local authorities oversee the roads in cities, towns, and villages. The Roads Department manages international and secondary roads (6,835 km), and district administrations and cities manage local roads (around 15,000 km).

Under present road construction and maintenance contracts the contractor is responsible for the execution of works which are normally defined by the Georgian Road Department (GRD), and the contractor is paid on the basis of unit prices for different work items, i.e. a contract based on "inputs" to the works. The results of this type of traditional road contracts are in many cases less-than-optimal. The problem is that the contractor has the wrong incentive, which is to carry out the maximum amount of works, in order to maximize his turnover and profits. Even if the work is carried out according to plan and considerable money is spent, the overall service quality for the road user depends on the quality of the design given to the contractor who is not accountable for it. In many cases the roads do not last as long as they should because of deficiencies in the original design, aggravated by inadequate maintenance.

Performance Based contracting or Output- and Performance-based contracting for Roads is designed to increase the efficiency and effectiveness of road asset management and maintenance. It should ensure that the physical condition of the roads under contract is adequate for the needs of road users, over the entire period of the contract which is normally several years. This type of contract significantly expands the role of the private sector, from the simple execution of works to the management and conservation of road assets.



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A countries GDP is directly correlated to the paved road kilometers as shown in the charts below. As shown in the charts below between 1997 and 2014 GDP PPP vs. Paved KM/Million Population is becoming more important

for economic growth. Efficiencies derived from maintenance/preservation performance based contracts will help to increase the Paved KM/Million Population.

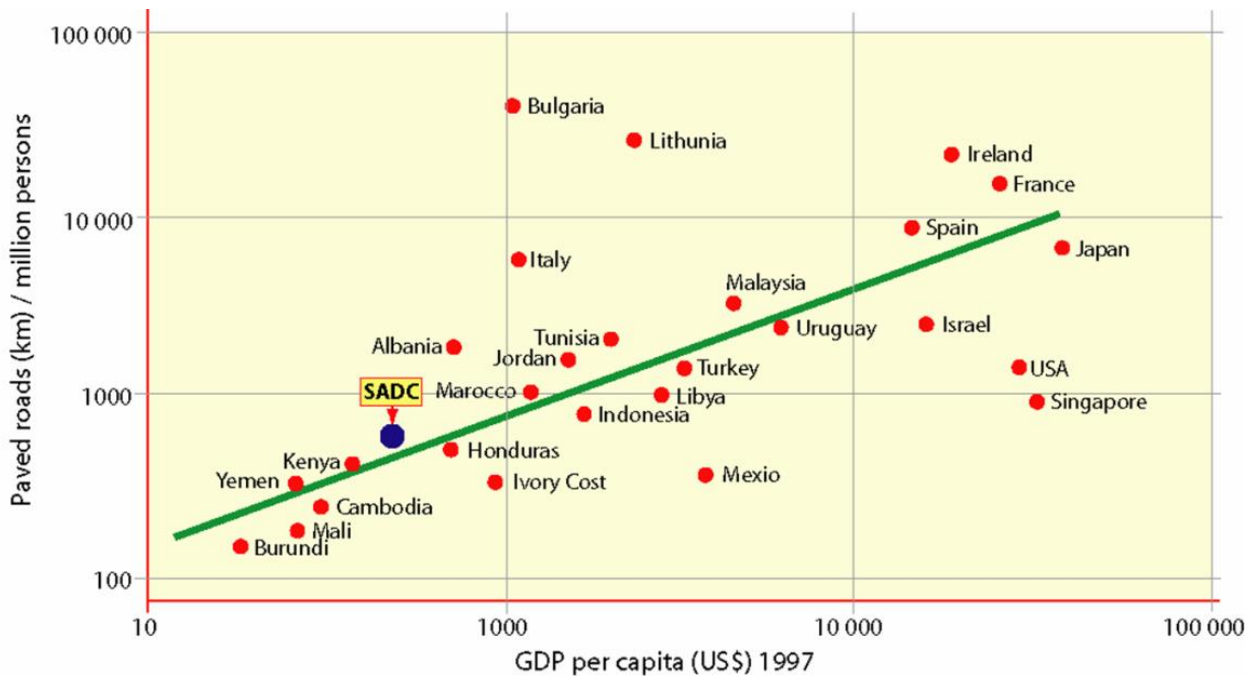
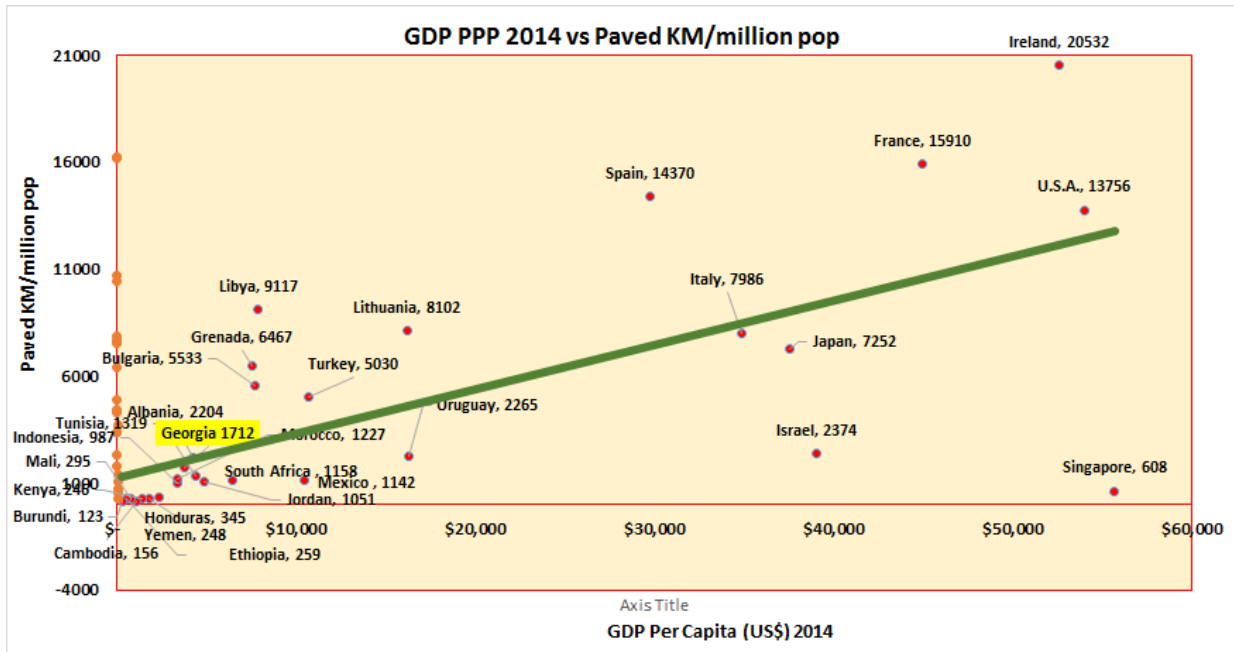


Chart 1: GDP vs. Paved RD KM /Million Populations in 1997 & 2014

Asian Development Bank, The European Bank for Reconstruction and Development, European Union, Japan International Cooperation Agency and Millennium Challenge Corporation have also assisted road network development in Georgia. WB works closely with these

development partners through frequent meetings and information exchanges.



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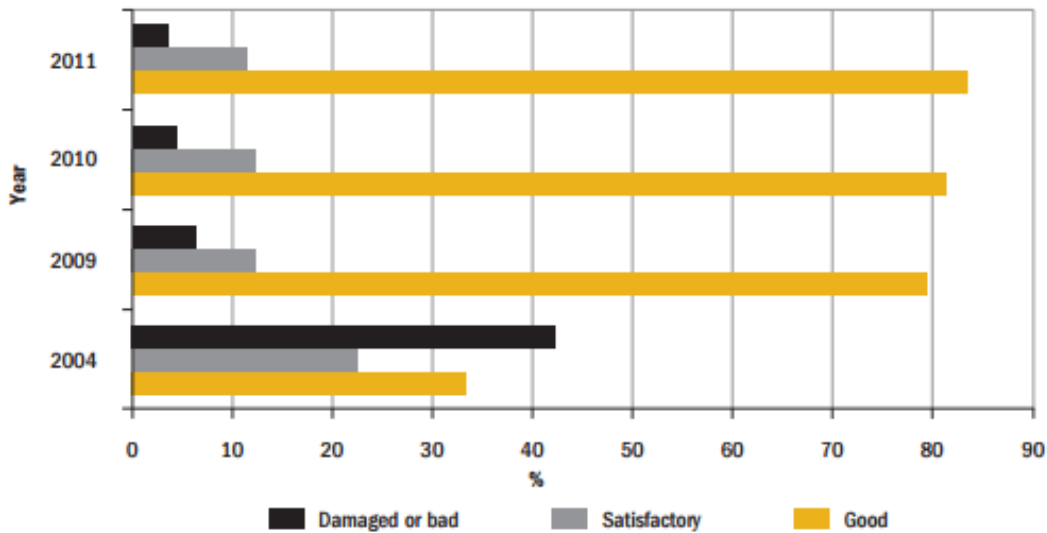


Chart2: Change in Georgia International Road Condition from 2004 to 2011

The MRDI has tendered the rehabilitation and maintenance of approximately 117 kilometers of secondary roads in Kakheti region of Georgia. The works and services will be implemented under an Output and

Performance Based Road Contract (OPRC) of 5 years' duration comprising an initial Rehabilitation phase followed by a Maintenance phase.

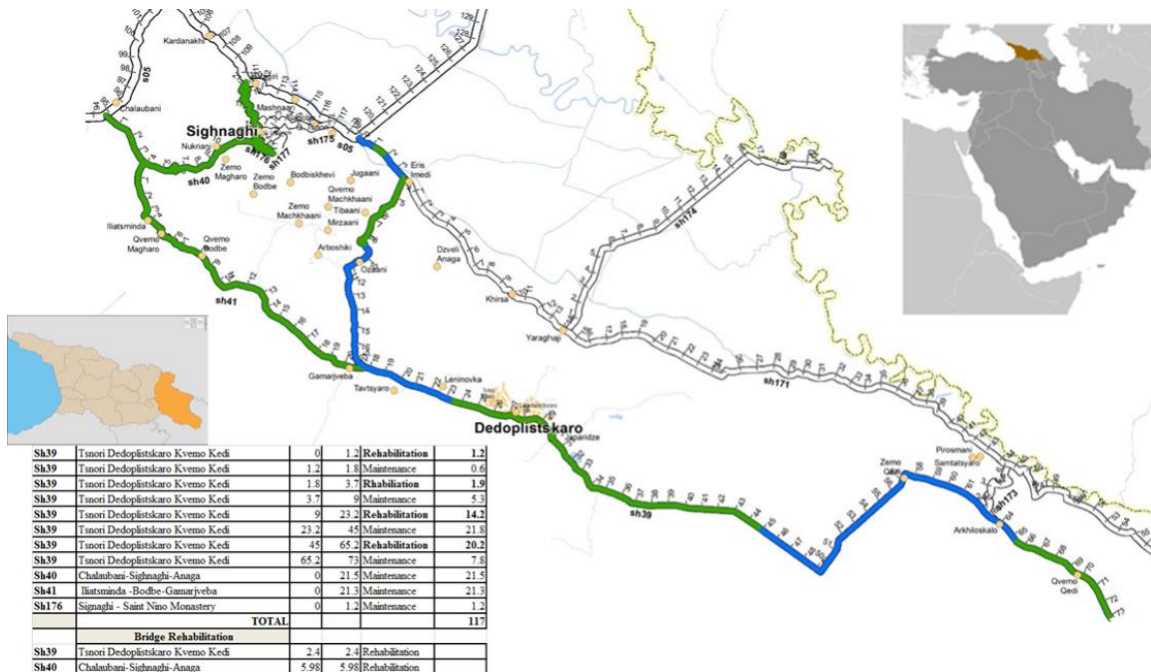


Figure 1: Main Sections of the Project Map

Therefore, the OPRC Contractor will be responsible for the overall management of the roads including design, rehabilitation, emergency and maintenance works.

As a result of it, the main objective of this project is to assist with the Monitoring of the OPRC Contract by overseeing the management of the OPRC Contract, including the continuous assessment of the OPRC Contractor's performance.

TESTS FOR EVALUATING INDICATORS - Asset management systems make use of data from a wide range of sources, both within and outside a road administration and supply information to various levels and parts of an administration (e.g. senior management, decision makers, etc.) where it may be combined with data from other systems. It is therefore vital that every effort is made to ensure that all data both used by and output from, an asset management system is of an appropriate quality.

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This in turn necessitates that all members of the Project Manager's Team be aware of the importance of data quality and that appropriate data checking and validation procedures are put in place. All information collected on the road sections will be studied; year program indicators and completion dates of each test; result of tests performed by the RDMRDI contrast to the award of this contract to check the values of indicators carry out by the OPRC Contractor. The Consultant is responsible for:

□ Monitoring that the OPRC Contractor maintains the roads open to traffic and substantially free of interruptions at all times.

□ Checking that the required Maintenance and Service Levels specified for each road section are being complied with in full through the system of formal and informal inspections. Set of indicators to be fulfilled by the OPRC Contractor during the maintenance period. This will applied from the end of first month after completion of rehabilitation works if any was developed or from the end of month 1 from the OPRC signature.

The inspections carried out by the Consultant will consist of formal (scheduled in advance) and informal inspections (as part of the general mandate received). They will cover entire sections of the road in both directions, also controlled branches, links, service roads and associated rest areas, adjusting the time of the inspection, when necessary, to conservation efforts or programmed by the dealer

works with ordinary or extraordinary; as well as the seasonal tasks (and other winter maintenance).

MONITORING SERVICE AND QUALITY INDICATORS - These inspections are primarily to monitor the implementation of those status indicators Quality and Service in accordance with the requirements must be assessed by the consultant team. A communication protocol with the OPRC Contractor shall be established along the lines of Inspection Manual, so that when the breach of an indicator has a direct impact on the safety of the track is immediately reported to the dealer so that minimum response time appropriate to correction. When the inspector considers appropriate and aligned with measurement method as provided in the contract, compliance with these indicators will be checked. Based on these results the correction factor to the rise or fall on the corresponding certification by counting the vehicles will be calculated. Furthermore, and as dictated by the annual Plan of indicators proposed by the Concessionaire and agreed with the Inspector, will proceed to track the results of tests conducted by teams of high capacity well paid by the dealer or the service. Contrast values there obtained correction factors, which are required to apply for certification according to the results of the test are determined. When actions undertaken for the improvement of an indicator, once finalized will be held in the affected measurement indicator committed.

Sh No	From	To	Work Type	Cum Length KM	ROAD USABILITY		AV TRAFFIC SPEED & RIDE		ROAD USER COMFORT & SAFETY		ROAD DURABILITY		ROAD DEFORMATION		ROAD & SHOULDER CLEANLINESS		ROAD & SHOULDER VEGETATION		ROAD SKID RESISTANCE		TOTAL
					12	11	12	15	14	13	12	11									
Sh39	1.20	1.45	Maintenance	1.45	5	60	5	55	5	60	5	75	5	70	5	65	5	60	5	55	500
Sh39	1.45	1.70	Maintenance	1.7	5	60	5	55	5	60	5	75	5	70	5	65	5	60	5	55	500
Sh39	1.70	1.80	Maintenance	1.8	5	60	5	55	5	60	5	75	5	70	5	65	5	60	5	55	500
Sh39	1.80	2.05	Rhabilitation	2.05	5	60	1	11	1	12	1	15	1	14	5	65	5	60	5	55	292
Sh39	2.05	2.30	Rhabilitation	2.3	5	60	1	11	1	12	1	15	1	14	5	65	5	60	5	55	292
Sh39	2.30	2.55	Rhabilitation	2.55	5	60	1	11	1	12	1	15	1	14	5	65	5	60	5	55	292
Sh39	2.55	2.80	Rhabilitation	2.8	5	60	1	11	1	12	1	15	1	14	5	65	5	60	5	55	292
Sh39	2.80	3.05	Rhabilitation	3.05	5	60	1	11	1	12	1	15	1	14	5	65	5	60	5	55	292

Table 1: EXCEL spreadsheet sample for Road TOTAL PERFORMNCE CONDITION INDEX ANALYSIS

TRACKING PERFORMANCE MANAGEMENT PLAN FOR THE OPRC - The Project Manager will monitor compliance by OPRC Contractor of all sections proposed Management Plan, which includes the following:

SURFACE MANAGEMENT: The Project Manager will collect information regarding surface auscultations, evolution calculation models and the assessment and prioritization of improvement actions. Preventive actions for maintenance will be developed, as well as correction measures will be recommended for values below the permissible thresholds.

REGULAR MAINTENANCE ROAD MANAGEMENT: The Project Manager will review the original proposal according to the needs assessment and taking into account implementation deadlines, estimated measurement, and average yields in the operations to

perform. A revision of the annual and monthly work plans will be develop to check staff resources, available equipment and materials, management of roads in relation to the care of accidents and incidents and signaling.

MANAGEMENT OF WINTER MAINTENANCE: In the Inception Phase, the last Winter Road Plan available will be reviewed, including a re-examination of the facilities and resources available. After each season, the proposed Plan will be analyzed and will be submitted to the OPRC Contractor. It will be extremely important the location of singular points in the sector that will require special attention due to their status at this time of year (high levels, winter maintenance associated parking, access status). It is also important to note that winter breaks could happen during the winter months, when it is snowing, or when snow accumulates at junctions, preventing visibility.



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STRUCTURES MANAGEMENT: An Action Plan will be prepared, which will include the estimated investment for rehabilitation in the year of concession (i.e. seals changes).

SLOPES AND LAND WORKS MANAGEMENT: The Project Manager will monitor slope ranking by slide and by potential damage in case of failure. That will be used to establish a visual inspection program to be agreed with the OPRC Contractor. A complementary action plan for land works, meshes, drains, sea walls and other structures will be prepared. An auscultation monitoring program will be established for those items with previous topographic monitoring protocols or that are being monitored at the moment.

SIGNALLING AND MARKING MANAGEMENT: The Project Manager will carry out daytime and night time inspections to ensure the full recognition of all of the signals and marks.

TRAFFIC MANAGEMENT: The Consultant will verify that the calculation of counting stations will comply with the OPRC. The Monthly Traffic Calculations as well as the Annual Report will be validated.

ROAD SAFETY MANAGEMENT: In a monthly basis, a contrast test will be carried out in order to check out the number of accidents published by the OPRC Contractor, and they will be crossed with other sources and databases. The Project Manager will collect as many information as possible in order to draft a monthly report

of the accidents. The correction factor will be recalculated each year.

COMMUNICATIONS AND INFORMATION MANAGEMENT: A 24/7 Communication Management System will be established as well as an Information Management System. The last one will be used for the OPRC Contractor in a daily basis in order to analysis road conditions and external communications protocols, and it will inform about traffic conditions on the road.

QUALITY MANAGEMENT: All existing checkpoints will be collected according to the OPRC Contractor's QAP. The Project Manager will supervise the proper implementation and enforcement of the actions to be taken in the field of conservation and operation of the road.

ENVIRONMENTAL MANAGEMENT: The OPRC Contractor will apply its own environmental management system for all its activities undertaken.

USE OF GEOGRAPHIC INFORMATION SYSTEM - Among other measures to improve the knowledge about the real status of assets and services the Project Manager will prepare and use network mapping and a geographic information system (GIS) so all information and knowledge can be further used in adjusting the contract and in monitoring the performance of the OPRC Contractor.



Figure 2: Time Stamped, GPS Tagged Video, Photo and Map Record

SPECIAL CONSIDERATION TO TRAFFIC SIGNALLING AND ROAD SAFETY - The economic and social rewards for achieving a sustained improvement in Road Safety are substantial and should far exceed the effort and costs incurred in achieving these improvements. However, implementing sustained and lasting advancement to Road Safety is notoriously difficult and takes a long time to achieve results. They require long-term and consistent political and financial support to succeed. Improving Road Safety traditionally requires strengthening the three “E”s: Engineering, Enforcement and Education:

Engineering measures involve improving the standards, design, implementation and maintenance of the physical infrastructure (roads, bridges/structures and other street furniture) and the vehicles using these facilities;

Enforcement, which is required to ensure that the regulations and standards stipulated are properly implemented and complied with, by all those involved; and

Education, which is necessary to ensure that all road user groups and other stakeholders (e.g. those involved in the various areas of road management), are fully aware of the importance of

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Road Safety, and integrate it automatically in their interaction with the roads.

The Project Manager will monitor that OPRC Contractor achieve performance indicators related to road safety (response time, road signs, traffic signals, guard rail, traffic markings, visibility...) and keep track of incidents to elaborate statistics and improvement measures in order to achieve the first of the elements required for an effective long term road safety strategy. Among elements of road safety, traffic signs are an essential element of the road system, and a road with poor signing or by poorly maintained signs is an insufficient road. Road users depend on traffic signing for information and guidance, and route authorities depend on signing for the economical operation of the route network, the group action of traffic rules, traffic control and facilitate to road safety. Three distinct types of traffic signal maintenance that will be frequently referenced:

□ Preventative maintenance. This type of maintenance is the periodic scheduled maintenance to minimize future problems. It includes inspection, calibration, cleaning, testing, sealing, painting, etc., in accordance with a predefined schedule to minimize the probability of unexpected failure and to maximize the life of the equipment. And the goal is to make the traffic signal fully functional as soon as possible. Since response maintenance is frequently necessary at the most inopportune time, the objective is to minimize this type of maintenance.

□ Operational maintenance. This type of maintenance is the periodic scheduled operational

maintenance to minimize existing and future congestion problems. This maintenance includes the analysis of traffic signal timings and other operational activities that can potentially improve safety and mobility at the traffic signal. The Project Manager will supervise the following:

□ Staff from OPRC Contractor. If the OPRC Contractor staff is enough to maintain the traffic signals to the established guidelines. It is recommended at least one qualified technician for every 40 signalized intersections.

□ The equipment disposed by the OPRC Contractor. It should have include as minimum vehicles, test equipment for retro reflective measures, digital multi meter, Controller and conflict monitor test equipment, Detector sensor test equipment, Small tools, Vacuum cleaner, Small generator for backup power for signals at major intersections during power outages, a field laptop with appropriate traffic signal controller and detection software, a small video monitor when using video detection systems, Replacement parts and Work zone traffic control devices

□ Maintenance activities. Various components all work together to provide a fully functional traffic signal. Neglecting any one of these components can be detrimental to the safe and efficient operation of the entire traffic signal; therefore, it is important to maintain each and every one of these components. The following traffic signal components are detailed in the following sections:

ELEMENT	OPERATION
SUPPORTS	Inspections of the welded and bolted connections
TRAFFIC SIGNALS SIGNING	On field inspections to confirm they are not missing signs
PAVEMENT MARKINGS	On field inspections of retro reflective

EVALUATION REPORTS - The purpose of the formal inspections is to enable the Consultant to verify the information presented in the Contractor's monthly statement and to issue the Interim Payment Certificate. Therefore, based on the outcome of the formal inspection, the Consultant will immediately correct any possible errors or misrepresentations in the Contractor's statement, countersign it and present it to the Client for payment, and to the Contractor for information. On the other hand, the Consultant shall notify the OPRC Contract within 24 hours

of its lack of compliance after an informal inspection to take remedial action as soon as possible and will subsequently check to see whether they have been rectified during the specified time. However, it is the duty of the Contractor's Self Control Unit, not of the Project Manager, to identify and ensure the rectification of defects in a timely manner. In any case the Consultant shall officially notify the OPRC Contractor in a case of any deviation and penalties will be deducted from the relevant monthly payment calculation.

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SECTION 9. Chemistry and chemical technology

INVESTIGATION OF SOME BIOLOGICALLY ACTIVE SUBSTANCES OF DRY STINGING NETTLE LEAVES

Abstract: The article presents the results of the study of some biologically active substances of dry leaves of nettle dioecious. The aim of the study is to determine the flavonoids, phenolcarbonic acids and ascorbic acid in the extract of dry stinging nettle leaves. The method of high-performance liquid chromatography determined the qualitative and quantitative composition of biologically active substances, the presence of which determines the uniqueness of nettle for therapeutic purposes.

Key words: nettle dioecious, high-performance liquid chromatography, flavonoids, ascorbic acid

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ИССЛЕДОВАНИЕ НЕКОТОРЫХ БИОЛОГИЧЕСКИ АКТИВНЫХ ВЕЩЕСТВ СУХИХ ЛИСТЬЕВ КРАПИВЫ ДВУДОМНОЙ

Аннотация: В статье представлены результаты исследования некоторых биологически активных веществ сухих листьев крапивы двудомной. Целью исследования является определение флавонолов, фенолкарбоновых кислот и аскорбиновой кислоты в экстракте сухих листьев крапивы. Методом высокоэффективной жидкостной хроматографии определены качественный и количественный состав биологически активных веществ, наличие которых определяет уникальность использования крапивы двудомной для лечебных целей.

Ключевые слова: крапива двудомная, высокоэффективная жидкостная хроматография, флавонолы, аскорбиновая кислота

Introduction

Дикорастущие растения из экологически чистых горных районов Грузии широко используются для лечения разных заболеваний. В фармакопеех стран мира, в том числе и Грузии внесены многие виды лекарственных растений, такие как крапива, бузина, шиповник и другие, хотя их состав и механизм действий полностью не изучены. Мы исследовали некоторые растения, в том числе листья крапивы двудомной на наличие элементарного железа и биологически активных веществ. Широкий спектр фенольных соединений, каротиноидов, аминокислот и органических кислот делает растительное трехвалентное железо крапивы уникальным, так как многие из этих веществ являются природными активаторами абсорбций железа [1, с.265-267; 2, с.50-58; 3].

Materials and Methods

Целью исследования является определение количественного и качественного состава некоторых биологически активных веществ сухих листьев крапивы двудомной, в частности, антоцианов, лейкоантоцианов, флавонолов, фенолкарбоновых кислот и других [5, с.115-122; 6].

Объектом исследований является крапива двудомная - *Urtica dioica* из экологически чистых горных районов Грузии. Дикорастущее на плодотворной почве лекарственное растение аккумулирует больше солнечной энергии, соответственно, оно богаче органическими субстанциями и минеральным составом.

Экстракцию сухих диспергированных листьев крапивы проводили 70%-м этанолом при температуре 70-80°C.



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Качественное определение химического состава биологически активных веществ различных видов лекарственных растений проводили методом Высокоэффективной жидкостной хроматографии высокого давления (ВЭЖХ), на хроматографе Waters (USA), Waters HPLC system equipped with a model 525 pump; хроматографическая колонка - C₁₈ – 4,6x150 Symmetry; детектирование для антоцианов - 510 нм, для флавонолов - 370 нм и 360 нм, для фенолкарбоновых кислот - 280 нм; подвижная

фаза – 5% муравьиная кислота и метанол - линейный градиент; скорость растворителя 0,7мл/мин; количество исследуемого образца 20 µl [4].

Математическую обработку итогов исследований проводили с точностью P < 0,05.

На рис. 1 представлена жидкостная хроматограмма высокого давления фенолкарбоновых кислот экстракта сухих листьев крапивы двудомной.

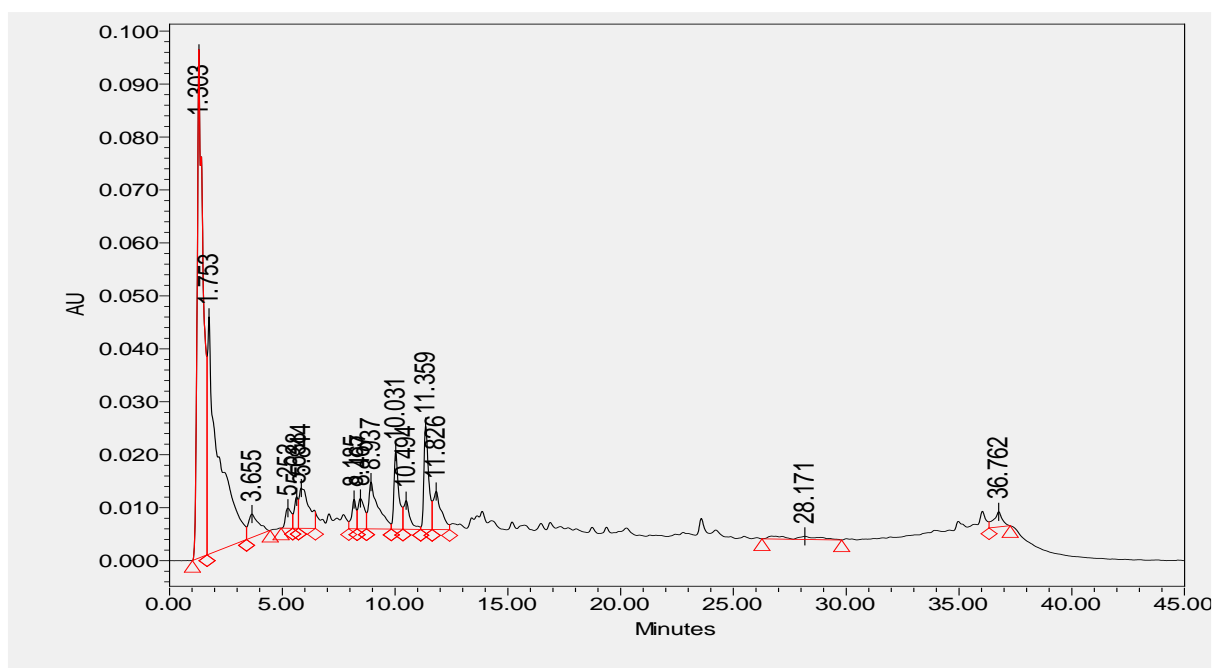


Рис. 1. Хроматограмма фенолкарбоновых кислот экстракта сухих листьев крапивы двудомной; детектирование 280 нм;

- Хлорогеновая кислота;
- Кофеиновая кислота;
- Эпикатехин;
- Рутин

Методом ВЭЖХ идентифицированы разные вещества фенольной группы, относящиеся к разным классам биологически активных веществ

[7, с.20-24]. На рис. 2 представлена соответствующая хроматограмма

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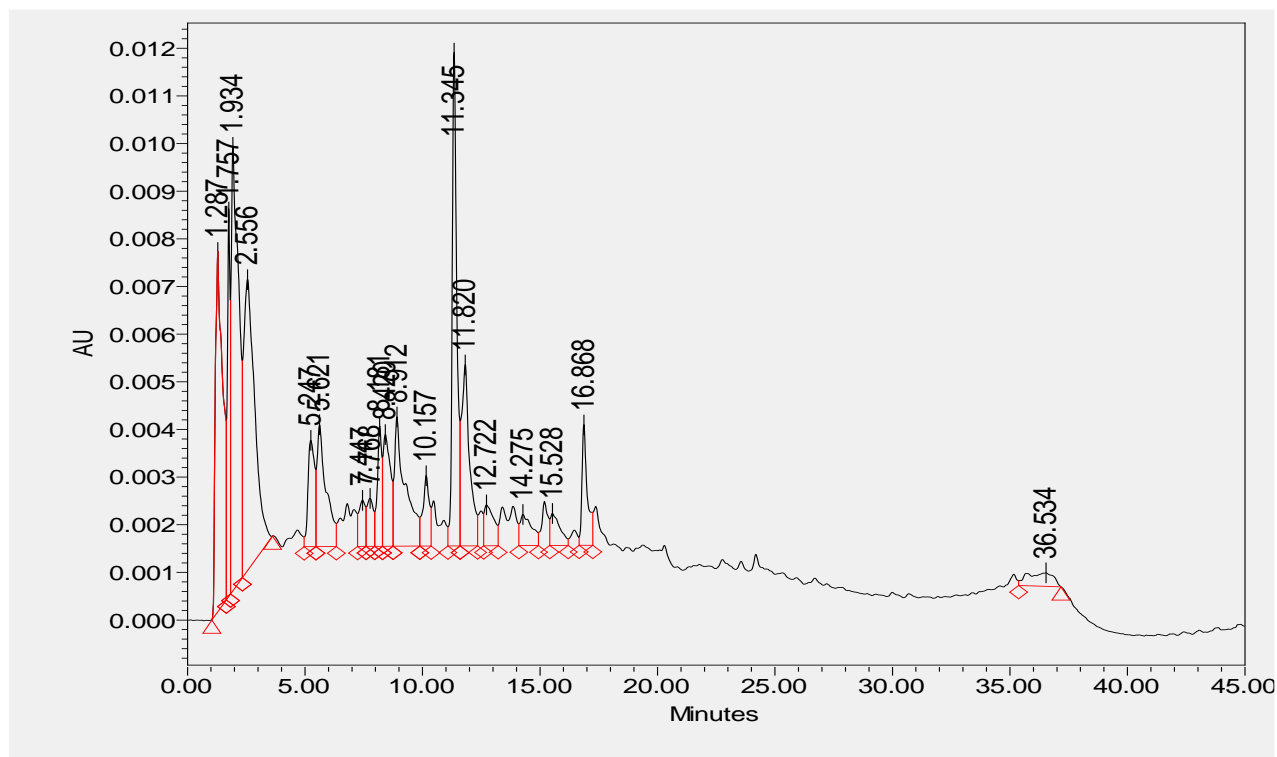


Рис. 2. Хроматограмма фенольных соединений экстракта сухих листьев крапивы двудомной; детектирование 360 нм;

- Изорамнетин-3-рутинозид;
- Кверцетин-5-глюкозид;
- Изокверцетин;
- Рутин

В исследуемых образцах выявлено наличие большого количества аскорбиновой кислоты (витамина С). Детектирование – 254 нм, подвижная фаза 20%-й метанол, рН 2,6.

На рис. 3 представлена хроматограмма аскорбиновой кислоты экстракта сухих листьев крапивы двудомной.

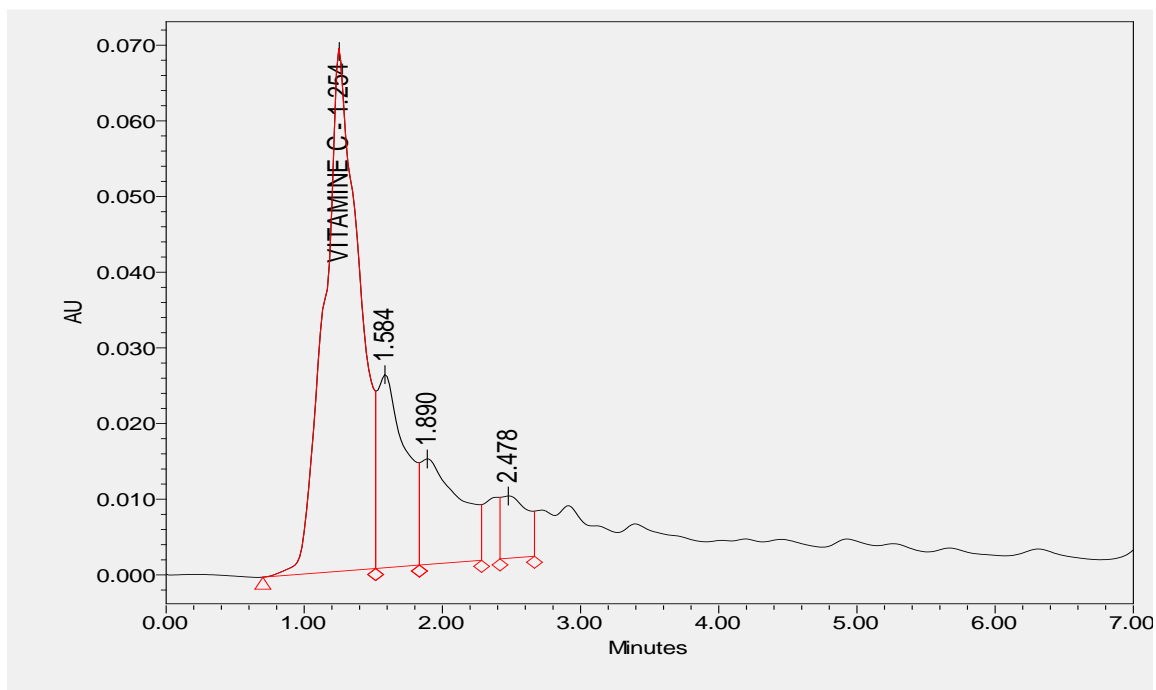


Рис. 3. Хроматограмма аскорбиновой кислоты экстракта сухих листьев крапивы двудомной; детектирование 254 нм

Заключение: В экстракте сухих листьев крапивы двудомной представлены фенольные кислоты, как в свободных, так в связанных формах. Доминирует хлорогеновая кислота, которая составляет около 1/3 всего количества фенольных кислот. Наличие большого количества хлорогеновой кислоты определяет интерес к крапиве двудомной, как к лекарственному растению с высокой антиоксидантной активностью.

Идентифицированные фенольные соединения - Изорамнетин-3 рутинозид, кверцетин-5-глюкозид, изокверцетин и рутин

(витамин Р) обладают большой биологической активностью и во многом определяют лечебные свойства крапивы двудомной [8, с.391-409].

Методом ВЭЖХ определено количество аскорбиновой кислоты – около 260 мг%. Листья крапивы двудомной богаты растительным железом, соответственно, так как витамин С является универсальным активатором абсорбций железа, экстракт сухих листьев крапивы можно использовать для создания лекарственного средства для профилактики и лечения железодефицитных состояний [9, с.53-55; 10, с.65-68].

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CRAFTSMANSHIP OF UZBEKISTAN IN SOVIET TIMES

Abstract: This article describes the influence of the handicraft industry in Uzbekistan during the years of the colonial Soviet regime and its impact on the socio-economic life of the population.

Key words: Values, traditional craft, teacher-student, skill, vocational training.

Language: English

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Introduction

In the Soviet times the craftsmanship of Uzbekistan has its contradictory and difficult years. The mastery of the Uzbek people, which was formed over the centuries and inherited from generation to generation, became a serious problem during the times of Soviet power. National tradition, national value, national culture, national spirituality, national craftsmanship and nationality were a strange idea for a tyrannical Soviet state. Therefore, although the expression and expression of nationality is contained in official documents of the colonial regime, in practice it is ignored, and it tries not to be able to perceive as much citizenship as possible. The significance and role of the nation as a form of social development is great in the creation of material and spiritual values.

The unstable Council tried to do this in ideological and political spheres, as well as in the social and economic spheres. The system of sacred private property, which was formed over the centuries and inherited from generation to generation, was destroyed by the secular regime.

Materials and methods

The impartial Soviet state forced the restructuring of society on a "socialist basis" with intensive and at the same time rapid pace: agriculture was compulsory, and enterprises artificially industrialized. National mastery was also tested by these "socialist experiments".

State control over all available production forces, weapons and tools was established and was elevated to the state policy as a "limiting" and

"prohibiting" principle. National mastery has also been in the public domain since its inception. The goal is to confiscate all assets, including small handicraft workshops, to create a "socialist" material wealth. The industrialization of crafts was forced by various methods and means to unite artisans and artisans who had different production capacities, organizing various associations, cooperatives, artillery and serving them in the interests of socialism. Thus, national and traditional principles of mastery have been brought to nothing. Artisans were deprived of the right to freedom from the right to independently sell their own free products.

In connection with the introduction of a new economic policy and some temporary freedoms, national mastery began on the market. The master has the opportunity to sell some of his products on the market, set a price and communicate with the buyer for free. But since 1927 the colonial regime has begun to put an end to the new economic policy. As a result, the cessation of free handicraft activity began, and the intensified crystallization worsened.

He tried to control all raw materials, coordinate the craft industry and tried to force the private trading system to cancel. The way to isolate and break up individual non-profit organizations of state cooperatives and artels. They did not allow them to sell their products on the market. As a result, small commodity producers and artisans became completely dependent on the state and the development of craftsmen by hired workers increased. Relations between the state and artisans proved to be inadequate.



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Unhappy Soviet Union combined skill in artillery, cooperatives and built large industrial enterprises, but did not provide them with modern technology. As a result, old-fashioned guns could not improve performance and could not provide financial support. In these art halls, the skill of workers and mass layoffs increased. As a result of the transfer of national craft to the industrial base, the types, types of folk crafts, craft features, style, traditions, appearance, decorations and colors of each artisan disappeared. Instead of these properties, production of a large number of identical products based on a non-standard industry will be created.

This was absolutely wrong for mass government procurement of industrial production. Because it was natural for the Bolsheviks to involve in this kind of violence against the ancient labor skills of the people of the country, on the other hand, it undermines the social position of thousands of local artisans and craftsmen. The evidence of life is that it is impossible to turn industrial and composite craftsmanship into "socialist" production on the basis of non-violent ideas. Hundreds of small workshops and shops based on individual or family work were also declared state property. In June 1920, the Samarkand People's Economic Council returned to more than 30 masters and small enterprises in their former possession [1].

Demand for skill especially increased in the 1920s. At that time, the supply of goods for the needs of the population from the center to Turkestan was stopped in accordance with the frequency. Under these circumstances, the Soviet Union considered it necessary to control artisans. In practice, it was planned that these masters should be deprived of independence, forced entry into the centralized system of opinions and for the defense needs of industry, and finally, to create and strengthen the economic foundations of a tyrannical society.

In total, there were 150,000 masters in the Turkestan Republic, including 61250 weavers, 24,000 ethicists, 20150 spinners, 8,680 breeders and 7,470 traders. All of them worked mainly for the state, which is under the strict control of the authorities. In general, the efforts of artisans to fulfill their tasks help them to make it so that in 1920 the state craft accounted for 48% of industrial production. This undoubtedly played an important role in solving the country's critical economic problems. Nevertheless, the overall strategy for the development of handicraft production was blocked by its development. This did not allow a healthy economic transition. Artisans and activists, like all the inhabitants of the country, became servitors of the state. The organization of their production activities will have a negative impact on the development of national traditions in the system of national craftsmanship, combining the creative efforts of individual talent masters.

In the early years, the process of involving cosmonauts and masters for cooperation was divided into two periods. The first stage was the creation of the Turkestan Union of Industry (Tourpromsoyuz) (February 1921), and the second - the Union of Industrialists of Uzbekistan (Uzpromzoyuz) (December 5, 1925).

The main task of the Turkish trade union was to help people restore the economy and develop their production capabilities, improve the living conditions of the working population, unite and control all business relations in the sphere of trade. However, the Turkestan Industrial Association did not have wide access to its organizational and economic activities due to a lack of financial resources. At the same time, due to the lack of sufficient experience in the alliance and the lack of material resources for development, he always needed assistance from government agencies. Handicraft production was provided with raw materials, semi-finished products and equipment. In turn, special attention was paid to the organizational structure.

The only central organization of the Uzbek craft cooperative was Uzpromzoyuz, the Uzbek Industrial Association, mainly through the Samarkand, Fergana and Zeravshan regions and councils of regional masters [4]. In Tashkent, the Association of Craft Co-operatives and Craftsmen was established on the initiative of the Union of Industrialists of Uzbekistan [5].

The creative cooperative of Uzbekistan in 1925 produced 283 skills, while the trade union of crafts grew, and the number of skills increased. In 1926, the number of masters was 341, in 1927 - 386, and in 1928 - 415 people. Bukhara craftsmanship in 1926-1927. Acquired raw materials and semi-finished products worth 289,771 thousand soums, and production of these products in the Union of Masters of Uzbekistan for 11529 thousand soums, cooperatives - 971 thousand soums, state organizations - 42,474 thousand soums and other organizations - finished goods for 54,974 thousand soums, soums [8].

In part, however, the state has also made a significant contribution to the craft industry in order to reduce the amount of money and reduce the tax on its income. For example, in 1927 Bukhara region provided long-term loans worth 25,000 soums to attract more craftsmen. As a result, by October 1927 the number of masters in the Bukhara region reached 3898, and on October 1, 1928 the number of masters (including four women) was 1886 (in 1928 due to a sharp decline in skill, cleaning skills in the Bukhara region) [9].

This was, in a sense, an attempt to create a handicraft industry from social production. However, there are no other obstacles to the development of the handicraft industry: the struggle of the state with traffickers exacerbates the situation of all small

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producers of direct investment, as foreign producers deal with sellers, that is, with a direct market. On the contrary, government agencies tried to establish tight control over all cooperative associations of small commodity producers, which means “denationalization” of the entire enterprise in urban conditions.

As a result of national traditional Uzbek craftsmanship, cadets of artisans gradually disappeared from the point of view of state statistics, which was shed in the category of “socialist” workers. The preliminary form of national craftsmanship was also understood in the training of the factory's technical personnel. Nevertheless, the Uzbek people managed to preserve the national school of mastery of apprenticeship and for many years of the rule of the desert regime, it was widely used secretly and openly.

Looking at the distance from time to time, it is obvious that the essence of socialist industrialization was, first of all, focused on the basis of material and technical socialism, the formation of a unified national economy of a unitary Soviet state that was to completely destroy the national “republican” economy goal.

The process of attracting artisans and artisans to the arena of the Union of Industrialists of Uzbekistan was held simultaneously with all regional unions. In the organizational structure of the handicraft cooperative, the production workshops, which have the main workshops, have become commonplace. Joint work of craftsmen and craftsmen in combination with “one on one” leadership, organizational and technical management of the production process, production tasks and common interests are related to the overall work of the team. The organizational structure of the aforementioned cooperative in the craft remained unchanged until 1960, when the craftsmanship ended.

The prestige of the handicraft industry in the Republic of Uzbekistan and its regions has disappeared. As a result of the colonial policy of the former Soviet Union, the Republic of Uzbekistan and its provinces have become republics and provinces supplying raw materials; Fourthly, the Central Committee of the Communist Party of Uzbekistan and the Council of Ministers of the Republic of Uzbekistan, regional and city committees, district party organizations, the Council of Minors of the Autonomous Soviet Socialist Republic, provincial, city, district and regional committees of the Central Committee of the Communist Party of the Soviet Union and the Council of Ministers of the USSR on April 14, 1956. the decision of the general meeting of the members of the councils of masters, the councils of masters of Uzbekistan (“Uzpromsovet”) cooperate with the enterprises of craft cooperatives, to the aria.

As a result of this decision, many crafts, such as “Sunny”, “Miner”, “Furniture” in Samarkand; and

many other handicrafts have turned into expanded enterprises.

In most cities and regions of the Republic of Uzbekistan, business cooperation in the field of trade was unattractive. The Central Committee of the Central Committee of the Uzbek SSR and the Council of Ministers of the Uzbek SSR determined that the existence of a handicraft cooperative in the Republic is ineffective and was adopted on April 13, 1960, “On measures to improve the national and craft cooperation of the Republic” [11]. In accordance with this decision, local artisans and craftsmen of Uzbekistan (Uzpromsovet) were transformed into state enterprises for handicrafts.

Ten masters and 32 local companies, the National Council of People's Commissars (Sovnarkhoz) and 176 handicraft cooperatives representing 264 enterprises and 61,000 members were re-established and reorganized into the leading local industry of Uzbekistan (Uzglavshimprom). [11] Thus, in 1960 the Uzbek Craft Council and its branches were abolished.

The policy of expanding the handicraft industry in the mid-sixties of the former Soviet Union in the current market economy did not coincide. Transition to the current market economy implies that production, grades, varieties and rapidly changing. The production is fast and flexible, with the ability to respond quickly to any needs and orders of customers. The product should be manufactured with a high taste, which can satisfy market demand. Large enterprises of the old type can not meet these requirements.

Therefore, in developed countries, the focus is on small businesses. Their number now exceeds 10 million in the United States, 9 million in Japan and more than 12 million in India. The creation of a small business does not require large investments, but only profits [12].

Summary Conclusion

Thus, in the first years of the Soviet system, national craftsmanship was undermined. National skill passed various Soviet “experiments and tests” Early organizational construction was abolished, and artisans were merged into industrial enterprises on an obligatory organizational basis and turned into large enterprises. As a result, the features and traditions of folk craft have gradually forgotten.

Only when Uzbekistan gained independence, attention to national craftsmanship grows. Completed in 1960, the Uzbek Council of Masters re-created the national spirit and a completely new one.

The “Hunarmand” Association was founded on the basis of the Decree of the President of the Republic of Uzbekistan of March 31, 1997 No. 1741 “On Measures to Support the Further Development of Folk Crafts and Crafts” and all masters are strictly defined in accordance with this Decree. salt of the Goddess of Taurus laridan ozode.

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SECTION 25. Technologies of materials for the light and textile industry

DEVELOPMENT OF NEW COMPOSITE MATERIALS BASED ON THE SYNTHETIC RUBBERS

Abstract: The article presents the results of studies of the influence of the quantitative content of the latent hardener and sulfur vulcanizing group on the physical-mechanical properties of polymeric composite materials based on SBOR and NBR-26 rubbers for the bottom of orthopedic footwear. It has been experimentally proved that the quantitative ratio of the latent hardener and of the sulfur curing group significantly influences on the physical-mechanical properties of the materials for the bottom of orthopedic footwear, the optimum values of which are achieved within the limits of 5-6 parts by weight curing agent per 100 parts by weight polymer.

Key words: latent hardener, polymeric composite materials, orthopedic footwear

Language: Russian

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РАЗРАБОТКА НОВЫХ КОМПОЗИЦИОННЫХ МАТЕРИАЛОВ НА ОСНОВЕ СИНТЕТИЧЕСКИХ КАУЧУКОВ

Аннотация: В статье представлены результаты исследований влияния количественного содержания латентного отвердителя и серной вулканизирующей группы на физико-механические свойства полимерных композиционных материалов на основе каучуков марки СКМС и СКН-26 для низа ортопедической обуви. Экспериментальным путем доказано, что количественное соотношение латентного отвердителя и серной вулканизирующей группы существенно влияет на физико-механические свойства материалов для низа ортопедической обуви, оптимальные значения которых достигаются в пределах 5-6 мас. ч. отвердителя на 100 мас. ч. полимера.

Ключевые слова: латентный отвердитель, полимерные композиционные материалы, ортопедическая обувь.

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Введение:

В обувной промышленности широко применяют серные вулканизаты на основе разных синтетических каучуков (вулканизаты на основе изопреновых, бутадиеновых, бутадиен-нитрильных и бутадиен-стирольных каучуков). Вопросы серной вулканизации широко изучены и рассмотрены в научных работах многих исследователей [1-6].

При серной вулканизации, образование шитых структур синтетических каучуков происходит в результате нескольких

последовательных и параллельных реакций, которые сопровождаются образованием пространственной химической сетки полимеров. На первом этапе происходит взаимодействие структурирующего агента с ускорителем и активатором с образованием активных центров. В дальнейшем происходят реакции присоединения каучуков к активным центрам шивающего агента, в результате чего образуются поперечные химические связи. При этом завершается формирование вулканизата с образованием пространственной структуры полимеров [4-7].



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На стадии переработки полимеров часто наблюдается понижение текучести, который связан с частичным образованием трудно перерабатываемой фракции. Это явление носит название скорчинг (преждевременная вулканизация), который отрицательно сказывается на физико-механические свойства вулканизатов и готовых изделий [7-9].

Для предотвращения преждевременной вулканизации в производственных условиях используют замедлители процесса вулканизации. В качестве замедлителей процесса вулканизации применяют органические кислоты и их соли, ангидриды, фенолы нитрозосоединения и др. Чаще всего применяются N-нитрозодифениламин, ($T_{пл.} > 65^{\circ}\text{C}$), фталевой ангидрид ($T_{пл.}=130^{\circ}\text{C}$) и N-циклогексинтиофталимид ($T_{пл.}=90^{\circ}\text{C}$) [1, 7].

Надо обязательно отметить, что возможности устранения процесса преждевременной вулканизации с помощью замедлителей ограничены во времени и температурных интервалах.

Серные вулканизаты, применяемые в обувной промышленности характеризуются сравнительно низкими деформационно-прочностными и адгезионными свойствами. У них сравнительно низкие показатели изгибостойкости, термостойкости, стойкости к старению, на сопротивление к истиранию и к действию агрессивных средств. В процессе переработки они характеризуются сравнительно большей вязкостью, что отрицательно влияет на процесс литья под давлением (недоливки в пресс-формах и др.). Кроме того, в процессе серной вулканизации выделяется оксид серы, который считается токсичным и канцерогенным веществом, ухудшающий санитарно-гигиенические условия труда.

Перечисленные выше недостатки можно устранить путем применения новых типов структурирующих агентов.

За последнее время появились целый ряд работ, направленных на использование в качестве функциональных добавок латентных (скрытых) отвердителей [4, 7-14]. Основная задача при разработке новых полимерных композиций с латентными отвердителями состоит в создании отверждающихся систем с определенным порогом активности (температура, давление и т.д.). Принципиально это выражается в создании условий, препятствующих преждевременному протеканию реакций структурирования. К достоинствам физических и физико-химических методов получения полимерных композиций с латентным отвердителем следует отнести тот факт, что они практически не создают ограничений в выборе типа отвердителя.

Использование латентных отвердителей и разработка новых полимерных композиционных материалов на основе бутадиен-стирольных и бутадиен-нитрильных каучуков является актуальной проблемой для обувной промышленности.

Объекты и методы исследования.

В ходе эксперимента использовали латентный отвердитель, который представляет собой структурирующий агент - соединение, проявляющее свою активность при температуре $120-160^{\circ}\text{C}$. Для сопоставительного анализа использовали серную вулканизирующую группу. В качестве основного полимера использовали каучуки следующих марок: СКМС и СКН-26. Кроме основных составляющих полимеров в композицию вводили наполнители, пластификаторы и другие композиты. Рецепт новой полимерной смеси приводится ниже в таблице 1.

Таблица 1

Рецептуры материалов на основе бутадиен-стирольных каучуков

№ п/п	Наименование компонентов	Рецептуры, масс. ч.			
		СКМС	СКН-26	СКМС	СКН-26
		1	2	3	4
1.	каучук	100	100	100	100
2.	Латентный отвердитель	3,5-6,0	3,5-6,0	-	-
3.	Серная вулканизирующая группа	-	-	3-6	3-6
4.	Модификатор (олигоэфиракрилат) МБФ	7-10	7-10	-	-
5.	Вазелин технический	10-12	10-12	10-12	10-12
6.	Парафин	15-20	15-20	15-20	15-20
7.	Канифоль	7-15	7-15	7-15	7-15
8.	Каолин	15-20	15-20	15-20	15-20
9.	Аэросил А-300	30-40	30-40	30-40	30-40
10.	Порообразователь, азодикарбонамид	1,5	1,5	1,5	1,5

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	ЧХЗ-21				
11.	Антиоксидант 2,2'-метилен-бис-6-третбутил-4-метилфенол	0,5-1,0	0,5-1,0	0,5-1,0	0,5-1,0
12.	Светостабилизатор 4-алкокси-2-гидроксифенол	1,0-1,5	1,0-1,5	1,0-1,5	1,0-1,5

Физико-механические свойства структурированных полимеров исследовали по общей методике, принятой в резиновой промышленности.

Экспериментальная часть. В таблице 2 приведены результаты физико-механических

исследований ПКМ (полимерные композиционные материалы) как с латентным отвердителем, так и серных вулканизатов соответствующих полимеров.

Таблица 2

Физико-механические показатели бутадиен-стирольных и бутадиен-нитрильных полимерных композиций на основе разных структурирующих агентов

№ п/п	Наименование показателей	С латентным отвердителем		Серные вулканизаты	
		СКМС	СКН-26	СКМС	СКН-26
1	2	3	4	5	6
	Предел прочности при разрыве, МПа	42,2	45,4	37,1	39,5
2	Плотность, г/см ³	1,07	1,09	1,07	1,09
3	Относительное удлинение при разрыве, %	700	750	700	650
4	Остаточное удлинение, %	20	25	30	35
5	Твердость по Шору А, усл. ед.	50	40	55	45
6	Сопротивление истиранию, Дж/мм ³	8	9	10	12
7	Сопротивление многократному изгибу, килоцикл, более	75	80	60	65
8	Текучесть расплава, Г/10мин (140-180 ⁰ С)	32,5	30,2	30,4	29,3
9	Вязкость по Муни, усл. ед.	50	60	50	60
10	Теплостойкость, ⁰ С по ВИК	220	210	190	185
11	Изгибная жесткость, Н/см	7,8	7,4	8,5	8,2
12	Прочность клеевых соединений с натуральной кожей, кН/м	8,2	7,8	5,1	4,3

Как видно из приведенных данных, латентный отвердитель оказывает существенное влияние на физико-механические свойства полимерных композиции. Предел прочности при разрыве каучуков с латентным отвердителем составляет 42,2-45,4 Мпа, относительное удлинение при разрыве 700-750%, остаточное удлинение 20-25%, сопротивление истиранию 8-9 Дж/мм³, сопротивление многократному изгибу 75-80 килоцикл, изгибная жесткость 7,4-7,8 Н/см, прочность клеевых соединений с натуральной кожей 7,8-8,2 кН/м. Для серных вулканизатов

предел прочности при разрыве составляет 33,1-32,5 Мпа, относительное удлинение при разрыве 550-650%, остаточное удлинение 30-35%, сопротивление к истиранию 10-12 Дж/мм³, сопротивление многократному изгибу 60-65 килоцикл, изгибная жесткость 7,8-8,2 Н/см, прочность клеевых соединений с натуральной кожей 4,3-5,1 кН/м. Как видно из анализа таблицы 2, каучуки с латентным отвердителем по всем основным параметрам превосходят серных вулканизатов соответствующих полимеров.

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Заклучение:

Исследования показали, что количественное соотношение каучуков с латентным отвердителем и каучуков серной вулканизирующей группы существенно влияет на физико-механические свойства материалов, оптимальные значения которых достигается при 5-6 мас. ч. отвердителя на 100 мас. ч. полимера. При этом прочностные свойства материалов существенно увеличиваются. В вышеуказанном интервале достигаются также минимальные значения остаточной деформации, что немаловажно для полимерной композиций низа ортопедической обуви. С последующим увеличением количества отвердителя в полимерной системе незначительно увеличивается прочность материалов, но при этом резко падают их деформационные и эксплуатационные свойства. Разработанные полимерные композиционные материалы с латентным отвердителем по всем основным показателям физико-механических

свойств превосходят показателей физико-механических свойств серных вулканизатов соответствующих полимеров. Полученные закономерности позволяют сделать вывод, что каучуки с латентным отвердителем обладают лучшими деформационно-прочностными свойствами, чем их серные вулканизаты. Кроме того, при серной вулканизации в полимерную систему требуется вводить замедлителей подвулканизации, активаторы и ускорители вулканизации и другие агенты, что создает большие трудности в производстве синтетических материалов для низа ортопедической обуви.

Использование латентных отвердителей в каучуках марки СКМС и СКН-26 в качестве структурирующего агента является весьма важным и перспективным направлением в области применения полимерных материалов для низа ортопедической обуви.

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SECTION 25. Technologies of materials for the light and textile industry

INVESTIGATION OF THE DENSITY OF THE SPATIAL GRID OF SYNTHETIC STRUCTURED BUTADIENE-STYRENE RUBBERS FOR THE BOTTOM OF ORTHOPEDIC FOOTWEAR

Abstract: The article deals with the formation of crosslinked structures of hydrocarbon polymers SBR-30, SBR-50 and SBR-70 with a latent hardener LH-3 and with sulfuric vulcanizing groups. The results of the investigation of the influence of the latent hardener LH-3 and sulfuric vulcanizing groups on the physical parameters of the spatial grid of structured butadiene-styrene rubbers are presented. It has been experimentally proven that the new spatially crosslinked styrene-butadiene styrene elastomers based on the latent hardener LH-3 have all the complex properties inherent in mesh polymers. The most significant features include their ability to have large reversible deformations, which is important for orthopedic insoles production. Based on experimental data, it has been proved that the most promising material for orthopedic insoles is a polymer composition based on the styrene-butadiene rubber SBR-30 with a latent hardener LH-3.

Key words: polymer composition, latent hardener, orthopedic insoles.

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ИССЛЕДОВАНИЕ ПЛОТНОСТИ ПРОСТРАНСТВЕННОЙ СЕТКИ СИНТЕТИЧЕСКИХ СТРУКТУРИРОВАННЫХ БУТАДИЕН-СТИРОЛЬНЫХ КАУЧУКОВ

Аннотация: В статье рассмотрены вопросы образования шитых структур углеводородных полимеров СКС-30, СКС-50 и СКС-70 как с латентным отвердителем ЛО-3, так и серными вулканизирующими группами. Приведены результаты исследования влияния латентного отвердителя ЛО-3 и серных вулканизирующих групп на физические параметры пространственной сетки структурированных бутадиен-стирольных каучуков. Экспериментальным путем доказано, что новые пространственно шитые бутадиен-стирольные эластомеры на основе латентного отвердителя ЛО-3 обладают всеми комплексами свойств, присущих сетчатым полимерам. К наиболее существенным особенностям относятся их способность к большим обратимым деформациям, что немаловажно для производства ортопедических супинаторов. На основе экспериментальных данных доказано, что наиболее перспективным материалом в качестве ортопедических супинаторов является полимерная композиция на основе бутадиен-стирольного каучука СКС-30 с латентным отвердителем ЛО-3.

Ключевые слова: полимерная композиция, латентный отвердитель, ортопедические супинаторы.

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Введение:

Процесс образования шитых структур углеводородных полимеров представляет собой комплекс сложных и многостадийных химических реакций. Теоретические вопросы

образования пространственных структур в линейных полимерных материалах рассмотрены в трудах многих исследователей [1-5].

Реакции шивания полимеров следует отнести к межмолекулярным реакциям.



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Структурирование сопровождается модификацией основной цепи макромолекул полимеров как за счет присоединения фрагментов агента сшивания, так и за счет развития процессов изомеризации и циклизации макромолекул полимеров под действием сшивающих агентов или продуктов их превращения. Учет этих реакций весьма важен, так как из-за их протекания сшитая структура полимеров представляет собой существенно измененные по сравнению с исходными линейными макромолекулами системы не только вследствие образования химических поперечных связей, но и за счет появления участков в линейных цепях с нарушенной регулярностью чередования звеньев [6-16].

В химической промышленности наиболее широко изучены и внедрены серные вулканизирующие группы в качестве структурирующего агента бутадиен-стирольных полимерных композиций. Но эти структурирующие агенты не лишены недостатков. К недостатку серной вулканизации относится необходимость введения в полимерную систему ускорителей вулканизации, замедлителей подвулканизации, активаторов и других агентов, что создает большие трудности в производстве синтетических материалов для ортопедических супинаторов. Вулканизаты, применяемые в промышленности характеризуются сравнительно низкими деформационно-прочностными и адгезионными свойствами. Кроме того, в процессе серной вулканизации выделяется оксид серы, который считается токсичным и канцерогенным веществом, ухудшающие санитарно-гигиенические условия труда [1-4].

Перечисленные выше недостатки можно устранить путем применения новых типов структурирующих агентов. Использование латентного отвердителя ЛО-3 ("скрытые" отвердители - это вещества, проявляющие свою активность при повышенных температурах, 120-160°C) и исследования закономерностей образования трехмерной сетки структурированных полимеров и физических параметров пространственной сетки с целью прогнозирования технологических и эксплуатационных характеристик полимерных материалов является актуальной проблемой для производства ортопедических супинаторов [7, 10-16].

Объекты и методы исследования:

В ходе эксперимента использовали бутадиен-стирольные каучуки следующих марок: СКС-30, СКС-50 и СКС-70 с латентным отвердителем ЛО-3 и серные вулканизаты соответствующих полимеров (для сопоставительного анализа). Каучук СКС-30 представляет собой нерегулярно

чередующиеся звенья бутадиена и стирола. Молекулы полимера содержат беспорядочно расположенные мономерные звенья бутадиена и стирола в цепи. Бутадиеновые звенья связаны между собой трансконфигурацией 1,4 (75-80% от общего их количества), так и в положении 1,2 (около 20-25 %). Вышеуказанный БС каучук содержит 70% бутадиена и 30% связанного стирола с молекулярной массой $3,5 \cdot 10^5$. Каучук СКС-50 представляет собой нерегулярно чередующиеся звенья бутадиена и стирола. Молекулы полимера содержат мономерные звенья бутадиена и стирола, беспорядочно расположенные в цепи. Бутадиеновые звенья связаны между собой трансконфигурацией 1,4 (50-55% от общего их количества), так и в положении 1,2 (около 45-50 %). Вышеуказанный БС каучук содержит 50% бутадиена и 50% связанного стирола с молекулярной массой $4,2 \cdot 10^5$. СКС-70 представляет собой нерегулярно чередующиеся звенья бутадиена и стирола. Молекулы полимера содержат мономерные звенья бутадиена и стирола, беспорядочно расположенные в цепи. Бутадиеновые звенья связаны между собой трансконфигурацией 1,4 (70-75% от общего их количества), так и в положении 1,2 (около 25-30 %). Вышеуказанный БС каучук содержит 30% бутадиена и 70% связанного стирола с молекулярной массой $4,9 \cdot 10^5$. Химическая активность БС каучуков определяется содержанием и типом двойных связей в бутадиеновых звеньях [4-5, 9, 16].

В качестве структурирующего агента для новых полимерных композиций использовали латентный отвердитель ЛО-3 (1,4 - фенилен-бис-диганидин) и серные вулканизирующие группы (для сопоставительного анализа). В полимерную систему латентный отвердитель ЛО-3 и серные вулканизирующие группы вводили 2-6 мас. ч. на 100 мас. ч. каучука. Образцы для испытания изготавливали по общей методике.

Структурными параметрами, определяющими свойства сшитых полимеров, являются следующие: плотность поперечных связей или длина молекулярных цепей между узлами сетки; химический состав и распределение поперечных связей; исходная молекулярная масса полимера; структура полимерной цепи, входящая в сетку. В качестве численных характеристик пространственных полимерных сеток наиболее часто используют следующие величины: функциональность узлов - f_u , определяемую как число цепей, входящие в узел; молекулярная масса - M_c отрезка цепи между узлами; число цепей между узлами в единице объема - N_c ; число молей цепи - n_c между узлами; показатель сшивания γ_c - число поперечных связей на одну макромолекулу; число узлов в единице объема - v_c ; степень

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сшивания – β_c доля сшитых звеньев на одну макромолекулу. Поскольку поперечные сшивки распределены статистически по всему объему полимера, то все перечисленные показатели являются средними величинами и связаны между собой следующими соотношениями [1-4, 15-16]:

$$n_c = \rho / M_c = N_c / N_A \quad (1)$$

$$v_c = (N_c f_y) / 2 = (N_A \rho f_y) / 2 M_c \quad (2)$$

$$\gamma_c = M_n / M_c \quad (3)$$

$$c = m / M_c \quad (4)$$

$$\gamma_c = \beta_c n \quad (5)$$

где ρ – плотность полимера; N_A – число Авогадро; M_n , m – средняя молекулярная масса полимера и молекулярная масса мономерного звена; n – степень полимеризации.

По плотности сшивания пространственные сетки можно разделить на редкие и густые. К редким относятся сетки, имеющие значения до v_c до 10^{32} м^{-1} , а к густым – сетки с большей плотностью. В общем случае густота (плотность) сшивок в химически сшитом полимере придает ему большие, по сравнению с несшитым полимером аналогичного строения механическую прочность и жесткость, ограниченное набухание в растворителях и другие свойства. Это обусловлено тем, что при сшивании цепей, начиная с некоторого значения M_c , зависящего от гибкости цепи и интенсивности межмолекулярного взаимодействия, происходит ограничение молекулярной подвижности и числа конформаций цепей между узлами сетки. Таким образом, можно управлять свойствами сшитого полимера, варьируя параметры пространственной сетки химических связей. [1-4, 13-15].

Экспериментальная часть.

Экспериментальным методом определяли величину M_c , исходя из значений измеряемого условно-равновесного модуля растяжения образцов, по формуле:

$$E = F / S_0 (l_0 / l - 1) \quad (6)$$

где E , МПа – условно-равновесный модуль; F , МПа – нагрузка растяженного образца, после часа растяжения; S_0 , см^2 – исходная площадь поперечного сечения образца; l , l_0 – конечная и исходная длины рабочего участка образца, соответственно. Условно-равновесный модуль растяжения определялся на разрывной машине с камерой для термостатирования после 1 ч растяжения 50% при температуре 70 °С по методике для ненаполненных резин [1-5].

На основе кинетической теории высокоэластичности полимерных материалов определяемый модуль упругости связан с величиной M_c формулой:

$$E = 3\rho RT / M_c \quad (7)$$

тогда

$$M_c = 3\rho RT / E \quad (8)$$

где ρ – плотность полимера г/см^3 ; T , К – температура; R – универсальная газовая постоянная. M_c – удельная молекулярная масса, приходящая на один узел разветвления (или одну поперечную связь).

Исходные данные для расчетов: $\rho = 0,94-0,99 \text{ г/см}^3$; $T = 343 \text{ К}$; $l_0 = 14 \text{ см}$; $S_0 = 0,2 \text{ см}^2$.

Найденные экспериментальные и расчетные значения молекулярной массы, приходящейся на один узел сетки, а также физико-механические свойства серии эластомеров приведены в табл. 1.

Таблица 1

Характеристики образцов структурированных БДС полимеров

№	Отвердитель	Соотнош. масс, БД / ПС	Молекулярная масса		M_c (узел разветвл.)		F	E
			БД	ПС	Расч.	Экспер.		
1	ЛО-3	70/30	3200	3600	4546	4465	3,2	28
2	ЛО-3	50/50	3400	3800	4152	4280	3,8	32
3	Серная вулк. гр.	70/30	3200	3600	4520	4550	3,5	31
4	Серная вулк. гр.	50/50	3400	3800	4150	4490	3,9	35
5	ЛО-3	70/30	3200	3600	4568	4490	3,2	28,5

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6	ЛО-3	50/50	3400	3800	4580	4520	3,3	33
7	Серная вулк. гр.	70/30	3200	3600	4650	4560	4,12	37
8	Серная вулк. гр.	50/50	3400	3800	4150	4210	4,1	41

Как видно из в табл. 1, новые пространственно сшитые бутадиен-стирольные эластомеры с латентным отвердителем ЛО-3 обладают всеми комплексами свойств, присущих сетчатым полимерам для производства ортопедических супинаторов. К наиболее существенным особенностям относятся их способность к большим обратимым деформациям. Свойства конкретного эластомера зависят от соотношения блоков бутадиена и стирола в составе сополимера, их молекулярных масс, а также от количества отвердителя в композиции и соответственно поперечных сшивок вулканизатов. Одно из основных достоинств нового материала является возможность направленной вариации физико-механических свойств путем комбинирования следующих параметров: количества сшивок, молекулярной массы блоков бутадиена и стирола, а также соотношения полимера и отвердителя.

Заключение:

Экспериментальным путем доказано, что плотность пространственных структурированных сеток для разных композиции следующая: для полимерной композиции на основе каучука СКС-30 с латентным отвердителем ЛО-3 составляет $1,26 \cdot 10^{27} \text{см}^{-3}$; для композиции на основе каучука СКС-50 с латентным отвердителем ЛО-3 равен $1,28 \cdot 10^{27} \text{см}^{-3}$, для композиции на основе каучука СКС-70 с латентным отвердителем ЛО-3 равен $1,29 \cdot 10^{27} \text{см}^{-3}$. Плотность сетки серных вулканизатов составляет: $2,15 \cdot 10^{31} \text{см}^{-3}$, $2,17 \cdot 10^{31} \text{см}^{-3}$ и

$2,18 \cdot 10^{31} \text{см}^{-3}$ соответственно для полимерной композиции СКС-30, СКС-50 и СКС-70. Как видно из расчетов с использованием латентного отвердителя ЛО-3, в полимерных композициях получают более гибкие пространственные химические сетки, чем у серных вулканизатов аналогичных полимеров.

Наибольший интерес по совокупности физико-механических свойств представляют образцы №1 и №5, полученные с использованием полимера СКС-30 с латентным отвердителем ЛО-3, содержащие 70% бутадиена и 30% связанного стирола с молекулярной массой $3,5 \cdot 10^5$. К наиболее существенной особенности относится их способность к большим обратимым деформациям, что немаловажно для производства ортопедических супинаторов. Полимеры с соотношением фрагментов бутадиена и стирола 50:50 и 70:30 с латентным отвердителем ЛО-3 мало перспективны, так как имеют высокие физико-механические показатели, являются более жесткими и обладают малыми обратимыми деформациями.

Количественные и качественные характеристики, полученные в ходе эксперимента могут быть использованы для описания свойств реальных полимерных материалов сшитой структуры. Полученные закономерности могут быть заложены в основу технологий приготовления и применения бутадиен-стирольного каучука СКС-30 с латентным отвердителем ЛО-3 в качестве материала для ортопедических супинаторов.

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**SECTION 29. Literature. Folklore. Translation
Studies.**

THEORETICAL BASICS OF STUDYING THE OLD RUSSIAN MESSAGE

Abstract: This article is dedicated to the history of the teaching of the genre of the message. Based on the research of many scientists, it was shown that the ancient epistolary rules of Old Russian bookishness were borrowed from Byzantine practice, which in turn was based on the traditions of ancient and Middle Eastern writing. Similarly, in ancient Russian letters, a number of epistolary formulas and topos are found, correlated with the ancient and Byzantine ones. Nevertheless, it should be emphasized that the Old Russian message has a number of significant features that have not yet been fully comprehended.

Key words: epistolary tradition, a message, literary etiquette, an epistolary formula, a style of a message.

Language: English

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Introduction.

The genre of the epistle of Old Russian bookishness is received in a sufficiently designed and developed form at the time of its inception during the transplantation of medieval Christian literature to Russian soil.

Codification of the epistles and its systematization occurred in the ancient rhetoric. The letter should begin with the name of the author and the greeting "Rejoice!". The narrative part contained an exposition of the main subject of speech. The letter ended with the wishes of health, happiness, and regards. Thus, in compositional terms, the epistle was to be three-part and consist of a prescript, semanthema and clause. In the initial part of the letter, the order of mentioning the name of the author (addresser) and the addressee could be different, which depended on the hierarchical relationships of the real participants in the correspondence. In general, the author should demonstrate respect for the correspondent and put his name after the name of the addressee. However, in messages to high-ranking officials, this order was changing. In addition, the epistles were recommended to decorate with various rhetorical figures of speech [8, p. 8-9].

Materials and Methods.

The epistolary theory of antiquity, set forth in the treatise of the pseudo-Demetrius of Faler "On the Syllable", in which the quotation of the unknown

author of Artemon is cited, demands from the writing person simplicity, conciseness, proportionality of volume and theme, free syntax. It is especially important that the letter relates to a dialogue, a conversation, and is contrasted with a scientific treatise or a judicial speech: "Unless in conversation with a friend would someone put it like Aristotle turns to Antipater when he writes about some aged exile. After all, such a conversation is more like a proof than a conversation. And the syntax should be more free. After all, it's ridiculous to use periods, as if writing is not a letter, but judicial speech" [8, p. 7]. "Frequent references to Aristotle's letters allow us to think that the main source of it was the teaching of the Peripatetics, to whom the main merit in the development of the epistolary theory belongs" [5, p. 176].

In the treatise pseudo-Demetrius of Faler from the composer of the message, it is necessary to be logical in describing the essence of the matter. The main content of the epistles is "the expression of friendship", "the expression of the moral image of a person", the creation of a portrait of his soul. "To tell the truth, the author notes, "and in every composition of verbal art one can discern the character of the writer, but most of all in a letter" [8, p. 7].

Already in antiquity, there were special rhetorical aids for writing letters. One of the most ancient letter-writers is entitled "Types of letters", it is composed in the form of a message addressed to



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an unknown Heraclitus. It complements the recommendations of the pseudo-Demetrius of Faler. Here, 21 meaningful versions of the epistles are singled out and their samples are given, which can become a model for the compilation of corresponding texts by clerical scribes to order [5, p. 176]. The second of the ancient surviving treatises "About the Style of Letters" was compiled by a Christian author and "takes literary etiquette into account", [5, p. 176] the letter-writer "Types of letters" is attributed to Proclus, the second "About the Style of letters" is attributed Libanus (between the 4th and 6th centuries A.D.).

Summarizing the information known from the monuments of antiquity V.A. Smetanin listed the main requirements for writing of this era:

1. The letter demonstrates the moral qualities, personal character and the mood of the author of the letter.

2. The letter should be proportionate to the topic and be distinguished by the conciseness of the syllable. When composing a letter, it is necessary to take into account the identity of the addresser – his rank, educational qualification, age, sex, etc.

3. The presentation of the topic should be public and convincing.

4. The style of writing should be close to speaking, and the tone should be emotional. However, one should beware of vulgarity.

5. The style of writing should be carefully polished. Elegance and grace does not tolerate excessive use of rhetorical means [11, p. 64-65.].

Already in the first treatises and letters, the main quality of the literary letter as a genre was determined - this is the theme of friendship, the obligatory presence of so-called philophonic motives. "A friendly letter in antiquity, as D.M. Bulanin, – was at the top of the hierarchy of texts, clothed in an epistolary form" [5, p. 177].

According to Aristotle, the condition for the birth and continuation of friendship is a joint life, separation carries a danger, since direct communication becomes impossible. In this case, the best replacement for personal communication is a letter [5, p. 177].

Of course, not one literary rule is immutable. The rules of rhetoric concerning the compilation of the epistol were also amended. Latin literature not only absorbed the Greek rhetoric techniques, but also took a step forward. As indicated V.A. Smetanin, Cicero gave the finished stylistic decoration to the Latin epistle. He also proposed a "three-fold classification of letters: according to their tone – to intimate and intended for public reading; attitude of the author to the letter to the addressee – on the official (*publicae*) and personal (*privatae*); in content – on simple notices, on friendly, joking, and on strict, serious and sad" [11, p. 15-16].

Already in Greek and Latin literature the letter becomes not only a genre of business or personal communication, but also acquires a literary character. Epistle begins to live an independent life, regardless of the reason for writing it. "The main thing is the message itself, and the author and the addressee are de-individualized" [2, p. 8]. As an example, you can refer to the works of Seneca, where the main philosophical content, as well as Pliny's letters, which were addressed to a wide range of readers.

In the II – V centuries A.D. researchers discover not only genuine correspondence, but also fictitious letters in which the form of the message becomes an artistic device. The form of the message is adapted to represent the character, transfer the mood of a particular person and a particular situation. V.A. Smetanin believes that with the help of reciprocal correspondence between several persons, the rudiments of the novel arise in late antique literature. A similar picture is found in the so-called pseudo-historical letters, which it was customary to compose in rhetorical schools on behalf of the heroes of antiquity. This leads to the emergence of epistolary biographical stories. "Understanding of the techniques is already given in the literature of the III century A.D., and epistolary "etopeya" – rhetorical reproduction of character is achieved by these techniques. The letter is perceived as a certain system of means of expression, conditioned by the character of the person on whose behalf it is written" [11, p. 18].

According to the researchers, the flourishing of genre of the friendly message falls on the IV – V centuries. However, at this time, not only secular authors of late antiquity but also Christian writers-classics create their compositions. Epistolary friendship is reborn, it is replaced by the concept of Christian love for one's close person, which leads to the loss of the actual philophronic motives. A friendly letter, turns "then into a soul-saving instruction or into controversial invective, then into a lengthy theological treatise. In fact, we should talk about new literary forms, only genetically related to the classical patterns of friendly writing. The new modifications are not characterized either by the emphasis on personal relations between correspondents, neither brevity, nor transparency of thoughts, nor simplicity of the syllable" [5, p. 178-179].

Even the pseudo-Demetrius of Falerski pointed to the existence of "false" letters, in fact treatises that were clothed in the form of messages. Close to them are New Testament apostolic messages. One of the first researchers of evangelical epistolography. S.A. Zhebelev noted: "The Apostle Paul wrote neither "epistles", nor real "letters". Paul's letters differ from the epistles in that they have a pronounced individual character, but draw closer to them by their content, with the exception of a letter to Philemon, that go

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beyond what we call a letter in the literal sense of the word" [6, p. 128]. Bulgarian researcher L.N. Moncheva believes that in the epistles of the Apostle Paul the capacity of the ancient form of epistolary is expanded by introducing specific didacticism, exegeses, theological discussion, philosophical generalization. Thus, a complex artistic form with genre syncretism is created. Accordingly, the image of the author of the apostolic epistle is also syncretic. It combines a preacher, an apologist, a polemicist, a theologian, an exegete, a biographer, an epistolographer [9, p. 190]. The apostolic message, as M.V. Antonova, proves is characterized by the de-individualization of the image of the addressee and the deconcentration of the depicted, which is a consequence of the desire to send its "message" to the widest circle of readers and to confine it to typical life situations, to universalize content [2, p. 33].

L.N. Moncheva in his study applies only to the Pauline letter, but the above observation concerns apostolic messages in general, since genre syncretism is characteristic of the whole body of these works intended to serve the missionaries. The Apostolic letters became a means of open struggle against paganism, and therefore naturally included in their content controversy, didactics, and theology, which undoubtedly reflected on the form of the work.

The form of the Byzantine epistle was studied in detail by foreign and Russian Byzantologists. In particular, V.A. Smetanin, relying on the work of foreign researchers F. Ziemann, H. Hunger, G. Karlsson, I. Sikutrisa et al, describes in detail the form of Byzantine writing. In addition to the three parts already mentioned, the epistle must have an inscript, that is, an external address. Accordingly, the letter should include four obligatory parts: 1) an inscript, 2) a prescript, 3) a semantheme, 4) a clause.

The prescriptus is usually a combination of two formulas: 1) an indication of the names of correspondents, 2) a greeting.

Semanthema in turn is divided into parts. The initial part of the semantheme consists of traditional formulas. The central part is the actual message. The final part of the semantheme also contains template expressions and keywords. V.A. Smetanin indicates fourteen stable mandatory epistolary formulas, which are found in the late Byzantine epistle:

- 1) the formula for ascertaining the receipt of a letter,
- 2) the formula of admiration for the addressee and his praise,
- 3) determining the stimulus for writing a letter,
- 4) a formula indicating a friendly communication or conversation,
- 5) the formula for expressing the relation to the content of the letter (praise or criticism),

6) the formula of "parousia" (the illusion of the presence of a correspondent as a result of receiving a letter),

7) philophrontic formula, that is, the expression of friendly feelings.

8) the formula concerning the receipt of the letter,

9) the formula for expressing the need for written communication,

10) the formula of assurance in mutual memory,

11) the greeting formula,

12) the formula of health wishes,

13) the formula for requesting a letter,

14) the formula for the motivation of one's own letter [11, p. 68-70].

All the above formulas were used in the prescript, the clause, in the introductory and final parts of the semantheme. If prescript formulas and clauses were sufficiently stable and compulsory, then the semantheme was not strictly regulated. The author had the right to select the expressions he needed. Actually, the content part of the letter had a completely free structure, it "did not have any pivotal words and was conformal to the semantic meaning" [11, p. 72].

As D.M. Bulanin, notes "the epistolary scheme served not only for practical purposes in Ancient Rus, from ancient times it was used in literary works". Many writers of the Kiev period addressed to it: Feodosiy Pechersky, Kirill Turovsky, Clement Smolyatich, the creators of the Kiev-Pechersk Patericon Simon and Polycarp, Metropolitans John and Nicephorus. Researcher defines Genre attribution of their writings in the form of messages as follows: "Slavic replica of the apostolic message, only genetically related to the Byzantine friendly letter". From his point of view, "the brevity and simplicity of style is not characteristic of Old Russian pastoral messages. The philophrontic topic is muffled and dissolves in moralizing". Furthermore, D.M. Bulanin believes that the Old Russian authors, included in the literary unity of Slavia Orthodoxa, "neglected the epistolary canons", which entailed "the genre amorphousness of the text" and allowed later editors "without a twinge of conscience to change their genre-nomination, calling them "words" and "legends" " [5, p. 183-84]. The researcher fairly concludes that in the literature of Ancient Rus there was no "literary letter in its pure form" [5, p. 184], but repeatedly states the existence of a tradition of Slavic-Russian teaching messages, but does not address the analysis of the latter, since this is not within the scope of his scientific tasks [5, p. 186, 195, 199]. D.M. Bulanin finds the first experience of literary writing in the XV century – this is the message of Vasily Dmitrievich Yermolin to Yakov, the secretary of Kazimier IV, the King of Poland and the Grand Duke of Lithuania [5, p. 189-192].

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In ancient Russian literature, which undoubtedly took into account the ancient and Byzantine epistolographic experience, for a long time there were no special works that determined the rules for composing the message. A.S. Demin, who studied ancient Russian writers, showed that collections of this type arise late. The first of them dates not earlier than 1478. Nevertheless, the authors of the messages took into account Byzantine epistolary models, samples of apostolic messages. If L.N. Monchev in the above-mentioned work considers the Pauline message mainly as a model of the genre in terms of specific content [9], then J. Birkoff in a number of works on ancient Russian epistolography proved “the existence of a quite definite epistolary consciousness regulating correspondence in Rus as in other nations” [15, p. 57]. Textual analysis allowed the researcher to find elements of epistolary formulas in the epistles of different epochs (the letter of Vladimir Monomakh, Epiphany’s message to Cyril Tversky, the message of Nil Sorsky). D.M. Bulanin, focused in his study on the genre of literary friendly letters, quite sharply characterized the work of J. Birkoff, noting that her thesis about the use of a fully developed epistolary style in the old Russian message remained unproven. Nevertheless, her works revealed “relics of the genre alien to Slavic writing”, which brought to Russia the apostolic message and Byzantine models [5, p. 159]. The last statement of the scientist seems to us to be the most balanced. It generally does not contradict the data of previous studies J. Birkoff and L.N. Monchevoy, and also consistent with the conclusions of M.V. Antonova about the combination of the traditions of the ancient, apostolic and Middle Eastern epistles in the Old Russian epistolography of Kievan Rus [2].

Russian and foreign researchers have convincingly shown that the ancient Russian epistolography can not be perceived unequivocally in the genre aspect: “All, no doubt, the researchers agree on one thing: the epistolary genre has always been a “frontier” genre, was between literature and records management – treated as “elegant” literature, and to business writing” [12, p. 6]. N.V. Ponyrko pointed out that the line between literary and private letters is determined “by the fact of the inclusion of a separate message in the book tradition” [10, p. 3], which is an indicator of the output of a work outside the limits of private correspondence.

To consider the epistles in ancient Russian literature in strict accordance with the ancient

friendly letter, from our point of view, is not lawful. Indeed, in ancient Russia, as shown by D.M. Bulanin, until the end of the XV – beginning of the XVI century epistolary genre has been absent “in a pure form” [5, p. 173-216]. To the same conclusion comes M.V. Antonov concerning the Old Russian message of the Kiev period [3, p. 101]. Of course, between the artistic and business message there are many transitional stages, and the presence of mixed and transitional forms is an essential quality of writing as a genre. Therefore, from our point of view, the position of the team of authors of the study “Auf Gottes Geheiß sollen wir einander Briefe schreiben: Altrussische Epistolographie” is productive, they refused to clarify the problems of the literary character of a text, but focused on studying the topic of the message distinguishing it from pragmatics everyday business writing [13].

Epistolographic rules and epistolary etiquette applied to ancient Russian literature were mainly studied in relation to authors who left a significant number of monuments of this genre. First of all, it concerns Maxim the Greek. In the study, D.M. Bulanin, on the one hand, shows that in the writings of Maxim the Greek a number of etiquette formulas are used, their composition generally corresponds to canonical requirements. However, at the same time these works are at different stages of transition to another genre form, the indicator of which is the loss of certain structural parts of the formulary [4, p. 100, 117 - 123]. To such conclusions comes V.V. Kalugin, studying the correspondence of Ivan the Terrible and Andrew Kurbsky [7]. In the work of M.V. Antonova “Ancient Russian message of the XI – XIII centuries: the poetics of the genre” also shows that the genre form of the ancient Russian message can be recognized as blurred, the reasons for this fuzziness are usually the content aspect, the presence or absence of a certain theme and pathos. Nevertheless, the exact genre qualification of the composition is quite possible on the basis of the presence not only of the signs of the formulary, but also of a certain system of relationships between correspondents [1].

Conclusion.

In general, we agree with the remarks of J. Birkoff, who believes that the epistolographic rules and topic in one form or another can be found in all ancient Russian writings, which are defined as messages [14, 55-77], and this is one of the essential features for genre attribution.

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**SECTION 31. Economic research, finance,
innovation, risk management.**

TENDENCIES OF HOUSING SPHERE DEVELOPMENT AND FEATURE OF HOUSING FUND MANAGEMENT IN UZBEKISTAN

Abstract: This article examines the features of housing and communal sphere, which is an important part of the territorial infrastructure, its impact on the quality of the population' life and the civilization' degree of society. And also, analyzed the reforms carried out, the activities carried out and the successes achieved in the years of independence in the housing sphere in Uzbekistan.

Key words: legislative basis of housing sphere, housing stock management, feature of housing construction.

Language: English

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INTRODUCTION

One of the factors characterizing the livelihood of the population is the development of the housing and communal services of the republic, which is an important part of the territorial infrastructure. The development of public services, the effectiveness of its activities not only shape the corresponding quality of life of the population, reflecting the degree of civilization of society, culture, way of life, but also serve as one of the most important prerequisites for developing economic potential and attracting investments [4;5].

In the years of independence, a number of normative and legal acts have been adopted in the Republic of Uzbekistan aimed at accelerating the reform of the communal sphere, preventing unjustified tariff increases. His sense-forming core was the transfer of ownership of housing to citizens of the country.

URGENCY

According to the Constitution of the Republic of Uzbekistan, the state guarantees legal protection of all forms of property, including private property [1]. Based on these norms, a number of legislative acts have been adopted in the republic that determine the legal basis for housing, urban and rural

development. The most important legal norms regulating the development of housing in urban and rural areas are the Housing and Urban Development Codes, the Laws of the Republic of Uzbekistan "On Mortgage", "On Private Homeowners' Associations", "On Privatization of the State Housing Fund". The Housing Code of the Republic of Uzbekistan regulates the relations of citizens, legal entities, public authorities and local authorities on the issues of the origin, implementation, change and termination of the right of ownership, the right to own and use living quarters, register the housing fund, secure, maintain and repair the housing fund, control over observance of housing rights of citizens and targeted use of housing fund, regulation of relations related to the construction of residential s, conversion and redevelopment of residential premises, the use of technical equipment, software utilities. It is determined that a dwelling may be in private or state ownership and be transferred from one form of ownership to another in accordance with the procedure established by law [2].

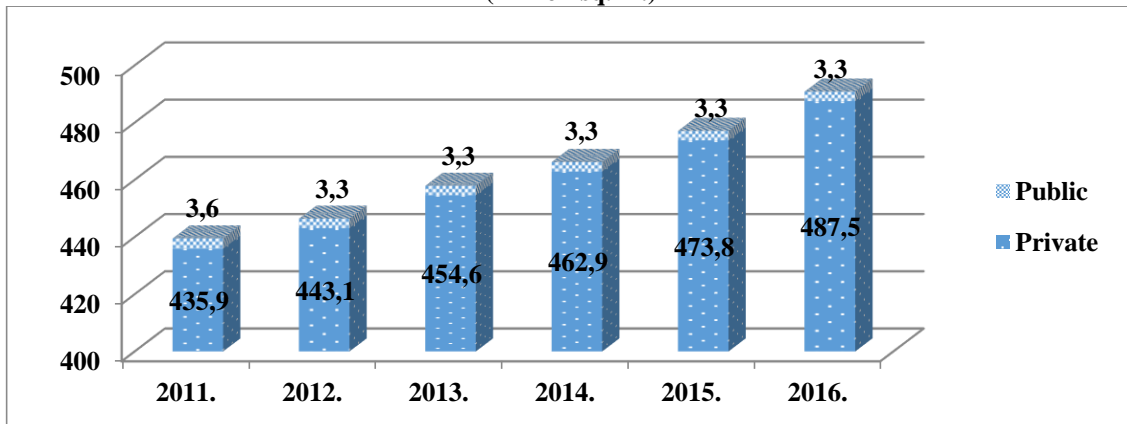
The housing fund in Uzbekistan is 490.8 million square meters. (to 01/01/2017). Of these, the private housing fund is 487.5 million square meters (or 99.3%), and public - 3.3 million square meters (or 0.7%).



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Diagram 1. Dynamics of housing fund growth in Uzbekistan (million sq. m.)



Source: *Data of the State Committee of the Republic of Uzbekistan on Statistics [11].*

The Law of the Republic of Uzbekistan "On Private Home Owners Associations", adopted in 2006, regulated relations in the field of creation and operation of private homeowners' associations in apartment buildings as a voluntary association for joint management and maintenance of maintenance, preservation and repair of housing fund. And also, in this Law, the procedure for the formation of private homeowner associations (PHA), their legal status, the rights and responsibilities of the state, the members of the PHA and other issues are fixed.

Everyone knows that one of the areas directly related to improving the quality of people's lives is the municipal economy. An important role in its effective functioning is always and everywhere played by timely payment for various utilities. A big role in the timeliness of this process in our country is to a certain extent called upon to play with PHA.

THEORETICAL APPROCHES

It should be noted that PHA is an association of private owners of residential premises in one or more compactly located apartment buildings, united by a common plot of land with elements of improvement. It is created on the initiative of private owners of living quarters for joint management and maintenance of maintenance, safety and repair of housing fund, use of common property of private owners of living quarters in an apartment building, is a non-profit organization and operates on the basis of self-government in accordance with its charter [3].

PHA in Uzbekistan developed in several stages, where with each stage as a result of reforms, its representation and the market of housing services changed:

1. With the adoption in 1999 of the Law "On Homeowners' Associations", the first partnerships started to appear in the republic, which were created on the initiative of the residents. These partnerships acted as self-governing homeowners' associations in

multi-apartment buildings. By the middle of 2000, there were about 360 of them, who managed more than 19% of multi-story apartment houses in the republic.

2. By the end of 2002, 1,388 Associations were registered in the republic, and 98.5% of multi-story residential buildings were transferred to management.

And in the beginning of 2004 there were 1342 Associations in the republic. Each of them combined an average of 40-50 apartment buildings. The total number of apartments in them was from 1000 to 2,500. The end of the second stage determined the dissatisfaction with the work of large partnerships, which appeared both among the owners and public authorities of all levels. Accents began to shift toward optimal sizes of Associations.

3. Further, the adoption of the Resolution of the President "On additional measures to improve the activities of private homeowner' associations" of February 10, 2005 No. DP-3, approves the Regulations on the procedure for state registration and registration of PHA, and removes barriers to state registration of PHAs created by initiative of the inhabitants. This document gave impetus to the increase in the number of single-homed and small Associations, large PHAs were disaggregated to the optimal size (8-10 houses with the total number of apartments up to 500-600). Their average size at that time was determined to the optimum value due to the attitude towards them as to housing-operational organizations. Decree of the President "On measures to prevent unjustified tariff increases and increase consumer responsibility for timely and complete settlements for public utilities" dated February 11, 2005 No. DP-5, extended the granted tax benefits to professional management companies that provide services to partnerships. As a result, management companies began to appear in many regions of the

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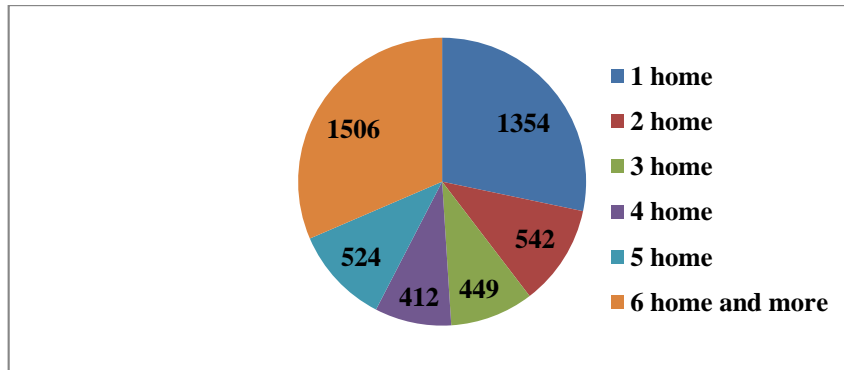
republic. Thus, the development of the market of housing communal services was stimulated.

4. Adoption of the new version of Law "On Private Homeowners' Associations" No 32 of April 12, 2006 and Cabinet of Ministers' Decree No 64 of

April 12, 2006 "On Further Measures for the Development of Private Homeowners' Associations and the Formation of a Real Housing Services Market," stimulated the disaggregation of partnerships up to 1-6 houses (up to 250 apartments).

ANALYTICAL PART

Diagram 2. Composition of PHA

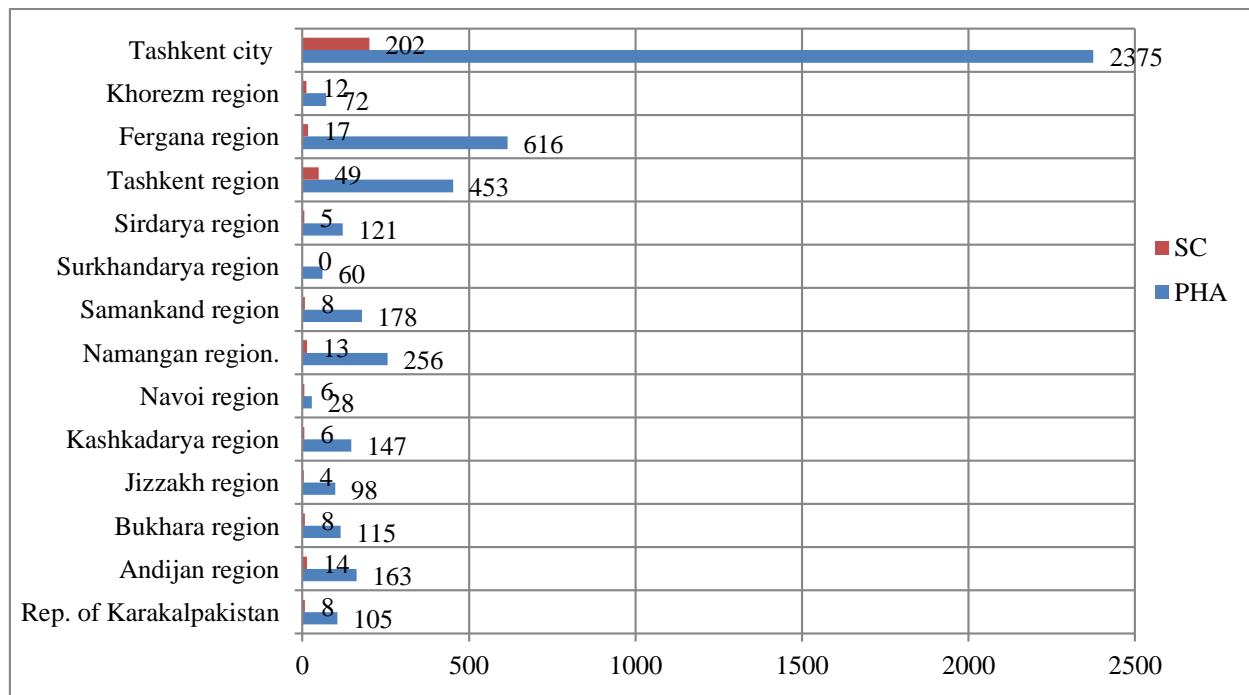


Source: *Data of the State Committee of the Republic of Uzbekistan on Statistics [11].*

Today, in the republic, 4 787 PHA and 352 Service Companies (SC) are involved in the

management of 29409 multi-storey buildings (until 01/01/2017).

Diagram 3. Number of PHA and SC in the context of regions



Source: *Data of the State Committee of the Republic of Uzbekistan on Statistics [11].*

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According to the existing legislative acts, the decision on the establishment of PHA is made at the general meeting of the owners of premises in one or more compactly located apartment buildings, where more than fifty percent of all owners of the premises of each apartment building or their representatives are present. The decision to create it is considered adopted if more than fifty percent of all property owners voted for it [6;7].

PHA acquires the status of a legal entity from the moment of its state registration. The state registration of the partnership is carried out in the state authorities at the local level in accordance with the procedure established by law.

The management bodies of the PHA are the general meeting of the members and the Direction of the PHA. The general meeting of the members is the supreme organ of PHA. Direction is its executive organ and is accountable to the general meeting of the members of the PHA.

The Audit Commission of the PHA is elected by the general meeting of the members of the Association from among its members consisting of not less than three persons for a term not exceeding two years, is accountable to the general meeting of

the members of the Association, and its members cannot simultaneously be members of the management Direction of the Association.

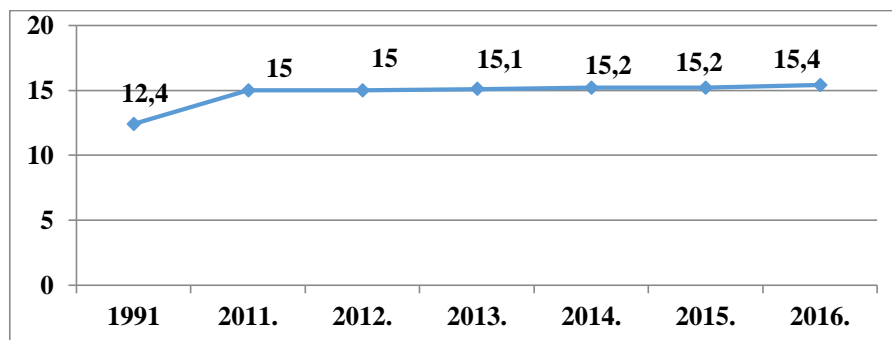
The Audit Commission of the PHA examines the financial and economic activities of the Association and is obliged to submit an annual report on the results of the audit of the financial and economic activities of the Association to the general meeting of the members of the PHA.

Disputes in the field of establishment and activities of the PHA are resolved in the manner prescribed by law.

In Uzbekistan, housing construction is a kind of locomotive for sustainability and progressive social and economic development. In conditions of significant potential demand, housing becomes a kind of catalyst for the development of a number of industries. Acting as a labor-intensive industry, it employs a large number of labor and stabilizes employment of the population [10].

Despite the high growth rates of the population, there has been a steady growth in the provision of housing for the population. If in 1991 there were 12.4 sq. m of total living area per person, in 2016 this figure reached 15.4 sq. m.

Diagram 4. Average seating area per person (sq.m.)



Source: *Data of the State Committee of the Republic of Uzbekistan on Statistics [11]*.

In total, in Uzbekistan for the years 2009-2015, 70,200 thousand sq. m of housing, of which 51200 thousand square meters are in rural areas and 19,000 thousand sq. m. in city. The volume of housing

construction in recent years, starting in 2009, has a steady positive trend and increased 1.6 times.

Table 1.

Dynamics of housing construction in Uzbekistan (thousand sq.m.) [11].

	2009.	2010.	2011.	2012.	2013.	2014.	2015.
Total	7700	8900	9200	10400	10700	11300	12000
City	2600	2200	2300	2700	2700	3000	3500
Rural	5100	6700	6900	7700	8000	8300	8500

Source: *Data of the State Committee of the Republic of Uzbekistan on Statistics*

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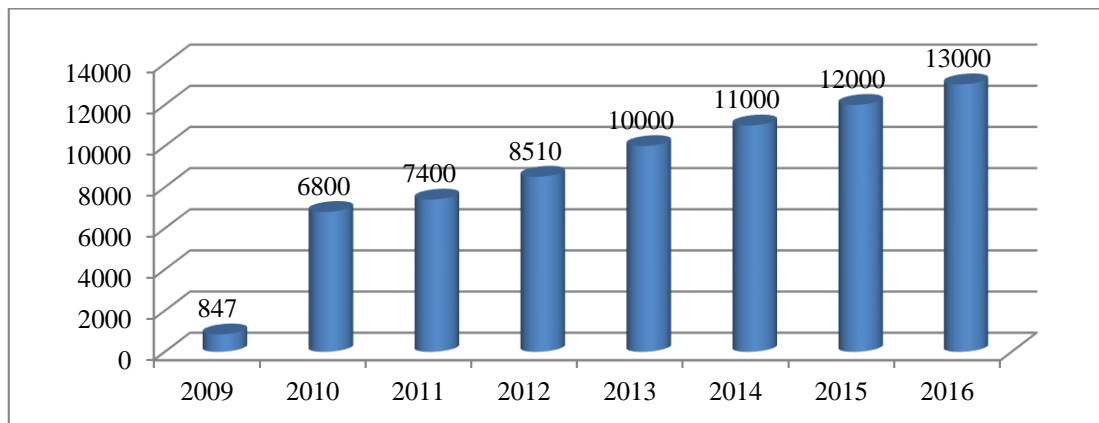
The main emphasis is, in the housing policy, rural housing construction on standard projects that meet the most modern standards of architectural and planning development and is not inferior in quality and comfort of housing in cities. Only in 2012, on a pre-selected 276 arrays with a total area of 1371 hectares, 8510 houses were built "on a turn-key basis". During the years of independent development of the country, the dynamics of the growth of the total area of the housing fund both in cities and in rural areas is also noted. There is a dynamic growth in the number of houses / apartments to meet the needs of the country's population. A systematic work is being done to supply housing with utilities, including electricity, heating, drinking water, sanitation, etc. The existing housing fund has a

relatively high level of provision with centralized water supply (82.7%), gas supply (83.5%), heat supply (45.0%) and sewerage (37.6%). The peculiarity of Uzbekistan is that the main share of housing construction (87.0%) falls on individual housing. According to the household survey, 97.7% of households in the country have their own house or apartment, including 99.5% in rural areas.

In general, 80.1%, and in rural areas 98.4% of families have their own land. The main type of housing is a separate house (77.1%).

It should be noted, that in 2009-2016, 69557 comfortable dwelling houses with a total area of 9573 thousand square meters were built on 1308 residential areas in the village, and over 83500 rural families improved their living conditions [8;9].

The diagram 5. The number of constructed residential houses for standard projects in rural areas in 2009-2016.

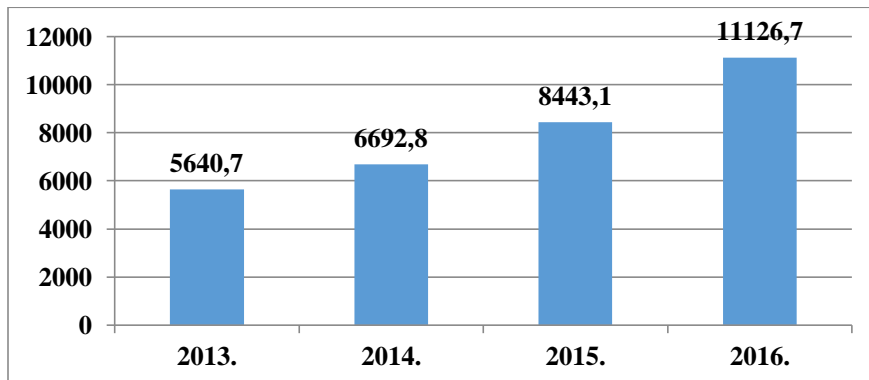


Source: Data of the State Committee of the Republic of Uzbekistan on Statistics [11].

Considering the analysis of investment in housing, this indicator is expected to reach 5640.7 billion UZS in 2013, 6692.8 billion UZS were issued

in 2014. By 8443.1 billion UZS will be invested in 2015 and 11126.7 billion UZS in 2016.

Diagram 6. Number of investments into housing in 2013-2016 (billion UZS)



Source: Data of the State Committee of the Republic of Uzbekistan on Statistics [11].

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At the same time the issues of further enhancing the level of development of the sphere of services in the country, the provision of new modern and qualitative services to the population, ensuring economic growth and strengthening the role of the service sector in solving the problem of employment of the population, first of all, in rural areas is one of the activities in the field as well.

In order to provide the population with access to safe drinking water and natural gas, targeted government programs are being implemented to provide rural population with drinking water and natural gas, as well as construction of trunk water and natural gas pipelines.

Table 2.

Perfection of individual houses (thousand sq. m.) [11].

Done job \ year	2011	2012	2013	2014	2015	2016
Pipe	4430,2	5101,1	5896,5	5894,5	5255,6	6057,9
Sewerage	872,4	1470	1523,9	1996,2	1764,4	1385,0
Central heating system	1236,9	2201,4	2612,6	2570,4	2204,7	2566,9
Hot water consumption	750	1277,9	1274,3	1588,8	1242,6	589,3
Bath	800,9	1288,9	1277,8	1703,5	1469,6	1088,8

CONCLUSION

In general, Uzbekistan has created the necessary legislative and legal framework for regulating housing and land relations, which are monitored for their timely improvement and refinement, taking into account the ongoing structural reforms. The formed regulatory and legal framework determined the main directions of the reform of housing communal services related to the transition to market principles of management.

In conclusion, it is important to note that in determining the level of social development in the country, the provision of housing to the population,

living conditions and the development of public utility services are of paramount importance.

In recent years, the government's consistent measures to support the service and service industries, the adoption of programs for the development of these sectors have led to the development of services in the regions of the country as well as to the high rates of service provision in the housing sector is coming. At the same time, as a result of reforms in housing and communal services, the quality of competition in the industry, comprehensive support and modernization of enterprises, as well as the quality of public services and public services are improving.

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SECTION 31. Economic research, finance,
innovation, risk management.

PERFORMANCE OF TAX VERIFICATIONS AS INDICATOR OF EFFICIENCY OF TAX ADMINISTRATION IN THE REPUBLIC OF KAZAKHSTAN

Abstract: The article analyzes the effectiveness of tax audits as a fundamental form of tax control. The evaluation of the results of the control work of tax authorities, which affect the effectiveness of tax administration, is given. Particular emphasis is placed on existing problems and directions for improving the practice of tax administration.

Key words: economy, tax administration, tax control, tax inspections, efficiency, effectiveness, budget, economic policy.

Language: Russian

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УДК 338.24

РЕЗУЛЬТАТИВНОСТЬ НАЛОГОВЫХ ПРОВЕРОК КАК ПОКАЗАТЕЛЬ ЭФФЕКТИВНОСТИ НАЛОГОВОГО АДМИНИСТРИРОВАНИЯ В РЕСПУБЛИКЕ КАЗАХСТАН

Аннотация: В статье проведен анализ результативности налоговых проверок как основополагающей формы налогового контроля. Дана оценка результатам контрольной работы налоговых органов, оказывающих влияние на эффективность налогового администрирования. Особый акцент сделан на существующих проблемах и направлениях совершенствования практики налогового администрирования.

Ключевые слова: экономика, налоговое администрирование, налоговый контроль, налоговые проверки, результативность, эффективность, бюджет, экономическая политика.

Введение

В современных условиях развитие экономики в значительной степени зависит от качества налогового администрирования при условии непрерывного повышения его эффективности и результативности.

Основная часть

Одной из форм налогового администрирования выступает камеральный контроль, задача которого выявить на этапе рассмотрения деклараций нарушения по исчислению и уплате налогов и обязательных платежей [1]. Как правило, такого рода нарушения связаны с ошибками в расчетах

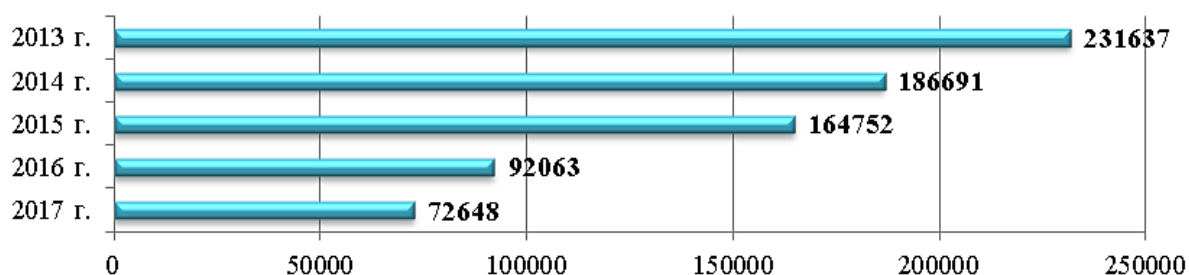
налогооблагаемой базы, сумм налогов и обязательных платежей, что приводит как к доначислениям, так и к уменьшению налоговых обязательств.

Камеральный контроль – это действенный механизм налогового администрирования в части профилактики, а не борьбы с нарушениями [2, с.115]. Благодаря процедурным и разъяснительным работам в рамках налогового администрирования факт выявления нарушений снижается, о чем свидетельствует динамика по количеству уведомлений и извещений, направленных налоговыми органами Республики Казахстан налогоплательщикам (рис.1).



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Примечание – составлено автором на основе данных [3]

Рисунок 1 – Динамика количества направленных налоговыми органами налогоплательщикам уведомлений и извещений по результатам камерального контроля, ед.

Как видно из представленных данных на рисунке 1, если в 2013 году было направлено 231637 уведомлений и извещений, то уже в 2017 году их количество сократилось в 3 раза и составило 72648 ед. Это объясняется увеличением показателя по количеству налогоплательщиков, представляющих налоговую отчетность в электронной форме с помощью сервиса виртуальный «Кабинет налогоплательщика» и «ИС СОНО», что говорит о результативности данных систем, которые позволяют автоматически проверять и исправлять в отчетности различные ошибки.

В рамках налогового администрирования назревшая необходимость четкого регулирования налоговых проверок подтверждает ряд статистических данных и организационно-экономических моментов. С 2015 года практика плановых проверок отменена и введен новый вид проверок как выборочные [4]. Так, на данный момент налоговые проверки делятся на

выборочные и внеплановые. Выборочные проверки назначаются в отношении налогоплательщиков с использованием Системы управления рисками [5], которая соответствует современным мировым аналогам и подлинно отражает экономическую зрелость Республики Казахстан и общества. Внеплановые проверки проводятся по заявлению самих налогоплательщиков, по инициативе правоохранительных органов в рамках Уголовно-процессуального кодекса, по решению налоговых органов [6].

Как показывают исследования, наиболее эффективной формой налогового контроля остаются выборочные проверки, причем переход к целенаправленному отбору налогоплательщиков для их проведения по критериям риска существенно повысил их результативность и позволил сократить количество, а следовательно затраты на их проведение (табл.1).

Таблица 1
Динамика показателей результативности проведения налоговых проверок налоговыми органами Республики Казахстан

Показатели	2013 г.	2014 г.	2015 г.	2016 г.	2017 г.
Всего проведено налоговых проверок, ед.	108854	47873	73605	76794	42018
Плановые / Выборочные проверки					
Проведено, ед.	2125	1080	1849	660	929
Выявлено нарушений, ед.	1943	812	1647	630	918
Доля результативных проверок, %	91,4	75,2	89,1	95,5	98,8
Доначислено сумм налогов и обязательных платежей, пени, млрд. тенге	88,9	87,8	104,2	120,5	183,8
Доначислено на 1 результативную проверку, млрд. тенге	1,0	1,2	1,2	1,3	1,4
Внеплановые проверки					
Проведено, ед.	106729	46793	71756	76134	41089
Выявлено нарушений, ед.	13533	4461	7316	9693	6428
Доля результативных проверок, %	12,7	9,5	10,2	12,7	15,6
Доначислено сумм налогов и обязательных платежей, пени, млрд. тенге	343,9	261,7	586,1	605,8	550,0
Доначислено на 1 результативную проверку, млрд. тенге	22,1	27,5	57,5	47,7	35,2

Примечание – составлено автором на основе данных [3]

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По данным таблицы 1, количество проверок в 2017 году было снижено более чем в 2,5 раза со 108854 до 42018 ед., что обусловлено снижением внеплановых проверок по сравнению с аналогичным показателем 2016 года. Этого удалось достичь благодаря эффективному использованию системы управления рисками и переносу акцента на дистанционный мониторинг налогоплательщиков.

За анализируемый период результативность выборочных проверок составляла 75,2%–98,8%. При сокращении количества проверок практически наполовину с 2125 ед. в 2013 году до 929 ед. в 2017 году, сумма доначислений, приходящихся на 1 результативную проверку увеличилась с 1,0 млрд. тенге до 1,4 млрд. тенге соответственно.

Вместе с тем, в целях кардинального улучшения условий для бизнес-среды со 2 апреля 2014 года по 1 января 2015 года был введен мораторий на проверки субъектов малого и среднего предпринимательства [7]. При несомненном снижении в 2014 году количества налоговых проверок в отношении их наблюдается и значительное снижение всех проверок в общем итоге более чем в 2 раза по отношению к показателям 2013 года. В то же время многие предприниматели восприняли мораторий как индульгенцию на любые нарушения законов и правил.

За 2013–2017 годы несмотря на меньшую результативность, по-прежнему значительную долю налоговых проверок занимают внеплановые. В 2017 году удельный вес внеплановых проверок составил 97,8%, что в 45 раз больше выборочных, которых всего лишь 2,2%. Результативность внеплановых проверок в 2016 году была на уровне 2013 года и составляла 12,7%, а в настоящее время практически достигла абсолютного максимума в 15,6%. Тем не менее, учитывая большой удельный вес внеплановых проверок в общем объеме проведенных налоговых проверок и сопоставив с показателями их результативности, то налицо практически

неизменно низкий их уровень. При этом, структура внеплановых проверок за 2017 год по субъектам инициирования выглядит следующим образом: по заявлению налогоплательщиков на ликвидацию – 88%, по результатам камерального контроля – 7%, по заявлению налогоплательщиков на возврат налога на добавленную стоимость – 3%, в рамках Уголовно-процессуального кодекса – 2%.

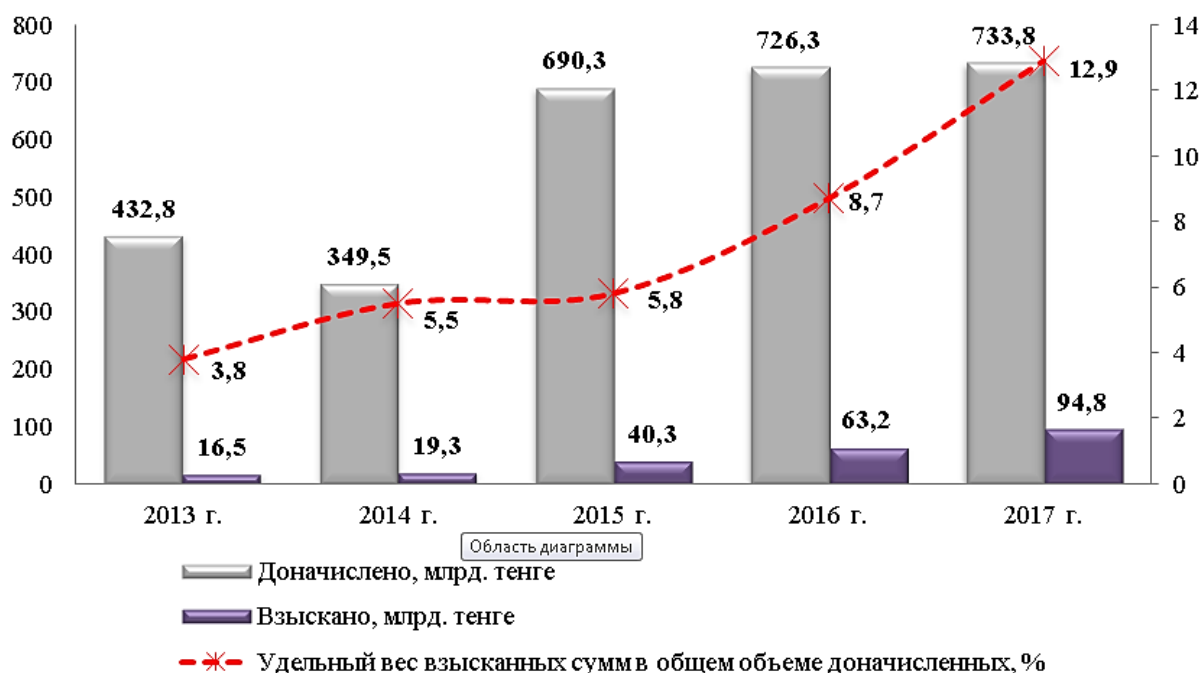
Таким образом, оценка проведения налоговых проверок подтверждает, что выборочные проверки постепенно становятся основной и наиболее результативной формой налогового контроля, а также свидетельствует об эффективности внедрения современной Системы управления рисками в рамках налогового администрирования.

По результатам проведенных внеплановых проверок и сумм доначислений сохраняется высокая степень конфликтных ситуаций, что приводит к спорам между налоговыми органами и налогоплательщиками. Сложившаяся ситуация во многом объясняет невысокую результативность внеплановых проверок в сравнении с выборочными. Причем значительная часть налоговых нарушений не выявляется в ходе внеплановых проверок. Данное обстоятельство объясняется весьма высоким уровнем латентности налоговых нарушений, причинами которой служат изобретательность нарушителей, тщательная маскировка и отсутствие явных следов совершаемых нарушений, наличие большого промежутка времени между моментом их совершения и выявления. Это указывает о необходимости поиска направлений совершенствования налогового администрирования в части организации внеплановых проверок.

Доначисленные и взысканные суммы налогов и обязательных платежей в государственный бюджет Республики Казахстан по результатам налоговых проверок представлены на рисунке 2.

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Примечание – составлено автором на основе данных [3]

Рисунок 2 – Динамика соотношения доначисленных и взысканных сумм налогов и обязательных платежей по результатам налоговых проверок

Как видно из рисунка 2, в 2013 году общий объем доначисленных сумм составил 432,8 млрд. тенге, тогда как в 2017 году показатель увеличился до 733,8 млрд. тенге. Подобная тенденция обусловлена улучшением результативности налоговых проверок, а эти доначисления представляют значительную сумму для бюджета республики.

Однако не все доначисленные по результатам налоговых проверок суммы поступают в бюджет. В 2016 и 2017 годах удалось фактически взыскать с налогоплательщиков и перечислить в бюджет наибольший процент доначисленных в ходе налоговых проверок сумм 8,7% и 12,9% соответственно. В 2013 году этот показатель был наименьшим и составил 3,8%. В целом, показатель 2017 года практически в 3,5 раза выше, чем он составлял в начале анализируемого периода.

Хоть соотношение доначисленных и взысканных сумм по результатам налоговых проверок увеличивается, стоит отметить, что оно подвержено сильным колебаниям в силу большого количества оспаривания решений налоговых органов налогоплательщиками и значительных объемов самих сумм доначислений. По данным 2017 года количество обжалованных актов налоговых проверок составило 861, из них только 63 были

удовлетворены, а количество проверок, признанных недействительными по результатам удовлетворенных жалоб – 14 [3].

Оперативное реагирование на нарушения, выявленные при рассмотрении жалоб, обобщение результатов и устранение внутриведомственных ошибок способствовали повышению качества налогового администрирования. В 2017 году наблюдается тенденция к сокращению количества жалоб, подаваемых на решения по результатам налоговых проверок более чем на 20% в сравнении с аналогичным показателем 2016 года. Действующая с 2013 года норма, согласно которой налогоплательщики, совершившие нарушение впервые, вместо штрафа получают предупреждение [8, с.3]. По итогам 2017 года от всех административных дел в 90% вынесено предупреждение [9].

Вместе с этим, действующая идеология по упрощению налогового администрирования направлена на защиту интересов добросовестных налогоплательщиков, а все неясности и неточности толкуются в большей степени в их пользу [10]. Такой принцип позволяет справедливо рассматривать налоговые споры.

Заключение

Налоговыми органами Республики Казахстан выстроена адекватная современным экономическим условиям система налогового

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администрирования. Контрольная работа налоговых органов, основанная на инструментах точечной выборки налогоплательщиков по категориям рисков способствует улучшению

результативности налоговых проверок и соответственно росту доначисленных и взысканных сумм налогов и обязательных платежей в бюджет.

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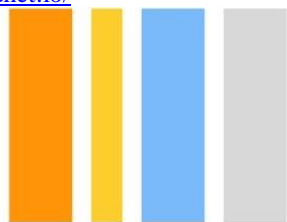
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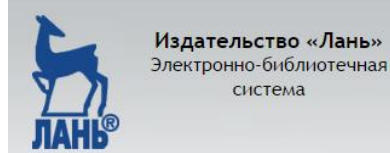
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