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THE DETERMINATION OF EFFECTIVE DOSE OF "SUMAKH FRUIT EXTRACT" FOR CORRECTION OF GENOTOXICITY OF METHYLNİTROSOGUANİDİNE DURING THE PROCESS OF ARTIFICIAL MUTATIONS IN BACTERIA

Abstract. To determine the effective dose of sumakh fruit extract as a modifier for artificial mutagenesis, an extract was added to the wild-type E. coli K-12 cell culture medium in the test dose, then the objects were exposed to mutagen. As a mutagen MNG (methylnitrosoguanidine) (5 mcg/ml) was added to the medium. Doses of mutagen were selected by calculating the aquatoxicity of their mutagenic effect.

As can be seen from the results of the experiment, the mutagen used reduce the viability of bacteria. Sumakh fruit extract at a dose of 0.01 mcg / ml most effectively reduces the frequency of mutations formed by MNG (table 1).

Keywords: methylnitrosoguanidine, antimutagens, sumakh fruit extract.

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ОПРЕДЕЛЕНИЕ ЭФФЕКТИВНОЙ ДОЗЫ “ЭКСТРАКТА ИЗ ПЛОДОВ СУМАХА” ДЛЯ КОРРЕКЦИИ ГЕНОТОКСИЧНОСТИ МЕТИЛНИТРОЗОГУАНИДИНА ПРИ ПРОЦЕССЕ ИСКУССТВЕННОЙ МУТАЦИИ У БАКТЕРИЙ

Аннотация. Для определения эффективной дозы экстракта из плодов сумаха, как модификатора при искусственном мутагенезе в среду посева клеток E.coli K-12 дикого типа добавлялся экстракт в испытуемой дозе, далее объекты в отдельности подвергались воздействию мутагена. В качестве мутагена к среде добавлялся МННГ (метилнитрозогуанидин) (5 мкг/мл). Дозы мутагена были выбраны путем вычисления эквитоксичности его мутагенного воздействия.

Как видно из результатов опыта, используемый мутаген понижает жизнеспособность бактерий. Экстракт из плодов сумаха в дозе 0,01 мкг/мл наиболее эффективно понижает частоту мутаций, образованную МННГ (табл. 1).

Ключевые слова: метилнитрозогуанидин, противомутагены, экстракт из плодов сумаха.

Поиск корректоров, способных противостоять вредному воздействию мутагенных и канцерогенных веществ в процессах мутаций синтетического и натурального происхождения ведется начиная со второй половины прошлого века. Особого внимания в данном направлении заслуживают натуральные вещества растительного происхождения.

В данном исследовании была произведена апробация широкого диапазона дозы **“экстракта из плодов сумаха“** как модификатора искусственного мутагенеза, сохранившего натуральные вещества растительного происхождения, а так же определение его наиболее эффективной дозы. Для объективной оценки его эффективности

в защите генома, была изучена противомутагенно активная доза экстракта из плодов сумаха при воздействии мутагенных веществ, различающихся по природе, типу, по механизму взаимодействия с наследственными субстратами, а так же по тяжести вызванных ими повреждений ДНК.

Часть исследований была проведена на E.coli K-12 дикого типа. В качестве мутагена в данном исследовании был использован МННГ (метилнитрозогуанидин). Проверяемые дозы экстракта были добавлены к объекту до мутагена. Для этих целей клетки бактерий выращивались до плотности 2–5*10^{-7} об/млпри температуре 37 °С на среде М-9 с добавлением $MgSO_4$, глюкозы, $CaCl_2$и триптофана. Далее в данную среду добавлялся экстракт из плодов сумаха в дозе от 0,001 до 100 мкг/мл.

Клетки после обработки их экстрактом из плодов сумаха инкубировались в течение 30 минут на водяной бане при 37 °С, осаждались центрифугированием и ресуспендировались на фосфатном буфере (ph 7,0). Далее к ним добавлялся МННГ (5 мкг/мл). После 30-ти минутной инкубации мутаген вымывался из клеток, клетки ресуспендировались в фосфатном буфере и выращивались на мясо-пептонномагаре (МПА) и агаре с добавлением триптофана.

МННГ являясь моно- и полифункциональным алкилирующим соединением, является мутагеном прямого типа, т.е. в начальной форме находится во взаимодействии с ДНК-мишенью. При выборе модели мутагена, так же учитывался спектр образуемых им типов первичного повреждения молекул ДНК. Т. о. МННГ, являясь донором алкильных групп, образует первичные повреждения нуклеотидного типа.

Статистика. Значимость изменения эффективности мутагенеза (κ) оценивали при помощи критерия Стьюдента (t) по формуле $t = \frac{K-1}{9K}$, где K – частное от деления частоты мутаций в сопоставляемых вариантах экспериментов. σK определяли по формуле $\sigma K = K\sqrt{(\frac{\sigma x}{x})^2 + (\frac{\sigma x_1}{x_1})^2}$, где x – средняя частота мутаций. σx определяли по формуле $\sigma x = \frac{\sqrt{\sum} xi}{n}$, где xi частота мутаций каждого опыта, n – количество опытов.

О степени активности испытываемых генозащитных средств судили по показателю ФЭП, который отражает собой отношение разницы между первоначальным и модифицированным уровнем мутирования к первоначальному.

Таблица 1.– Дозозависимая модификация экстрактом из плодов сумаха МННГ – индуцированного мутагенеза клеток E. coli K-12 дикого типа

варианты№ / Опыт	Контроль	ДМСО	МННГ	Экстракт + МННГ, мкг/мл					
				0,001	0,01	0,1	1,0	10	0,001
1	2,23	6,3	215,0	180,5	61	105,5	211,42	192,8	287,6
2	4,44	7,2	182,6	72,35	105	172,6	158,1	260	227,5
3	11,47	5,41	257,2	114,17	93	78,9	170,45	150	67,9
4	7,73	5,25	113,3	144,93	61	187,1	104,0	89,2	152,9
Σ	25,87	24,16	768,1	512	320	544	644	692	736
ẍ	6,46	6,04	192	128	80	136	161	173	184
k				1,5	2,40	1,41	1,19	1,11	1,04
t				6,09	8,75	5,32	3,22	2,2	0,85
p				<0,001	<0,001	<0,001	<0,01	<0,05	>0,05
ФЭП				0,33	0,58	0,29	0,16	0,10	–

В данном опыте экстракт из плодов сумаха использовался на объектах до мутагена. В таблице 1 продемонстрированы жизнеспособность и показатели мутагенеза клеток E.coli K-12 дикого типа после обработки экстрактом, а так же после воздействия МННГ. Как видно по результату данной таблицы, используемый мутаген понижает жизнеспособность бактерий. Исследование показало, что экстракт из плодов сумаха в дозе 0,01 мкг/мл наиболее эффективно понижает частоту мутаций, образованную МННГ (табл. 1).

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ANTIMUTAGENIC ACTIVE DOSE OF "SUMAKH FRUIT EXTRACT" FOR CORRECTION OF GENOTOXITY OF MITOMYCIN C DURING THE PROCESS OF ARTIFICIAL MUTATIONS IN BACTERIA

Abstract. To determine the effective dose of sumakh fruit extract as a modifier for artificial mutagenesis, an extract was added to the wild-type E. coli K-12 cell culture medium in the test dose, then the object was exposed to mutagen. As a mutagen, the object was exposed to mitomycin C (0.01 mcg/ml) that was added to the medium. Doses of mutagen were selected by calculating the aquatoxicity of their mutagenic effect.

As can be seen from the results of the experiment, the mutagen that had been used reduced the viability of bacteria. Sumakh fruit extract at a dose of 0.01 mcg/ml most effectively reduces the frequency of mutations formed by mitomycin C (table 1).

Keywords: mitomycin C, antimutagens, sumakh fruit extract.

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ПРОТИВОМУТАГЕННО АКТИВНАЯ ДОЗА “ЭКСТРАКТА ИЗ ПЛОДОВ СУМАХА” ДЛЯ КОРРЕКЦИИ ГЕНОТОКСИЧНОСТИ МИТОМИЦИНА С ПРИ ПРОЦЕССЕ ИСКУССТВЕННОЙ МУТАЦИИ У БАКТЕРИЙ

Аннотация. Для определения эффективной дозы экстракта из плодов сумаха, как модификатора при искусственном мутагенезе в среду посева клеток E.coli K-12 дикого типа добавлялся экстракт в испытуемой дозе, далее объект подвергался воздействию мутагена. В качестве мутагена к среде добавлялся митомицин С (0,01 мкг/мл). Дозы мутагена были выбраны путем вычисления эквитоксичности его мутагенного воздействия.

Как видно из результатов опыта, используемый мутаген понижает жизнеспособность бактерий. Экстракт из плодов сумаха в дозе 0,01 мкг/мл наиболее эффективно понижает частоту мутаций, образованную митомицином С (табл. 1).

Ключевые слова: митомицином С, противомутагены, экстракт из плодов сумаха.

Поиск корректоров, способных противостоять вредному воздействию мутагенных и канцерогенных веществ в процессах мутаций синтетического и натурального происхождения ведется начиная со второй половины прошлого века. В данном направлении особого внимания заслуживают натуральные вещества растительного происхождения.

В данном исследовании была произведена апробация широкого диапазона дозы **“экстракта из плодов сумаха“** как модификатора искусственного мутагенеза, сохранившего натуральные вещества растительного происхождения, а так же определение его наиболее эффективной дозы. Для объективной оценки его эффективности в защите генома, была изучена противомутагенно активная доза экстракта из плодов сумаха при воздействии мутагенных веществ, различающихся по природе, типу, по механизму взаимодействия с наследственными субстратами, а так же по тяжести вызванных ими повреждений ДНК.

Данное исследование было проведено на E.coli K-12 дикого типа. В качестве мутагена был использован митомицин С. На В исследовании проверяемые дозы экстракта были добавлены к объ-

екту до мутагена. Для этих целей клетки бактерий выращивались до плотности 2–5*10^{-7} об/млпри температуре 37 °С на среде М-9 с добавлением $MgSO_4$, глюкозы, $CaCl_2$и триптофана. Далее в данную среду добавлялся экстракт из плодов сумаха в дозе от 0,001 до 100 мкг/мл.

Клетки после обработки их экстрактом из плодов сумаха инкубировались в течение 30 минут на водяной бане при 37 °С, осаждались центрифугированием и ресуспендировались на фосфатном буфере (ph 7,0). Далее к ним добавлялся митомицин С (0,01 мкг/мл). После 30-ти минутной инкубации мутаген вымывался из клеток, клетки ресуспендировались в фосфатном буфере и выращивались на мясо-пептонном агаре (МПА) и агаре с добавлением триптофана.

При выборе модели мутагенов, так же учитывался спектр образуемых ими типов первичного повреждения молекул ДНК. Т. о. к типам повреждений, образуемых митомицином С относятся соответственно циклобутан-пиримидиновые димеры, мутационные моноаддукторы и ковалентные межнитевые швы молекулы ДНК.

Статистика. Значимость изменения эффективности мутагенеза (κ) оценивали при помощи критерия Стыюдента (t) по формуле $t = \frac{K-1}{9K}$, где K – частное от деления частоты мутаций в сопоставляемых вариантах экспериментов. σK определяли по формуле $\sigma K = K\sqrt{(\frac{\sigma x}{x})^2 + (\frac{\sigma x_1}{x_1})^2}$, где x – средняя частота мутаций. σx определяли по формуле $\sigma x = \frac{\sqrt{\sum} xi}{n}$, где xi частота мутаций каждого опыта, n – количество опытов.

О степени активности испытываемых генозащитных средств судили по показателю ФЭП, который отражает собой отношение разницы между первоначальным и модифицированным уровнем мутирования к первоначальному.

Таблица 1.– Дозозависимая модификация экстрактом из плодов сумаха Митомицин С-индуцированного мутагенеза клеток E. coli K-12 дикого типа

Варианты № / Опыт	контроль	Митомицин С	Экстракт +Митомицин С, мкг/мл					
			0,001	0,01	0,1	1,0	0,001	100
1	9,1	437	463	234	488	527	660	771
2	14,6	580	310	127	356	413	527	634
3	24,3	789	503	209	470	522	589	575
4	20,8	730	276	218	362	430	540	380
Σ	68,8	2536	1552	788	1672	1892	2316	2360
ẍ	17,2	634	388	197	419	473	579	590
k			1,63	3,22	1,51	1,34	1,09	1,075
t			12,1	9,53	10,85	8,50	2,90	2,50
p			< 0,001	< 0,001	< 0,001	< 0,001	< 0,01	> 0,05
ФЭП			0,39	0,69	0,34	0,25	0,09	0,07

В опытах проведенных на бактериях экстракт из плодов сумаха использовался на объектах до мутагена. В (таблице 1) продемонстрированы жизнеспособность и показатели мутагенеза клеток E.coli K-12 дикого типа после обработки экстрактом, а так же после воздействия митомицина С. Как видно по результатам данной таблицы, используемый мутаген понижает жизнеспособность бактерий. Экстракт из плодов сумаха в дозе 0,01 мкг/мл наиболее эффективно понижает частоту мутаций, образованную митомицином С (табл. 1).

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GAMETOCIDAL EFFECT OF EMISSIONS OF CEMENT PRODUCTION (ON THE EXAMPLE OF OJSC "IVANO-FRANKOVSKTSEMENT")

Abstract. Anthropotechnogenic impact on ecosystems consist not only of explicit general toxical effect on biota, leading to a reduction of the survivability of both specimens and their populations as a whole, but also in long-term effects, particularly gametocidal ones.

Most of the mutations induced by polutants are recessive and appear in haploid pollen cells or embryos during embryonic development of seeds. Meiosis acts as a kind of barrier in the transmission of some types of such mutations to the offspring, resulting in sterile pollen and non-viable seeds [1]. Therefore, the number of abnormal meiotic cells and sterility of pollen grains are the most significant criteria in evaluating the effect of technogenic pollutants [1].

Keywords: gametocidal impact, pollutants, urban technogenity, exotoxicants, anthropotechnogenity.

The research was conducted in spring periods within a 10-km zone of impact area of PJSC Ivano-Frankivskcement, located in Tismenitsky district of Ivano-Frankivsk oblast.

Biotoxic effects of cement production emissions were estimated by pollen reactions of woody plants available in sufficient number of plantations of similar age and sanitary condition: *Salix caprea L., Populus pyramidalis Roz., Tilia cordata Mill* and *Betula pendula Roth*. The species were defined according to the "Identification of higher plants of Ukraine" [3]. All researches were carried out in situ synchronously throughout the research area.

With the purpose of revealing gametocidal effect of urbotechnogenic environmental factors, the sterility of male gametophyte of woody indicator plants was investigated. Pollen of woody plants was collected from flower inflorescences during blossoming from the leeward side of the tree at the lower tier of the crown from branches of the same order of branching according to the standard method [2]. The presence of starch in pollen grains was considered as a criterion of male gametophyte fertility. This indicator is characterized by considerable lability in heterogeneous environmental conditions and versatility in relation to various biological objects. Studies have shown that sterile pollen grains differ from fertile ones not only in colour intensity, but also in linear size and nature of the eczine. The results of the test for sterile pollen of woody plants indicate intensification of gametocidal effect in a number of localities: Yamnytsia village → Uhryniv village → Pavlivka village → Viktoriv village → Pidluzhzhya village, which shows an increase in the

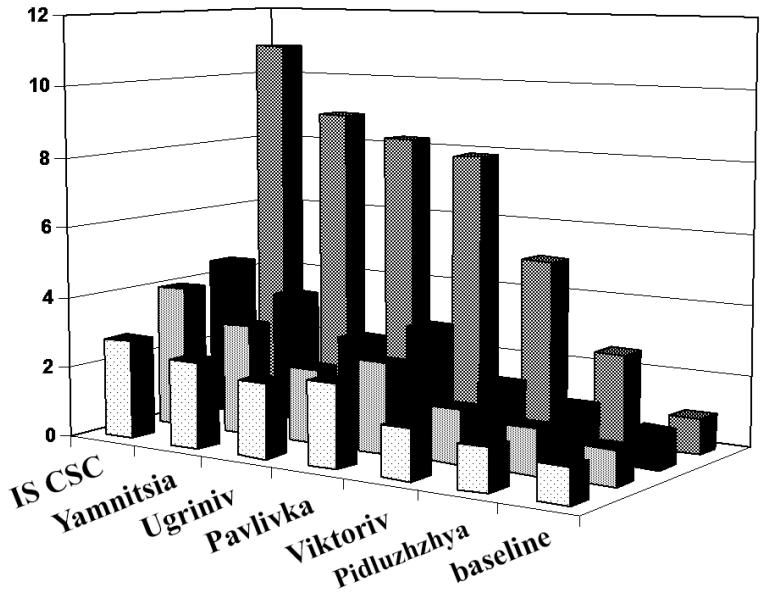
share of starchless pollen in pollen culture (Table 1). The maximum excess of the baseline value was recorded in plants of the industrial site (IS) of the cement-slate combine (CSC).

Table 1. – Sterility levels of pollen from woody indicator plants in the impact area of PJSC Ivano-Frankivskcement

Study area	Starch-free pollen grain level,% M ± m			
	P. pyramidalis	*T. cordata*	*B. pendula*	*S. caprea*
Industrial site of CSC	77.3±7.66*	26.6±2.02*	19.6±1.83*	8.4±0.59*
Yamnitsia	63.2±3.40*	21.8±1.53*	15.3±1.24*	7.3±0.42*
Ugriniv	58.7±1.33*	15.6±0.97*	10.2±0.74*	6.2±0.26*
Pavlivka	55.8±1.57*	18.8±0.75*	12.4±0.64*	7.0±0.21*
Viktoriv	35.4±0.98*	10.6±0.48*	7.4±0.45*	4.3±0.15*
Pidluzhzhya	18.0±0.62*	8.3±0.30*	6.2±0.29*	3.6±0.11
Baseline territory	7.1±0.31	5.9±0.18	4.9±0.15	3.0±0.09

*Note: * – significant changes in the studied parameters compared with the baseline value*

Species responsiveness of male gametophyte to influence of urban-technogenic factors was noted, as evidenced by the pattern of changes in pollen sterility coefficient (P_{SC}) (Fig. 1). The maximum level of starchless pollen grains was found for *P. pyramidalis*. In particular, in plants growing in conditions of PE PJSC Ivano-Frankivskcement the level of pollen sterility exceeded the baseline index (7.1 ± 0.3%) by 10.89 times, reaching 77.3 ± 7.66%. Low values of P_{SC} values of *P. pyramidalis* were noted in Pidluzhzhya village – 2.54.



	IS CSC	Yamnitsia	Ugriniv	Pavlivka	Viktoriv	Pidluzhzhya	baseline
S. caprea	2,8	2,43	2,1	2,33	1,43	1,2	1
B. pendula	4	3,12	2,1	2,53	1,51	1,27	1
T. cordata	4,51	3,7	2,64	3,19	1,8	1,41	1
P. pyramidalis	10,89	8,9	8,27	7,86	4,99	2,54	1

Figure 1. Sterility level of pollen of woody plants of the studied localities

Male gametophyte of *T. cordata* shows lower sensitivity to xenobiotics in comparison with *P. pyramidalis*. The maximum sterility of pollen in linden was observed in specimens from an industrial plant site and was 26.6 ± 2.0%, corresponding to a PSC value of 4.51. The high values of *T. cordata* PSC were obtained for the specimens from greenery of Yamnytsia, Ugryniv and Pavlivka villages: 3.70, 2.64 and 3.13, respectively. The complex influence of the factors in the Viktoriv village was associated with a 1.8 times increase in pollen sterility compared to the baseline value (5.9 ± 0.2). Minimal gametocidal influence, is observed on the territory of the Pidluzhzhya village, was associated with an increase in the number of sterile pollen grains by 1.4 times compared to the baseline.

The pollen sterility coefficient for *B. pendula* fluctuates in the range from 19.6% in the CSC area to 6.2% in Pidluzhzhya with the baseline value of 4.9%.

S. caprea has the highest tolerance to the action of urban-technogenic factors, based on PSC values. Statistically significant difference of the coefficient relative to the baseline value was found in all surveyed localities, except for Pidluzhzhya village, where there was a trend towards a decrease in the number of fertile pollen. In the plant sanitary protection zone, pollen sterility is the highest and amounts to 8.4 ± 0.6%. In general the following series of sensitivity of male gametophyte to impact of emissions of cement production is offered according to values of pollen sterility level: *P. pyramidalis* (11.0 > PSC < 7.34 – highly sensitive species) > *T. cordata* > *B. pendula*(7.33 > PSC < 3.67 – species of medium sensitivity) > *S. caprea* (<3.66 – insensitive species). The increase in the number of sterile pollen of woody plants in the impact area of Ivano-Frankivskcement is accompanied by an increase in heterogeneity of group reaction (Cv,%), which is additional evidence of stress of the adaptation process. Therefore, if at the baseline area, coefficient of variation for different species is in the range 6.21–9.90%, at the territory of PE CSC, its value reaches 15.72–22.17%. Therefore, the impact of cement production emissions causes disturbance of the microsporogenesis process and leads, in particular, to an increase in the proportion of starchless pollen. The specified parameter can serve as an informative indicator of early changes of natural ecosystems under the impact of urban-technogenic pressure. At the same time, woody plants show high specific sensitivity to the cumulative effects of ecotoxicants, which should be taken into account when conducting biomonitoring studies, planning environmental protection measures aimed at optimizing the natural environment and the conservation of biological and landscape diversity, as well as when providing recommendations for landscaping of residential and industrial areas of urban ecosystems. The degree of sensitivity of plants to gametocidal effects of factors of the urbanized environment is a species trait.

Under anthropotechnogenic pollution of the environment by cement production emissions together with a decrease in the fertility of pollen of woody plants, an increase in its morphological diversity is also observed. The latter is manifested by an increase in the number of giant and dwarf pollen grains, respectively, 1.3–1.5 times greater or less than the average norm. The studied heterogeneity results from violations of meiotic division during microsporogenesis, when monads, dyads and other sets of cells are formed next to tetrads [4]. There is evidence that dwarf and multinucleated giant pollen are useless and degenerate in the early stages of development. An increase in the frequency of abnormally sized pollen grains in all tree species occurs in the following sequence of monitoring sites: baseline area → Pidluzhzhya village → Viktoriv village → Pavlivka village → Uhryniv village → Yamnytsia village → PE PSC.

The male gametophyte of P. pyramidalis is the most vulnerable to the action of urbotechnogenic factors. Particularly, in the model individuals with PE CSC, the ability to germinate and form a pollen tube after one day exposure to agar medium is preserved in 19% of pollen grains, which is 11.09 times lower than the baseline value. For this species, the maximum inhibition of pollen tube formation was

also noted in the studied urban ecosysteum. This is evidenced by the reliable ($P < 0.05$) decrease of their length in proportion to the distance to the source of pollution. Therefore, at daily exposition the specified parameter varies in a range from 281.8 ± 2.07 microns at specimens of green plants in the Podluzhzhya village to 128.1 ± 6.42 microns on the territory of Ivano-Frankivskcement with a baseline value of 320.3 ± 2.07 microns. Similar character of changes of parameters of pollen viability is inherent in other flag species. At the same time, the range of analyzed parameters decreases: *T. condata* > *B. pendula*, and *S. caprea* has maximum tolerance to the action of gametocidal factors. The pollen sterility coefficient for this species during daily germination varies from 1.47 to 3.30 in specimens from different zones of the urban ecosystem. The maximum fluctuation of the pollen tube length was 52.1 microns when the pollen was germinated on agar medium for 24 hours. An increase in heterogeneity of the group reaction was also observed in the pollen culture of plants, which is indicated by the increase of the coefficient of variation (C_v) of the analyzed parameters. The considered parameters of pollen viability can serve as informative highly sensitive markers of changes in ecological state of ecological systems in technogenesis zone. In all observation variants the proportion of non-germinated pollen grains was higher than that of starchless pollen grains. In S. caprea, B. pendula this difference is the most expressed and averages 20–30% in different functional zones.

Influence of cement production emissions increases starch-free pollen levels of woody plants. According to this criterion, the maximum resistance is in male gametophyte of *Salix caprea L.*; the minimum – *Populus pyramidalis* Roz. Sterility coefficients of pollen of the above species in different functional zones are, respectively, 1.47–4.39 and 2.04–11.25. Sterility coefficients of pollen of the mentioned species are 1.2 to 2.8 and 2.54 to 10.89, respectively. Depressive changes in the viability of pollen of woody plants are manifested by an increase in the proportion of non-germinated pollen grains and a decrease in the length of pollen tubes. The most vulnerable is male gametophyte of *P. pyramidalis*, in which the ability to germinate and form a pollen tube in the conditions of the studied area decreases by 2.97–11.09, and the length of pollen tubes is reduced by up to 2.5 times. The sensitivity of woody plants to the complex of anthropotechnogenic factors decreases in the following sequence: *P. pyramidalis* > *T. cordata* > *S. caprea* > *B. pendula*. The pollen viability test and the level of leaf surface necrosis are of maximum bioindicative informativity.

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Section 2. Machinery construction

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STUDYING AND ANALYSIS OF THE THERMALLY STRESSED STATE OF THE HYDROGENERATOR STATOR CASINGS BY METHODS OF MATHEMATICAL MODELING

Abstract. The stressed state of the Hydrogenerator housing is considered, taking into account thermal loads. The sequence of carrying out of calculations for the related task is submitted. The possibility of using of the housing with optimized design based on the choice of permissible mechanical stresses with preliminary verification with the method based on convergence by reducing the basic mesh size is substantiated.

Keywords: Hydrogenerator, stresses, temperature, finite element method, construction, electrical machine body.

Introduction

In recent decades, there is a tendency that can be observed not only to increase the efficiency (efficiency) of the electric machines, and also to reduce its mass and dimensional indices per unit of capacity. As a rule, this is due to the increase in com-

puter power and the occurrence of new materials, which allows more accurately modeling of the electric-magnetic, mechanical, temperature and ventilation processes in the electric machines and reduce the weight of the machine units.

The Design under Studying

The object under study The housing of synchronous three-phase vertical Hydrogenerator designed for operation at Kremenchug HPP is considered as the object under study.

Synchronous three-phase vertical Hydrogenerator is purposed and designed for operation at Kremenchug Hydrogenerator, (Ukraine), as part of refurbished Hydroelectric unit as a source of peak power in the Ukrainian power system and to perform the functions of a high-speed emergency and frequency reserve. It is allowed Hydrogenerator operation at rated continuous duty S1 according to Publication IEC60034–1–2004.

The Hydrogenerator is mated directly with the vertical hydraulic turbine.

The Hydrogenerator is manufactured in accordance with the requirements of GOST 561689, IEC Publications 60034–1–2004, 60034–18–2008, Detailed Technical Specifications, a set of Technical Documentation, "Regulations for the Operation of Electrical Equipment (PTEEP)" and is designed for operation in conditions of temperate climate directly in the machine room. Climate design version is "UHL", category of arrangement is 4 as per the State Standard GOST 15150–69.

For possibility of transportation the stator casing is manufactured split of the (sectors).

From the internal part, prisms are welded to the shelves of the stator housing using gussets, onto which the stator core segments are blended.

The stator core is blended from died and varnished segments of sheet cold rolled electrical steel with thickness of 0.5 mm. The stator blending is carried out "in a ring" at mounting.

In axial direction, the core is tightened together using pressing down plates and tie rods.

In height, the stator core is divided into packages, between which channels are formed with the help of spacers for cooling air passaging. The outer core packages are glued.

The surface of the stator bore and core grooves is semi-conductive.

Thus, to study the stressed-strain state, it is necessary to solve the conjugate problem of thermal strength, taking into account the peculiarities of the geometry, the distribution of heat release and heat transfer coefficients (three-dimensional modeling of the air flow inside).

Figure 1. Casing at Treatment Stage

In (Figures 1–2) the segments of the casing in the shop are submitted. The welds shall be tested by ultrasonic to ensure that they are free from defects. The body is sequentially placed in the ring and the basic geometry is formed.

Figure 2. Ready Made Casing Elements

Thermal Problem Solution

For a spacious modeling of the cooling air flow in the Hydrogenerators in the SolidWorks software complex, this three-dimensional model was built (see Figure 3). When modeling both, geometrical features of the stator winding bars and construction of stator and rotor ventilation ducts were taken into consideration.

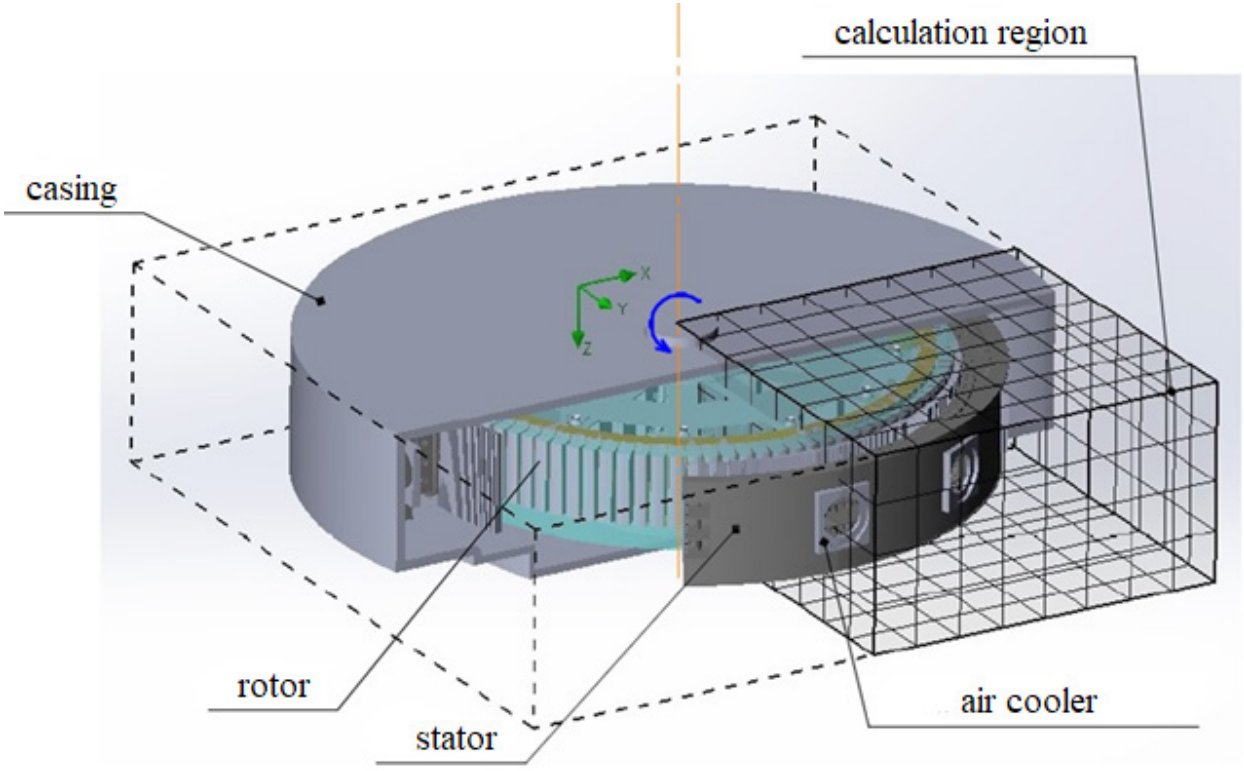

Figure 3. Calculation Three-Dimensional Model of Hydrogenerator

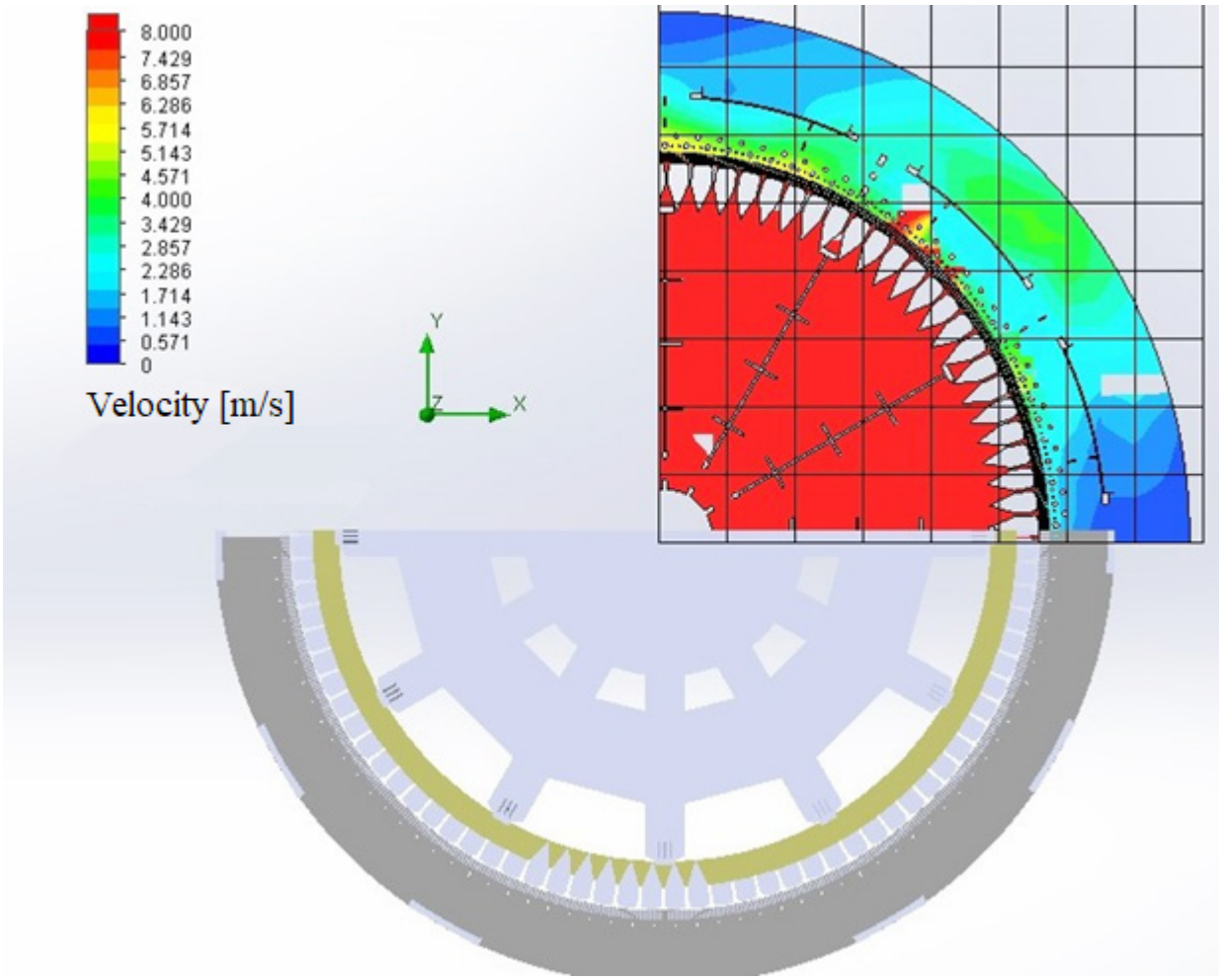

Figure 4. Velocity Distribution in the Stator Channels

Comparison of the results in the temperature ratios of the Hydrogenerator units, which are based on the analytical way and with the help of SolidWorks Flow Simulation, are submitted in (Schedule 1).

Schedule 1. Generator Units Temperature at Rated Mode

Maximum and average temperatures of the units	Temperature, °C
Maximum temperature of the rotor poles	70
Maximum temperature of the rotor winding	96
Maximum temperature of the stator winding (overhang part of the bottom bar)	74
Maximum temperature of the stator winding (slot part)	77
Maximum temperature of the stator winding (overhang part of the top bar)	80
Average temperature of the stator winding	76
Maximum temperature of the stator steel (tooth)	80
Maximum temperature of the stator steel (back)	72
Maximum temperature of the pressing down raker (top)	95
Maximum temperature of the pressing down raker (bottom)	100

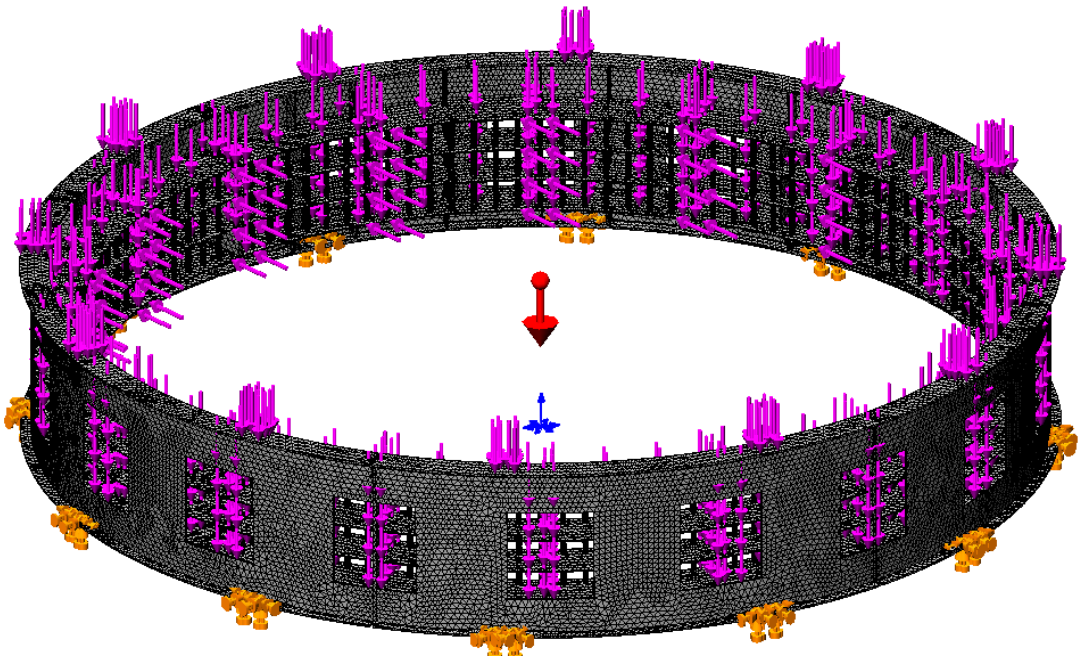

Figure 5. The Grid and Applied Loads

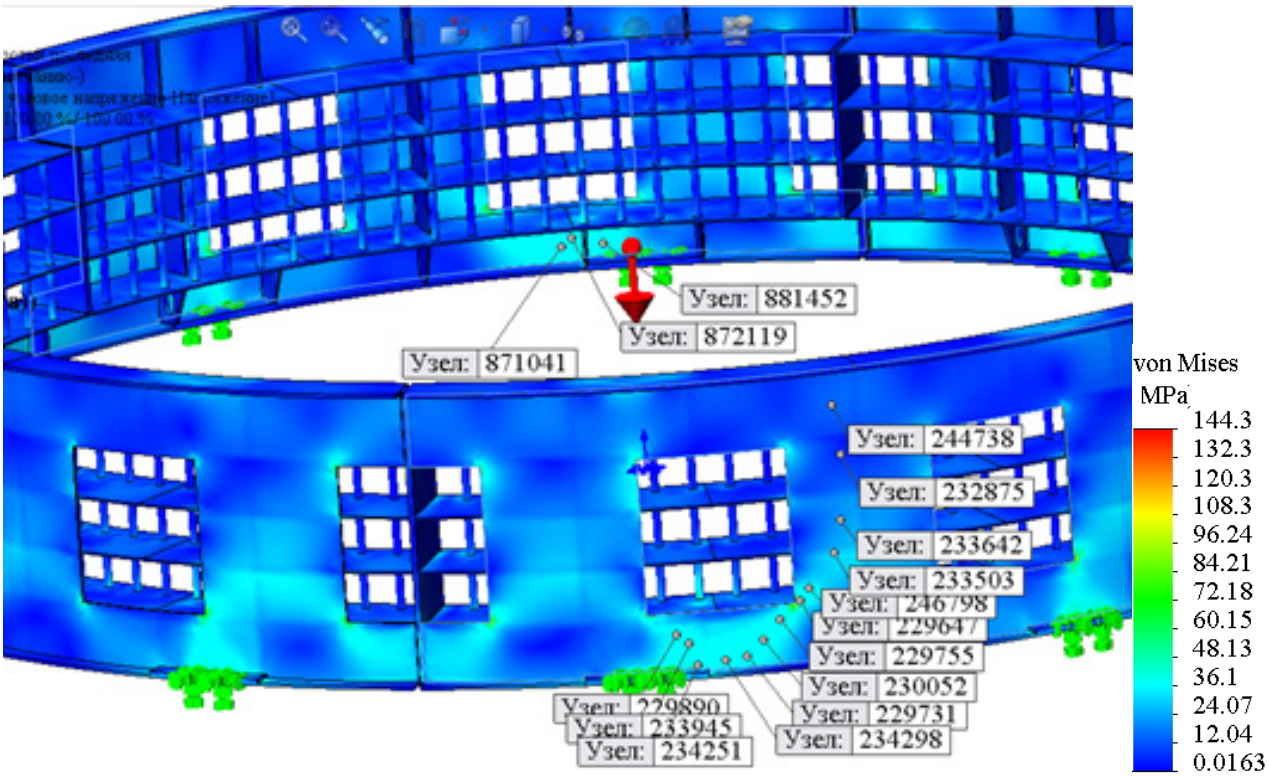

Figure 6. Diagram of Stresses in the Shielding at Double Short-Circuit

Thus, the calculated temperatures can be used as boundary conditions of the first kind for the strength problem.

Research of the Stressed-Strain State of the Stator Casing

In (Figure 5) the calculation model is shown and in (Figure 6) the results are indicated. The arrows in-

dicate the directions of the forces arising from a short circuit. The calculation is based on the classical theory of electrodynamics.

The diagram (Figure 6) shows that the stresses do not exceed the maximum allowable for steel 3.

In (Figure 7) the change in relative convergence with decreasing of finite element dimension is shown. It is seen from the given results that at dimensions of the minimum element of 0.5 mm the necessary level of convergence of results for stresses was reached.

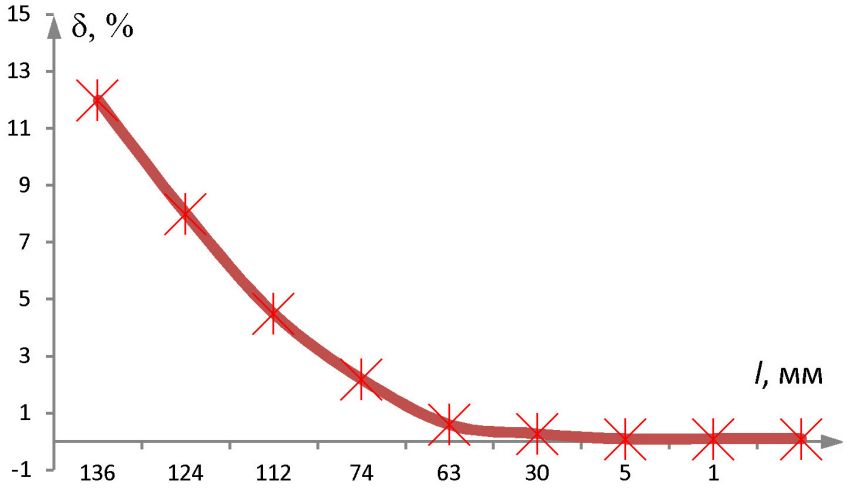

Figure 7. Dependence of Relative Convergence on the Dimension of a Finite Element

Conclusion

In submitted work, the stressed-strain state of the stator casing of the Sredneprovskaya HPP is considered. The design features of the housing are indicated. It has been reliably proven that a casing with a lightweight design can accept critical loads caused by forces of short-circuit, while it was possible to take into account the thermal components. Given problem in an explicit formulation, without using constructive assumptions and setting all the acting forces, was solved for the first time.

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Section 3. Earth Sciences

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SUNDOWNING IN PATIENTS WITH DEMENTIA: AN OBSERVATION IN HOLMES RESIDENCE AND A RESEARCH ON THE PATHOPHYSIOLOGICAL FACTORS AND THERAPEUTIC APPROACHES

Abstract. The definition and mechanism behind Sundowning Syndrome, also known as Sundown Syndrome, is still controversial. Usually, Sundowning Syndrome is characterized by a series of neuropsychiatric symptoms like agitation and confusion and is highly prevalent in the demented population with cognitive impairment. Some hypotheses of its cause include disrupted circadian rhythms and medications, while the methods to attenuate the symptoms vary. To study the hypotheses further, careful research on the literature of this subject for the past years is done. In addition to the works of literature, an observation at the Wingate Residence, in Pittsfield, MA lasted from September to December 2019 to test out some of the hypotheses' effectiveness and to help have a better understanding of the hypotheses.

Keywords:

Introduction

The term "sundowning" usually refers to a series of syndromes that most often accompany dementia, including neurodegenerative diseases like Alzheimer's Disease (AD). It is important to know that there is insufficient research about sundowning, for the symptoms are named merely based on the time period of sunset; sundowning's clear definition, etiology, and the validity of treatments and clinical constructs are still open to debate.

Despite the debates, the term is broadly used to describe neuropsychiatric symptoms. To be more specific, a person with sundowning syndrome usually goes into a state of confusion and restlessness in the late afternoon as the sun sets, sourcing the name "sundowning." This state will continue into the night. During this time period, this person will likely show the symptoms including but not limited to anxiety, aggressiveness, and wandering.

Some of these symptoms are hard to distinguish from those resulting from dementia and neurodegenerative disease like Parkinson's Disease (PD). The line between the two sides is a blur. The most important characteristic of sundowning is that it typically happens in the late afternoon with obvious disruptive behaviors that are not present during the daytime.

As mentioned above, there is no clear definition of sundowning. In the past, multiple observations and researches were conducted to study this set of symptoms and they used various terms to de-

scribe the syndrome. One of the earliest pieces of literature that mention this idea is when Cameron described his findings of "nocturnal delirium," in which he studied the symptoms of agitation when patients were in a dark environment. Whereas Prinz and Raskind in the book *Sleep Disorders: Diagnosis and Treatment* specifically study the symptoms of confusion and disorientation in the elderly during sunsets. They mention other possible behaviors related to sundowning including screaming, wandering, and delusions. In the 21st century, people started focusing on the disrupted cardiac rhythm's relation to sundowning syndrome. That's also when the term sundowning started being widely used to refer to related symptoms and behaviors. For example, Volicer et al., in their article studying sundowning in patients with AD, explicitly defined sundowning syndrome as "the appearance or exacerbation of behavioral disturbances associated with the afternoon/ or evening hours." The researchers also recognize the fact that there is no consensus on the definition, symptoms included or even the existence of sundowning syndrome. This divergence is also demonstrated when Sadok used a different definition in his book about behavioral psychiatry, where he defined sundowning as "a syndrome in older persons that usually occurs at night and is characterized by drowsiness, confusion, ataxia, and falling as the result of being overly sedated with medications." Whereas Bliwise, in his article *What Is Sundowning* said that "In contemporary geriatrics, the phenomenon of agitation seemingly caused by, or at least strongly associated with darkness." Almost all of those articles mention the fact that people still hold doubt about the existence of sundowning, even for those who believe its existence, they argue the cause and mechanism behind it.

The reason some doubt the existence or necessity of defining sundowning is because one can hardly tell if the sundowning behaviors are merely a result of dementia or environmental shifts. In addition, while sundowning syndrome is commonly believed to occur in the evening or nighttime, some point out that there are some patients that show more agitation during the daytime.

For those who argue the exact cause of the syndrome, one of the popular theories is disordered circadian rhythms. Other researchers have found no reliable correlation between sundowning and circadian rhythms. Other possible explanations include sleep disorders, side effects of medication, and environmental factors. All of those theories can be divided into two groups: psychological and physiological factors.

In this article, using my own data and observations of sundowners from the Holmes Residence, I will investigate how the data matches different theories. While at the same time, I will also use my observations to study the viability of different possible treatments for sundowning behaviors.

Method

Using the results of the observations from the Holmes Residence, specifically two representative residents who have the most severe and obvious sundowning behavior, to investigate the efficacy of the potential treatments for sundowning syndrome and the viability of the theories in terms of the cause behind sundowning syndrome.

Subjects

The following information is mainly based on the data from resident profiles in the Wingate Residence.

Mary

Mary is a 100-year-old, widowed female born on November 21st, 1920. According to the assessment she received before moving into the residence on September 14th, 2018, she has no specific allergies to either food or medicine. Because of her diabetes, she is receiving a diet plan of low salt and low fat. Followed is the medication she's been receiving from 2018 until now.

Mary was diagnosed with dementia, hypothyroid, mitral valve prolapse, depression, and diabetes.

She has suffered from wandering behaviors both previously and currently. In the first few days of the observation, Mary had no problem in terms of

immobility. She didn't need any extra equipment. According to the archives, Mary had been walking independently when she moved in. However, in mid-October, she started needing help when standing up from the chair and she owned a unique decorated walker. But she could still move freely with no one standing beside her until the point observation is done. Thus she has been placed in the Memory Care unit where the outermost door is locked to prevent escape. Mary shows signs of anxiety from time to time.

Table 1.– Mary's Medications

Medication	Dosage	Route	Daily	Time
Crestor	10mg	Mouth	Daily	5:00 pm
~~**Imodium**~~	~~125mg~~	~~Mouth~~	~~Daily~~	~~8:00 am; 12:00 pm; 5:00 pm~~
Levothyroxine	75mg	Mouth	Daily	8:00 am
Neurontin	400mg	Mouth	Daily	5:00 pm
	~~100mg~~	~~Mouth~~	~~Daily~~	~~12:00 pm~~
Sertraline	100mg	Mouth	Daily	8:00 am
ASA enteric (coated)	81mg	Mouth	Daily	
Clonazepam (Klonopin)	0.5mg	Mouth	Daily	

Furthermore, usually, Mary is rather kind and loving without verbal or physical aggressiveness, though she showed signs of aggressiveness from October to November. It's postulated that the aggressiveness seems to be caused by another resident. Mary's behavior returned to normal from the beginning of November.

Nico

Nico is an 81-year-old widowed Japanese-American female. She was diagnosed with dementia, diabetes, hyperlipidemia, and HTN. Below is her medication chart.

Table 2.– Nico's Medications

Medication	Dosage	Route	Daily	Time
Amlodipine	7mg	Mouth	Daily	8:00 pm
Antacid	500mg	Mouth	Daily	8:00 am
Azopt	5mg	Mouth	Daily	8:00 pm
Atorvastatin	80mg	Mouth	Daily	8:00 pm
Lisinopril	20mg	Mouth	Daily	8:00 am
Metformin	500mg	Mouth	Daily	8:00 am
Sertraline	25mg	Mouth	Daily	8:00 pm
Tamoxifen	20mg	Mouth	Daily	8:00 pm
Trazodone	12.5mg	Mouth	Daily	8:00 am
Vitamine D	300 units	Mouth	Daily	8:00 am

Nico, according to the staff in the facility, is usually a kind lady who is passionate about helping organize various activities and help with housework. "She enjoys helping clean up after a meal, sweeping the floor, and doing the laundry with us when she's free."

At the same time, Nico needs assistance with bathing and finding her glasses from time to time. She doesn't need help with walking but she has wandering problems. Because of her dementia, she suffers from memory loss and the inability to recognize

time and place. Fortunately, she has no sleep disorder. Her sleep starts at 9 pm and lasts until 7 am with no interruption. Also, she actively participates in all sorts of activities that are designed to help people stretch and keep their brains active.

Nico emphasizes her personal space a lot. She would become angry if she feels her personal space is violated. For example, a nurse comes into her room without knocking first. Despite the fact that she's kind and warm-hearted, she possesses aggressiveness as the daylight is reduced. "As long as she feels the things are not going the way that she precedes they should, she can become verbally aggressive and agitated and resistive," says a nurse. Nico has a history of paranoia and orientation issues. Her sundowning syndrome symptoms include wandering to other people's rooms, exerting violence, including biting and hitting from time to time. Those behaviors put other residents at risk, thus she has a separate single room. At the same time, Nico can be confused and anxious, which is orientated toward herself only. One day her neighbors found her outside of her home confused, this behavior exacerbated as time went by, resulting in her moving into the facility.

Results

How prevalent?

How prevalent are the "Sundowning syndromes"? It needs to be recognized that the pieces of literature about sundowning syndrome are much less when compared to those done for other subjects. There have been controversies in terms of how to decide how prevalent the syndrome is. In the Wingate Residence where my research took place, for example, there were only a few people that possessed a continuous and strong expression of sundowning, while most of the other residents show unstable behaviors. Sometimes the symptoms are particularly obvious, while other times, they are more subtle behaviors. Also, the expression of the symptoms is different. As described in the "Subject" section, some of the residents tend to wander while others might show signs of agitation, conflicts, or illusions. One noticeable thing during the observation was that the sundowning syndrome can be "contagious." Let's use Rachel, a resident of the Wingate facility, as an example. Usually, in most cases, A tends to be quiet and calm during dinner time. However, when Rachel becomes agitated and starts conflicts, A would easily be influenced and become unstable as a result and the influence would spread to other people as well. In addition, some people tend to have similar symptoms in the morning instead of in the late afternoon. Thus, the process of distinguishing the sundowning syndromes' prevalence is as ambiguous as to its definition.

Other pieces of literature also show this ambiguity. According to Donald L. Bliwise, "the simplest way to document whether demented nursing home patients "sundown" would be to systematically and repeatedly observe such individuals using reliable behavioral rating scales." Based on this principle, there are always flaws with some of the studies done to find out the prevalence of sundowning, since they usually apply limited observation duration such as 2–3 minutes.

According to the information published by the Alzheimer's Association in 2006, the range of how many percentages of AD patients with sundowning syndrome varies from 2.4% to 25%. Despite the high percentage of sundowning in AD patients, people with all kinds of cognitive or memory impairments can also have sundowning symptoms, which is proved by the memory disorder unit in Wingate Residence.

Usually, Sundowning is considered to be the second most common type of disruptive behavior in institutionalized patients with dementia. In Wingate Residence, when asked about the things that cause difficulty in caregiving, sundowning is the first thing that comes to most people's minds.

What causes it and what may alleviate these symptoms?

Circadian rhythms

A large proportion of literature about sundowning's cause has been focusing on the abnormalities of circadian rhythms in the human body. When talking about the role of circadian rhythms, the involvement

of the Suprachiasmatic Nucleus (SCN) is discussed. The SCN is located in the hypothalamus, and it is considered the pacemaker for the body. In other words, it controls the circadian rhythms and regulates many different body functions in a 24-hour cycle. One of the most important functions in the case of sundowning is its regulation of the sleep-wake patterns in the human body.

Under the normal scenarios, with the stimulation from light and photoreceptors, the suprachiasmatic nucleus will activate the pineal gland to release melatonin that promotes sleep. By controlling the release of hormones like melatonin, the SCN coordinates a person's sleep-wake cycle. In the study conducted by Feinberg et al., it is reported that elderly people tend to start dream periods earlier and have more interruptions or awakenings during sleep. According to an epidemiological study, five common sleep complaints – trouble falling asleep, waking up, waking too early, needing to nap, and not feeling rested – occur more frequently when people get older, and approximately 38% of people over 65-years-old have the problem of sleep disturbances. These indicate the degeneration of the SCN and a disrupted circadian hypothalamus as people age. Sleep is closely tied with neurodegenerative diseases, as it is both the cause and result of the exacerbation of the brain. Therefore, one possible explanation for the increasing sundowning behavior in dementia patients or ones with cognitive impairment would be the exacerbation of the hypothalamus. This deterioration is caused by the formation of senile plaque that increases with age and contributes to dementia and cognitive impairment. Studies have found in patients with neurodegenerative diseases like AD, the autopsies of their brains show a decreased volume of the SCN, which suggests more disrupted circadian rhythms including the sleep-wake cycle in AD patients. This idea is supported by an investigation done by Huitron-Resendiz et al., where they use platelet-derived beta-amyloid precursor protein (PDAPP) transgenic mice for study and comparison. As a result, the PDAPP transgenic mice exhibit more disrupted sleep-wake cycles and deficits in REM and non-REM sleep. Furthermore, in the research done by Hess, it's shown that almost half of dementia patients have experienced sleep-wake disturbances. Similarly, Bliwise et al. suggested that nighttime sleep disturbance has a correlation with the severity of dementia.

As a result of the disrupted cycle, the patients may fail to achieve a normal sleep-wake cycle and have abnormal energy patterns during the daytime. They may have more surplus energy at dinnertime compared to normal people. This idea is demonstrated in the study conducted by Satlin et al., where patients with severe AD usually have greater total daily motor activity during the evening and less control or restrictions on the motor circadian rhythms when compared with healthy elderlies. As a result, they have an increased tendency of agitation, wandering, and confusion, all of which are the common symptoms of sundowning syndromes.

According to Bliwise DL, he suggested a few hypotheses about the psychological explanation for the sundowning syndromes. Including one that neuronal degeneration that reduces the activity of the SCN and causes disturbances to the REM sleep can result in the rest-activity cycle disturbance, which in turn promotes sundowning in the AD patients.

It needs to be clear that the exact causation relationship between sleep disturbance has not been formally established. But the effect of the abnormalities in circadian rhythms on sundowning syndromes' developments can be a promising direction for further research.

Inadequate exposure to light

Aside from the idea of disrupted circadian rhythms, inadequate exposure to light can also be one of the contributing factors for sundowning syndrome.

For example, in *Sleep Disorders and Insomnia in the Elderly* written by JE Morley, he describes a patient with visual impairment who repeatedly shows sundowning symptoms as daylight is reduced. Moreover, as suggested by Mayo Clinic, low lighting and

increased shadows can be two of the factors for sundowning syndrome.

Caregivers

Despite the controversies of whether nursing home residents have less severe sundowning syndrome than those at home, studies show that how the patient is being taken care of is also crucial to the severity of the sundowning symptoms. Both the situation in the Wingate Residence and Evans LK's study suggests that sundowning is more common and more severe in those who are newly admitted to living facilities. Also, it is noticeable that when sundowning occurs in the late afternoon, it's usually when the staff and caregivers start rotation. The change in a familiar environment –people come and leave– can be a cue of the sundowning symptoms.

The insufficient staff-patient ratio can also be a concern. It's supported that without enough attention given by caregivers, a person with dementia could easily develop boredom and dissatisfaction and thus increase the tendency of agitation. The study by Sonja Pedell et al. proves the necessity of social interaction for dementia people by ensuring the effectiveness of shared social touchscreen interactions for them. In addition, Madden KM and Feldman B prove that sundowning happens more frequently on Sunday when the caregiver's resource is the least available than the rest of the week.

Last, the caregivers face various stresses including the residents' sleep problems, which will inevitably reduce the capability of the caregivers and directly result in the increasing likelihood of sundowning syndromes.

Medication

There is also a theory proposed by geriatricians suggesting that sundowning is likely a result of the usage of multiple medications.

Many dementia patients take antidepressants. Resident Taeko takes Trazodone and Sertraline. In fact, Sertraline has the side effects of insomnia and agitation, anxiety, and tremors. While Trazodone may induce numbness, confusion, blurred vision, and nervousness. All of those side effects of Taeko's medication may help explain her sundowning syndrome. Patients are taking medications that may induce side effects that need to be reduced by other medicines with other side effects. After all, the medications inevitably can cause behavioral change which might be the reason for sundowning syndrome.

How to Deal with It?

Ambient Environment

In the Wingate Residence, methods are applied to the people's ambient environment in order to alleviate their sundowning syndrome. These include playing soft music during dinner, practicing light therapy, and increasing the daily activities offered. Playing soft music in the late evening, as well as minimizing unnecessary noise, aim to reduce residents' agitation by minimizing outside sensory stimulation and resulting excitement.

The idea of light therapy in sundown syndrome is an extension of research about AD patients not receiving enough daily daylight. Several articles have shown that exposure to bright light can have many benefits in AD patients, for it effectively reduces the daily motor activity in nighttime and daytime sleepiness for the patients. Moreover, the agitation in dementia patients can also be reduced under light therapy. At the same time, however, Forbes D et al. suggest that there is insufficient evidence to support the effect of light therapy on cognition improvement, agitation, and other behavioral symptoms of sundowning. What Wingate Residence would do is to turn on the lights earlier and put down the curtains before the sun starts to go down, which helps provide a better transition so the elderlies wouldn't be agitated due to the daylight reduction.

Moreover, the practice of light therapy may work better by turning the lights on when the patients are paying attention to other things like afternoon activities and TV programs. Therefore, staff in Wingate Residence also keep the TV on and design a series of activities in the afternoon. One of the problems they were facing in sundowning management is that late

evening is usually when the staff change rotation and the caregiver resource isn't available. But if they start sending another group of staff helping the elders doing afternoon activities at the same time period, the sundowning behaviors reduce dramatically in terms of frequency and severity. This is because physical exercise helps reduce the excessive energy the dementia patients have in the late afternoon.

Last, it's important to make sure the patient is adhering to a standard daily routine. Any interruption in the daily routine is intervening in the normal function of human circadian rhythms and causing panic due to the unfamiliarity in the environment. This is supported by my observation: the Wingate residents usually go over a radical sundowning behavior period in the daylight saving period, since their daily routine is disrupted while the sun goes down at the same time as before.

These acts on the ambient environment have lasted for almost a year and are proved to be effective during my observation when the sundowning behavior seldom occurs or sometimes occurs in a less aggressive way. However, it is hard to identify how much one element contributes to the general calmness since the elements in the ambient environment interact with each other and can be barely separated by completely eliminating one element's influence.

For now, the behavioral intervention described above is usually the first choice in terms of attenuating the sundowning symptoms rather than the medication practice.

Medication

Aside from the influence of the ambient environment, the effectiveness of the medication is another important approach. When talking about the medication for sundowning syndromes, given the fact that the majority of researchers believe in the circadian rhythm's influence in the development of sundowning syndrome, the first subject would be the regulation of related hormones.

Melatonin is a sleep-inducing hormone secreted by the pineal gland when it is not stimulated by sunlight. Various studies have demonstrated the correlation between abnormal melatonin regulation and sundowning syndrome development. More studies suggest that the proper supplementing of melatonin can help reduce the severity of the sundowning syndrome, it can help reduce daytime sleepiness, and help with the normal operation of the circadian rhythms. Although melatonin is shown to have the potential for adjusting circadian rhythms, it is noteworthy that it may be helpless in terms of other symptoms. Those studies that prove melatonin's effectiveness can not eliminate the effect of the outside environment, which is a concern when considering melatonin's actual potential in the treatment.

In addition, the role of antipsychotic medications is worth discussion as well. According to a survey result from Stoppe G et al., more than 40% of surveyed physicians would consider antipsychotic medication for the treatment of sundowning syndrome. Whereas substances like Benzodiazepines, frequently used drugs to help relieve nocturnal delirium is used by few dementia patients in the Wingate Residence and is seldom considered; even though it can help relieve the behavioral sundowning symptoms, it can also cause drug tolerance, dependence, and other important health risks including central nervous system depressions, which makes it a less ideal choice.

The purpose of antipsychotic medication is to reduce the behavioral symptoms of sundowners. It may be especially effective in terms of anger, aggression, and paranoia. However, there hasn't been much literature about the effectiveness of antipsychotic drugs in sundowning treatment specifically. Other antipsychotic medications including quetiapine, have been reported effective in terms of reducing sleep disturbances in one-third of the patients. Despite the lack of valid literature and study in its effectiveness, the antipsychotic medication's effect is controversial. It's reported that "antipsychotic medications exhibit modest effects on agitation in patients with severe dementia with only 15–20% effect size over placebo… about one-third of patients on antipsychotic medications may experience mild

sedation, which may be favorable in sleep facilitation." There are also studies suggesting antipsychotic medication's potential effect in various sleep disturbances and maladaptive behaviors and daytime agitations. Still, more information is needed to validate the effectiveness of antipsychotic medications.

Until now, no valid and reliable standard is available for sundowning diagnosis and treatment selection, and physicians tend to do a holistic evaluation based on the patients' medical history and health condition. Furthermore, there are no sufficient and effective drugs or medications that could be used to treat or alleviate sundowning syndromes, and further research is definitely needed.

Conclusion

The exact definition of Sundowning Syndrome is still unequivocal, and there are many controversies surrounding it. The debate also extends to the cause of the sundowning. One popular theory is disrupted circadian rhythms, resulting in abnormal daily motor activities when patients have a surplus in the late afternoon and are active at night while experiencing daily sleeplessness in the morning. People also argue sundowning is a result of limited exposure to light. The possibility of side effects of medication is also discussed. Generally, researchers tend to think about sundowning as a result of interrupted daily routines and unfamiliar environments. However, none of the hypotheses is supported by enough evidence. The standard for diagnosis of sundowning and model used to predict the sundowning incidence is suggested but more research is still needed.

On the other hand, there is no treatment that can effectively eliminate these symptoms. There are two main ways to attenuate sundowning: non-pharmacological and pharmacological. Non-pharmacological ways mainly aim to reduce the behavioral symptoms by using methods like light therapy that act on the patient's ambient environment. While the pharmacological way includes medications like melatonin and antipsychotic medications that regulate factors that affect sundowning like disrupted circadian rhythms.

For now, there is no perfect method that is proved to be the most effective for sundowning symptoms and can act without side effects. For non-pharmacological methods, particularly, since it acts on the ambient environment like light and sound, it's hard to conduct research studies that completely eliminate other factors and focus on one single element like light exposure to test out the efficiency of the method.

The existence of sundowning behaviors creates a significant burden for those caregivers to manage dementia patients. Figuring out the complicated relationships between different factors and sundowning syndrome can help relieve the stress it causes in terms of the management of sundowning syndrome.

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Section 4. Agricultural sciences

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METHOD OF LOCALIZING INFECTION IN NUTRIENT MEDIA FOR *IN VITRO* CULTIVATION OF PLANT MATERIAL

Abstract. The article presents a method for localizing infection in nutrient media in vitro. The effect is achieved by applying potassium sorbate to the infected surface or along the perimeter of the infected surface in an amount of 0.5 to 50 mg per flask, depending on the area of the infected surface. Potassium sorbate provides local decontamination of the nutrient medium, which contributes to the preservation of plant material cultivated in vitro, as well as the saving of deficient components of the nutrient medium.

Keywords: potassium sorbate, sterility, microflora, androgenesis, sugar.

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МЕТОД ЛОКАЛИЗАЦИИ ИНФЕКЦИИ В ПИТАТЕЛЬНЫХ СРЕДАХ ПРИ КУЛЬТИВИРОВАНИИ РАСТИТЕЛЬНОГО МАТЕРИАЛА *IN VITRO*

Аннотация. В статье представлен метод локализации инфекции в питательных средах в условиях *in vitro.* Эффект достигается путем нанесения на инфицированную поверхность или по периметру инфицированной поверхности сорбата калия в количестве от 0,5 до 50 мг на одну колбу в зависимости от площади инфицированной поверхности. Сорбат калия обеспечивает локальное

обеззараживание питательной среды, что способствует сохранению культивируемого *in vitro* растительного материала, а также экономии дефицитних компонентов питательной среды.

Ключевые слова: сорбат калия, стерильность, микрофлора, андрогенез, сахарная свекла.

Введение

В современной селекционной практике широко применяют методы биотехнологии. Культивирование и манипуляции с клетками, тканями и органами растений *in vitro* на искусственных питательных средах в строго контролируемых условиях позволяют значительно сократить продолжительность селекционного процесса, проводить быстрое размножение независимо от климатических условий, получать безвирусный растительный материал, создавать новый исходный селекционный материал [1]. Необходимым условием успешного проведения всех этапов работ с растительным материалом *in vitro* является соблюдение асептических условий в помещении, ламинарных боксах, стерильность питательной среды, инструментов, вводимых в культуру эксплантов. Источником контаминации могут быть компоненты питательных сред, инфицированные экспланты, внутрилабораторная передача инфекции из воздуха, от персонала, используемых препаратов и от одной культуры клеток другим [2]. Но даже тщательное соблюдение правил асептики и эффективная стерилизация эксплантов не исключают наличия внутренней латентной инфекции, которая проявляется даже после 2–3 пассажей при культивировании растительного материала [3]. Контаминация приводит к гибели эксплантов, клонов и потере ценного растительного материала. Как правило, при обнаружении инфицирования, культивируемые объекты немедленно удаляются.

Для предотвращения контаминации пительных сред премущественно рекомендуют использовать антибиотики [3; 4]. Однако, применение антибиотиков нередко подавляет не только развитие инфекции, но и тормозит жизнедеятельность эксплантов, негативно влияет на морфогенез и регенерацию растений. Поэтому актуальной задачей является поиск эффективных в отношении микрофлоры питательных сред веществ с менее агрессивнным воздействием на растительные обьекты и разработка методов инактивации микрофлоры или локализации инфекции. Особенно важным является разработка методов устранения заражения или локализации инфекции, которые могут быть использованы при микроклональном размножении редких или трудно размножаемых *in vivo* растений, получении гаплоидов, например, при индукции андрогенеза в культуре *in vitro*, когда потеря каждого обьекта (каллуса, эмбриона, микроклона) критична для эксперимента [5].

К группе подобных веществ принадлежит известный консервант сорбат калия – пищевая добавка (Е202), которая обладает антимикробным действием и входит в список наиболее популярних консервантов вследствии ее безопасности для организма человека. Сорбат калия активно угнетает рост и распостранение дрожжей, бактерий, грибов [6].

Целью работы является разработка метода локализации инфекции в питательных средах в условиях *in vitro* путем использования сорбата калия

Материалы и методы

В экспериментах использовали модифицированную питательную среду Мурасиге – Скуга с полной и уменьшенной в 2 раза дозой макроэлементов, с витаминами по Гамборгу [3], с добавлением аскорбиновой кислоты (витамина С) – 1,0 мг/л, амінокислот: глутаминовой – 500 мг/л, аспарагиновой – 50 мг/л, аргинина – 5 мг/л, пролина – 2 мг/л, гидроксипролина – 2 мг/л, сахарозы – 30 г/л, регуляторов роста: 2,4-Д – 2,0 мг/л, 6-БАП – 0,6 мг/л [5]. На эти питательные среды высаживали отрезки цветоносов, пыльники с ди- и тетраплоидных опылителей сахарной свеклы (селекционный материал Белоцерковской

опытно-селекционной станции), которые использовали для индукции процессов андрогенеза.

Для создания асептических условий проводили стерилизацию помещений, ламинаров, лабораторной посуды, инструментов, дистиллированной воды. Для обеззараживания эксплантов применяли: гипохлорит калия – раствор «Белизны» (25%) с экспозицией 30–35 минут, 3% перекись водорода в течение 15 минут.

При появлении инфекции во время культивирования эксплантов на инфицированную поверхность питательных сред или на границу инфицированной поверхности наносили сорбат калия. Внесение препарата осуществляли под ламинаром с помощью стерильных инструментов – скальпеля или пинцета. Сорбат калия использовали в количестве от 0,5 до 50 мг одну колбу в зависимости от размеров инфицированной поверхности. В перерасчете на мм^2 это составляло – 0,16 мг.

Результат обработки поверхности или периметра питательной среды сорбатом калия определяли визуально или путем сравнения площади инфицированной поверхности до нанесения сорбата и после нанесения через 1, 5, 10, 15 и 30 суток. Схема опыта включала варианты: 1) контроль – без применения сорбата к при инфицировании поверхности питательной среды; 2) сорбат калия – обработка периметра инфицированной поверхности; 3) сорбат калия – обработка локуса инфицированной поверхности.

Повторность опыта – 10–15 – кратная.

Результаты и обсуждение.

Результаты исследований показали, что сорбат калия является эффективным средством для подавления инфицирования питательных сред, используемых для экспериментов с растительными обьектами в культуре *in vitro.* Согласно данным наших исследований сорбат калия активно подавлял рост и распространение дрожжей, бактерий, грибов при локальном обрабоке поверхности инфицированного участка питательной среды и предотвращал распространение инфекции на поверхности питательной среды при нанесении по периметру инфекционного пятна или проведении условной границы между инфицированным и неинфицированными объектами.

Количество вносимого препарата составляло 0,5–50 мг на одну колбу зависило от размеров инфицированного локуса среды. Количество вносимого препарата составляло 0,16 мг/мм^2. Максимальное количество препарата 50 мг наносили на инфицированную поверхность площадью 314 мм^2 при радиусе пятна 10 мм. При этом дальнейшее распространение инфекции прекращалось и экспланты (сегменты цветоносов, пыльники сахарной свеклы) оставались неповрежденными, что давало возможность продолжить эксперименты – сегменты цветоносных побегов сохранить для дальнейней работы, а морфогенно активные пыльники культивировать до фазы органогенеза или без потерь перенести экспланты на новую питательную среду.

При незначительном инфицировании питательной среды дрожжевой инфекцией позитивный эффект локализации достигался при внесении сорбата калия по периметру пятна при проведении условной границы между инфицированным и неинфицированными объектами. Расчетное количество препарата – 10,05 мг, наносили на периметр инфицированной поверхностипри радиусе пятна 10 мм.

При нанесении сорбата калия непосредственно на поверхность инфекции наблюдали сокращение диаметра пятна пораженной поверхности, изменение внешнего вида инфекции – цвета, структуры.

Наблюдения в течении 1–20 суток за обработанными сорбатом к инфекцированными обьектами показали, что инфекция не возобновлялась и распространение по поверхности питательной среды не происходило.

Итак, сорбат калия активно подавлял рост и распространение инфицирование поверхности питательной среды при поражении дрожжевой, бактериальной и грибковой инфекцией, при этом

не оказывая токсического действия на культивируемые растительные экспланты. Тогда как антибиотики, вводимые в среду, подавляя патогенную микрофлору, могут угнетать жизнедеятельность эксплантов, тормозить пролиферацию каллуса и негативно влиять на морфогенную активность и регенерацию растений.

Таким образом, разработан простой в исполнении и эффективный метод локализации инфекции в питательных средах в условиях *in vitro.* Эффект достигается путем нанесения на инфицированную поверхность или по периметру инфицированной поверхности сорбата калия в количестве от 0,5 до 50 мг на одну колбу в зависимости от площади инфицированной поверхности. Сорбат калия обеспечивает локальное обеззараживание питательной среды, что способствует сохранению культивируемого *in vitro* растительного материала, а также экономии дефицитних компонентов питательной среды.

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ADOPTION OF CONSERVATION AGRICULTURE FOR SUSTAINABLE AGRICULTURE IN DROUGHT AFFECTED CONDITIONS OF KARAKALPAKSTAN

Abstract. Dramatic changes in soil management concepts are needed to counter the threat. Conservation agriculture proposes options for such changes through addressing a very broad variety of issues related to soil management concepts, water resources management and erosion control, mechanization and tillage, mulching, etc. This article brings together research results, experiences and practical suggestions that can be of immediate use for identifying problems and for formulating, executing and evaluating actions so as to benefit and improve the productivity and conservation of soil and water resources. Conservation agriculture is a new concept not only for farmers, but also for specialists, administrators and policy makers in Karakalpakstan. All stakeholders got convinced that CA is feasible for soil and climatic conditions of Karakalpakstan. Research results shows CA is more economical and sustainable.

Keywords: Conservation Agriculture, no-till, permanent bed planting, irrigation and wheat.

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ВНЕДРЕНИЕ ПОЧВАЗАЩИТНОГО И РЕСУРСОСБЕРГАЮЩЕГО ЗЕМЛЕДЕЛИЯ ДЛЯ УСТОЙЧИВОГО СЕЛЬСКОГО ХОЗЯЙСТВА В ЗАСУШЛИВЫХ УСЛОВИЯХ КАРАКАЛПАКСТАНА

Аннотация. Истощение почвы является широко распространенной и прямой угрозой устойчивому развитию сельского хозяйство. Почвозащитные технологии предполагают разработать концепции управления земельными и водными ресурсами, контролем над эрозией, механизацией и обработкой земли, мульчированием и др. Данная статья сводит вместе совокупность результаты опытов и практических советов, готовых к немедленному применению для выявления проблем, разработки, осуществления и оценки действий по улучшению плодородия, а также сбережения земельных и водных ресурсов. Ресурсосберегающая технология – это новая понятие не только для фермеров, но также для специалистов, руководителей и высокопоставленным политикам в Каракалпакстане. Все партнеры убеждены, что ресурсосберегающая технология подходить почвенно-климатическим условиям республики Каракалпакстан. По результатам исследований можно сказать, что ресурсосберегающая технология экономична и устойчива.

Ключевые слова: Почвозащитное и ресурсосберегающее земледелие, прямой посев, постоянные гребни, полив и пшеница.

Введение

Экологические и экономические преимущества прямого посева семян сельскохозяйственных культур обуславливают возрастающую тенденцию его применения в мире [1, 29–51]. Эта технология не только удовлетворяет экологическим требованиям (защита почвы от эрозии или низкий расход энергии), но и экономит производственные затраты и рабочее время. Возрастающий ассортимент машин для прямого посева семян, создание специальных гербицидов, приспособление сортов сельскохозяйственных культур к технологическим требованиям прямого посева, развитие резистентных к гербицидам сельскохозяйственных культур, а также практический опыт способствуют распространению этой технологии.

Резко обострилась и проблема получения безопасных продуктов питания вследствие увеличения содержания нитрозоаминов, тяжёлых металлов, остатков пестицидов и т.д. Характерно, что в большинстве стран Африки и Латинской Америки, а также в регионах умеренного и, тем более, сурового климата возможности реализации высокой потенциальной урожайности новых сортов и гибридов существенно ограничивались из-за недостаточной устойчивостью к температурным, водным, эдафическим и другим стрессам [1, 29–51].

В Северной и Южной Америке, а также Австралии метод прямого посева стал уже общепринятым. В Узбекистане прямой посев применяется пока только на опытных участках, но уже имеются результаты исследований по данному направлению. При всех соображениях по применению прямого посева семян надо учитывать, что это не просто другая агротехника, а новая система земледелия.

Материал и методика

Все наблюдения, полевые и лабораторные исследования проводились согласно общепринятым методикам по показателям развития и продуктивности культурных растений (фенологические наблюдения, полевая всхожесть и густота стояния растений, динамика роста растений по фенологическим фазам, величина и структура урожая). Опыты закладывались в соответствии с существующей методикой и предусматривали четыре варианта обработки почвы: 1 – традиционная обработка почвы (ТОП); 2 – минимальная обработка почвы с дискованием на 15–20 см (МОПД); 3 – минимальная обработка почвы с чизелованием на 15–20 см (МОПЧ); 4 – нулевая обработка почвы (НОП). Для выявления достоверного влияния изучаемых факторов на исследуемые показатели использовался дисперсионный анализ по программе Ген Стат – 2017(https://www.vsni.co.uk/software/genstat) [2].

Результаты исследований

По показателю полевой всхожести при разных методах обработки почвы не имели существенных различий. Результаты экспериментов, проведенных в Каракалпакстане, показывают, что величина среднего числа всходов пшеницы за три года были в пределах 5,8–8,1% ниже на участках с нулевой обработкой (прямой посев) по сравнению с пшеницей, выращенной по традиционной технологии при одинаковом уровне посева (Рисунок 1). В 2016 году в прямом посеве полевая всхожесть семян озимой пшеницы по сравнению с контролем (традиционная обработка почвы) и минимальной обработкой почвы с дискованием уменьшилось 6,5% и 6,5%, а на варианте с минимальной обработкой почвы с чизелованием 6,3%. Аналогичное положение наблюдалось и в 2018 году. Здесь при нулевой обработке почвы по сравнению с традиционной, минимальной обработки почвы с дискованием и чизелованием уменьшило соответственно на 8,1, 6,2 и 5,8% в 2018 году.

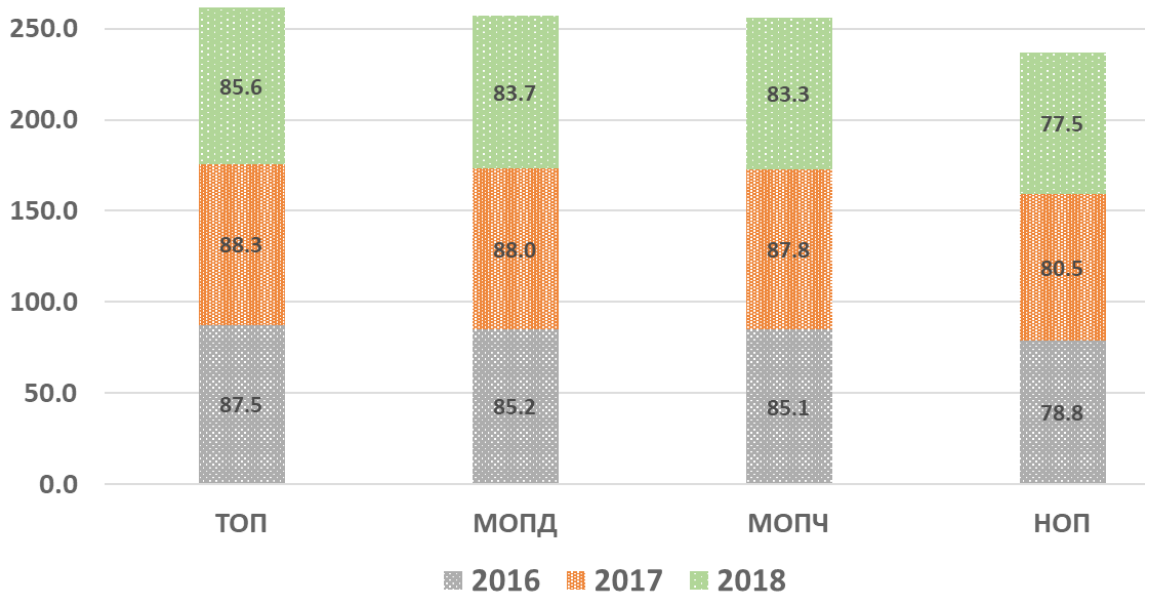

Рисунок 1. Влияние обработки почвы на всхожесть семян пшеницы.

Урожайность пшеницы на экспериментальном участке в основном ниже независимо от метода обработки земли из-за высокого уровня засоленности земель по сравнение другими регионами Узбекистана так как средняя урожайность озимой пшеницы на поливе составляет около 5600 кг/га (https://stat.uz/) [3]. Стоит отметить, нулевая обработка почвы может воздействовать положительно на урожайность озимой пшеницы. Некоторыми авторами отмечена увеличение урожайности почвы при применение нулевой обработки почвы [4, 52–55; 5, 266–280; 6, 285–296]. В наших опытах урожайность при системе нулевой обработки количественно выше, чем при традиционной обработке земли (рисунок 2). Минимальные обработки почвы с дискованием и чизелованием уменьшила урожайность озимой пшеницы на 5,44–9,41%. Наибольшая урожайность, наблюдалась на четвертом варианте в 2018 году (5250 кг/га). Если рассматривать урожайность озимой пшеницы по годам, то она находилась в пределах ошибки опыта. Наименьшая урожайность была получена на варианте традиционной обработки почвы в 2016 году (3975 кг/га). Это объясняется тем, что потеря влаги при нулевой обработке ниже, чем при традиционной вспашке, и при меньшей испаряемости накопление солей в околокорневой зоне снижается, что способствует разрастанию корней и в конечном

счете – к более высоким результатам урожайности. В долгосрочной перспективе нулевая обработка при сохранении растительных остатков поможет снизить засоленность почвы благодаря комбинированному эффекту снижения испарения и рециркуляции органических веществ [7, 40].

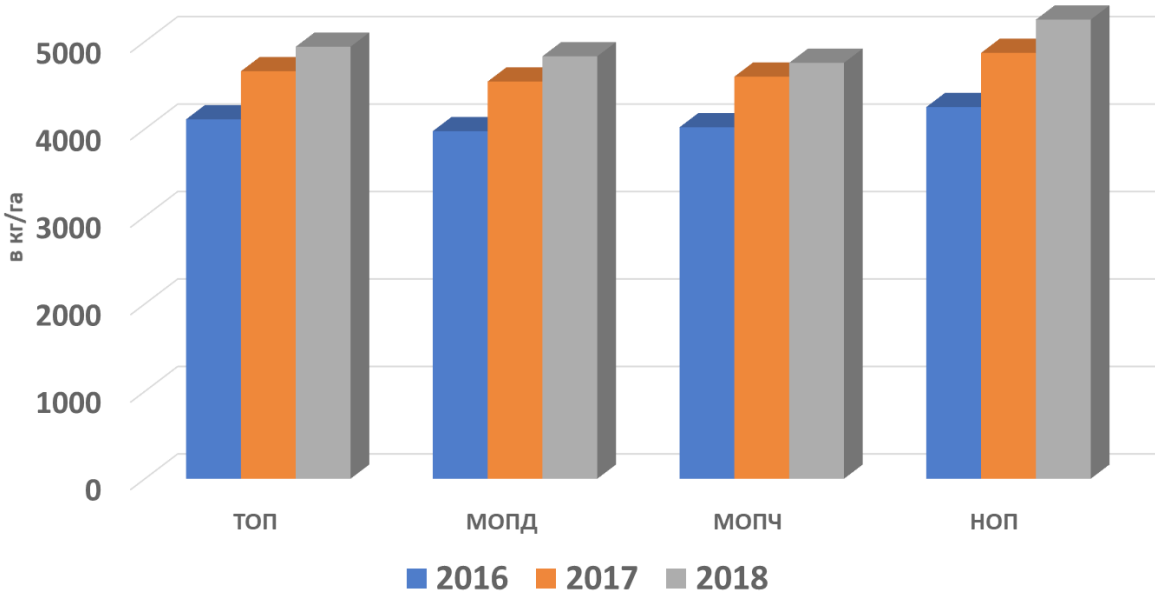

Рисунок 2. урожайность озимой пшеницы в зависимости от обработки почвы, в кг/га

Обсуждение

Почвозащитное и ресурсосберегающее земледелие – это новая понятие не только для фермеров, но также для специалистов, руководителей и высокопоставленным политикам в Каракалпакстане. По результатам исследований можно сказать, что Почвозащитное и ресурсосберегающее земледелие экономична и устойчива. Ни одна новая система земледелия не будет нормально работать до тех пор, пока не активизируется экономический и психологический вопрос о понятии прибыльности, доходности экономической эффективности фермерского хозяйства. Поэтому необходимо организовать обучение пользователей с выдачей им инструкций, рекомендаций и руководств, и разработать правовые аспекты.

При умелом использовании прямого посева можно достичь такой же урожайности, что и при других системах почвообработки, с теми же затратами и применением того же количества удобрений и средств защиты растений, хотя и других видов. В принципе, технология прямого посева годна для возделывания озимой пшеницы на орошаемых условиях Каракалпакстана.

Активизировать научно-исследовательские работы в области почвозащитных технологий и системы прямого посева. Разработать соответствующие системы земледелия, включающие в себя применение специальных сортов, высококачественных семян, новые методы орошения, удобрений, гербицидов (пестицидов) и др.

Заключение

Уменьшение интенсивности обработки почвы при возделывании озимой пшеницы приводит к увеличению урожайности. Увеличение урожайности связано с увеличением влаги в почве и выживаемостью растений к уборке, что, в свою очередь, напрямую связано с качеством работы посевного агрегата.

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Section 5. Technical sciences

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DIGITALIZATION IS AN ELEMENT OF THE COMPETITIVENESS OF TEACHERS AND STUDENTS

Abstrac. A study of the competitiveness of teachers in the era of digitalization was carried out. Collected statistic data of digital literacy and students' opinions on the choice of further profession and work. The result of this article was the introduction of digital technologies in education in the near future.

Keywords: teachers, students, competitiveness, digitalization, creativity.

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ЦИФРОВИЗАЦИЯ ЭЛЕМЕНТ КОНКУРЕНТОСПОСОБНОСТИ ПРЕПОДАВАТЕЛЕЙ И СТУДЕНТОВ

Аннотация. Проведено исследование конкурентоспособности преподавателей в эпоху цифровизации. Собраны статистические данные цифровой грамотности и мнения студентов по выбору дальнейшей профессии и работы. Итогом этой статьи явилось внедрение цифровых технологий в обучение в ближайшее время.

Ключевые слова: преподаватели, студенты, конкурентоспособность, цифровизация, творчество.

Постоянные изменения инноваций в мире выражают сильную конкуренцию не только среди студентов, но и среди преподавателей, которая с каждым годом становится предметом целенаправленного изучения. В данной работе – это тема будет центральной, поскольку компетентность и творчество преподавателя очень сильно влияет на его рейтинг, а также качество обучения студентов. У обучающихся при низкой конкурентоспособности преподавателей соответственно теряется творческий потенциал, что уже наталкивает на мысль с объективной точки зрения на коренное изменение структуры образования.

По опросу уже в 2017 году – 33% респондентов отметили, что им не хватает индивидуальности, чтобы побороть конкуренцию, как правило, это студенты, который закончили высшее образование. Не удивительно, ведь как правило все дипломные работы статичны, то есть не имеют динамики в исследовании, меняется лишь специальный вопрос, где рассматривают малую часть комплексного вопроса, что способствует серьезной конкуренции или типичным кадрам. У сегодняшних «студентов» отсутствует компетенция в творчестве и в последствии не проявляют профессиональную компетентность. Современные кандидаты педагогических наук выражают интегральную оценку в творчестве в виде совокупности личных качеств специалиста отражающая уровень знаний, умений, опыта, достаточного для достижения целей профессиональной деятельности и социально-нравственную позицию личности. Из этого можно сделать вывод, что будущему выпускнику любого ВУЗа обязательно нужна не только современная база (то есть современные технологии, обеспеченные лаборатории в ВУЗе и др.), но и психологическая настроенность на какие-то научные разработки. Здесь всплывает уже проблема педагогическо-профессионального формата.

Возвращаясь к теме не хватки знаний и опыта здесь стоит отметить не только актуальность материалов, по которым «учатся» студенты, но и база самого преподавателя. В современное время педагогу обязательно нужно проходить квалификацию не только в обновлении совей базы данных о предметах, но и оформлении статей, его структуры и др.

Посмотрим, какая ситуация, происходит на уровне практики. Для оценки такой ситуации возьмем и используем такой термин как цифровая грамотность. Данный термин в работе будет означать не только хорошее владение компьютером, но и умение синхронизировать, обрабатывать информацию, таким образом, чтобы получить новые

новаторские идеи и хранить эту информацию, как и в сетевых хранителях, так и материальных. Аналитический центр НАФИ представил интересную статистику цифровой грамотности у педагогов, отвечающих за предмет «информатика» или «ИКТ», в ВУЗах – это «Программирование» и другие предметы. Предположим, что объем информации, который они дают обучающимся одинаковый, тогда справедливо будет установить следующий график, основанный на статистике.

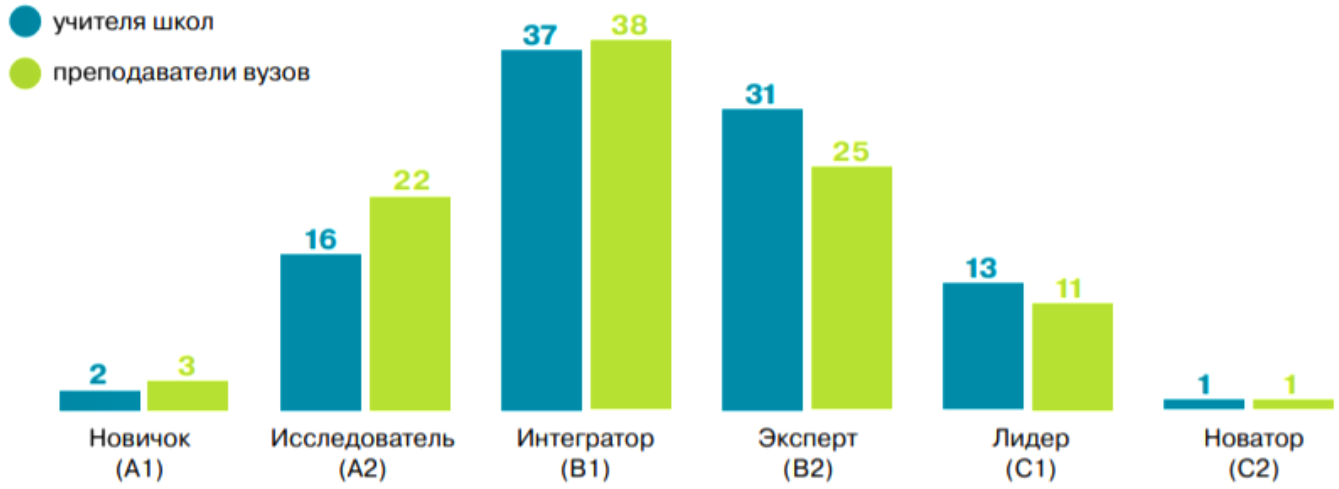

Рисунок 1. Распределение учителей школ и преподавателей Вузов по уровням опыта использования цифровых технологий в образовательном процессе, в % от опрошенных

Поясним, что каждый из этих уровней подразумевает между собой:

A_1 Новичок педагогу необходимо развивать навыки использования цифровых технологий в образовательном процессе. Необходимо улучшить учебный процесс, следовать улучшениям в новом семестре/новой четверти и постепенно повышать компетентность в сфере применения цифровых технологий.

A_2 Исследователь педагог осознаёт, что цифровые технологии обладают высоким потенциалом, и хотел бы изучать их с целью применения в своей педагогической практике. Начал время от времени пользоваться цифровыми технологиями на своих занятиях. B1 Интегратор педагог экспериментирует с цифровыми технологиями в разных контекстах и с разными целями, интегрируя их в свою преподавательскую практику. Использует их творчески, стремясь совершенствовать свои профессиональные навыки и расширять области применения цифровых технологий. B_2 Эксперт педагог уверенно, творчески и критически использует целый ряд цифровых технологий в своей профессиональной деятельности. Целенаправленно отбирает цифровые технологии и материалы для конкретных ситуаций и пытается разобраться с достоинствами и недостатками разных цифровых стратегий. Он полон любопытства, открыт новым идеям и понимает, что есть ещё много не опробованных им цифровых технологий, которые он мог бы применить в своей педагогической практике. Экспериментируя, он пополняет, структурирует и совершенствует свой арсенал стратегий. C_1 Лидер педагог сформировал последовательный и комплексный подход в применении цифровых технологий в педагогической практике. Он владеет целым набором цифровых стратегий и знает, как выбрать наиболее подходящую из них для той или иной ситуации. Педагог постоянно размышляет и развивает свои практические навыки. Он всегда в курсе новшеств, поскольку регулярно обменивается опытом с экспертами и всегда готов помочь коллегам – научить их пользоваться цифровыми технологиями в учебном процессе

и объяснить, какую пользу могут принести цифровые стратегии в образовании.

С2 Новатор педагог ставит под сомнение адекватность современной практики преподавания – как с применением инновационных решений, так и традиционными методами. Он размышляет об ограничениях и недостатках современного образовательного процесса и стремится улучшить его. Педагог-новатор экспериментирует с высоко инновационными и сложными цифровыми технологиями и/или разрабатывает новые педагогические подходы. Также является проводником инноваций и примером для других педагогов.

По графику можно заметить, что компетентность и творчество преподавателя находится на среднем уровне, что для школ, может быть допустимо. А для ВУЗов можно наблюдать иную картину.

Кандидат педадгогических наук Адыгейского Университета на основе источников 2005 года, что уже является достаточно устаревшим источником, указывает, что самым важным составляющим данного вида компетентности являются качества личности преподавателя, а именно способность к творчеству: интуиция, ассоциативность, одухотворенность, воображение; чувство новизны; гибкость и критичность ума, изобретательность, самобытность; умение видеть знакомое в незнакомом; способность к анализу, синтезу и комбинированию; способность к предвидению, переносу опыта; способность ставить и решать нестандартные задачи; стремление к новому, свободе и др.

Подводя итог выше сказанного, можно отметить, что педагог – это универсальная личность, которая отвечает за развитие студентов и должен соответствовать современности общества, а структура обучения обязательно должна иметь элемент цифровизации.

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Section 6. Pharmaceutical Sciences

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EMOTIONS CONCENTRATION BEHAVIOR MEDICATION AMONG CHILDREN

Abstract

Objective: This study aims to: 1) examine the predictors of Emotions Concentration Behavior Medication; 2) build a predictive model for Emotions Concentration Behavior Medication using logistic regression model.

Methods: 2017 National Survey of Children's Health data was used for this study. The National Survey of Children's Health (NSCH) is being conducted by the U. S. Census Bureau for the U. S. Department of Health and Human Services' (HHS) Health Resources and Services Administration's (HRSA) Maternal and Child Health Bureau (MCHB). It is designed to provide national and state-level information about the physical and emotional health and wellbeing of children under the age of 18 living in mailable residential housing units in the United States, their families and their communities, as well as information about the prevalence and impact of children with special health care needs.

All the participants who were eligible were randomly assigned into 2 groups: training sample and testing sample. A logistic regression model was built using training sample. Receiver operating characteristic (ROC) was calculated.

Results: About 8.06% of 18905 children had Emotions Concentration Behavior Medication, about 9.23% among 9719 male children and 6.81% among 9186 female children.

According to the logistic regression, children born outside of the USA were less likely to have Emotions Concentration Behavior Medication (OR=0.468). When the first adult had worse mental health, the children were more likely to have Emotions Concentration Behavior Medication (OR=1.328).

When children's age increased by 1 year, the children were more likely to have Emotions Concentration Behavior Medication (OR=1.152). Female children were less likely to have Emotions Concentration Behavior Medication (OR=0.747). Children with normal birth weight has less likelihood to have Emotions Concentration Behavior Medication (OR=0.714).

Children in a family which is hard to Cover Basics Like Food or Housing were more likely to have Emotions Concentration Behavior Medication (OR=1.085). Children who experienced adults Slap, Hit, Kick, Punch Others less likely to have Emotions Concentration Behavior Medication (OR=0.701). Children who lived with mentally ill were less likely to have emotions concentration behavior medication (OR=0.652).

The area under curve was 0.7699. The optional cutoff time is 0.6637. The mis-classification error was 0.0778. The sensitivity rate is about 0.41% and the specificity is 99.98%.

Conclusions: In this study, we identified important of predictors of Emotions Concentration Behavior Medication among children, for example children age, sex, mental health of adults, and financial status of the family.

Keywords: Emotions Concentration, Behavior Medication, Logistic Regression, ROC Curve, Odds Ratio.

1. Instruction

Children with behavioral or emotional disorders are a special group and need special care. Many times children have symptoms that are different from adults with the same disorder [1]. Childhood behaviour and emotional problems with their related disorders have significant negative impacts on the individual, the family and the society. They are commonly associated with poor academic, occupational, and psychosocial functioning. It is important for all healthcare professionals, especially the Paediatricians to be aware of the range of presentation, prevention and management of the common mental health problems in children and adolescents [2].

In this study, we aim to 1) examine the predictors of the having Emotions Concentration Behavior Medication among children; 2) build a predictive model for having Emotions Concentration Behavior Medication using logistic regression model.

2. Data and Methods:

Data:

2017 National Survey of Children's Health data was used for this study. The National Survey of Children's Health (NSCH) is being conducted by the U. S. Census Bureau for the U. S. Department of Health and Human Services' (HHS) Health Resources and Services Administration's (HRSA) Maternal and Child Health Bureau (MCHB). It is designed to provide national and state-level information about the physical and emotional health and wellbeing of children under the age of 18 living in mailable residential housing units in the United States, their families and their communities, as well as information about the prevalence and impact of children with special health care needs.

Models:

We also used logistic regression models to calculate the predicted risk. Logistic regression is a part of a category of statistical models called generalized linear models, and it allows one to predict a discrete outcome from a set of variables that may be continuous, discrete, dichotomous, or a combination of these. Typically, the dependent variable is dichotomous and the independent variables are either categorical or continuous.

The logistic regression model can be expressed with the formula:

$$\ln(P/1 - P) = \beta_0 + \beta_1 * X_1 + \beta_2 * X_2 + \ldots . + \beta_n * X_n$$

Model evaluation:

The discriminatory ability – the capacity of the model to separate cases from non-cases, with 1.0 and 0.5 meaning perfect and random discrimination, respectively– was determined using receiver operating characteristic (ROC) curve analysis. ROC curves are commonly used to summarize the diagnostic accuracy of risk models and to assess the improvements made to such models that are gained from adding other risk factors. Sensitivity, specificity,

and accuracy will be also calculated and compared. For all these measures, there exist statistical tests to determine whether one model exceeds another in discrimination ability.

Optimal Cutoff for Binary Classification maximizes the accuracy.

Mis-Classification Error is the proportion of all events that were incorrectly classified, for a given probability cutoff score.

Sensitivity: probability that a test result will be positive when the disease is present (true positive rate.

Specificity: probability that a test result will be negative when the disease is not present (true negative rate, expressed as a percentage).

Variables:

3. Results

About 8.06% of 18905 children had Emotions Concentration Behavior Medication, about 9.23% among 9719 male children and 6.81% among 9186 female children.

Basically, a corrgram is a graphical representation of the cells of a matrix of correlations. The idea is to display the pattern of correlations in terms of their signs and magnitudes using visual thinning and correlation-based variable ordering. Moreover, the cells of the matrix can be shaded or colored to show the correlation value. The positive correlations are shown in blue, while the negative correlations are shown in red; the darker the hue, the greater the magnitude of the correlation.

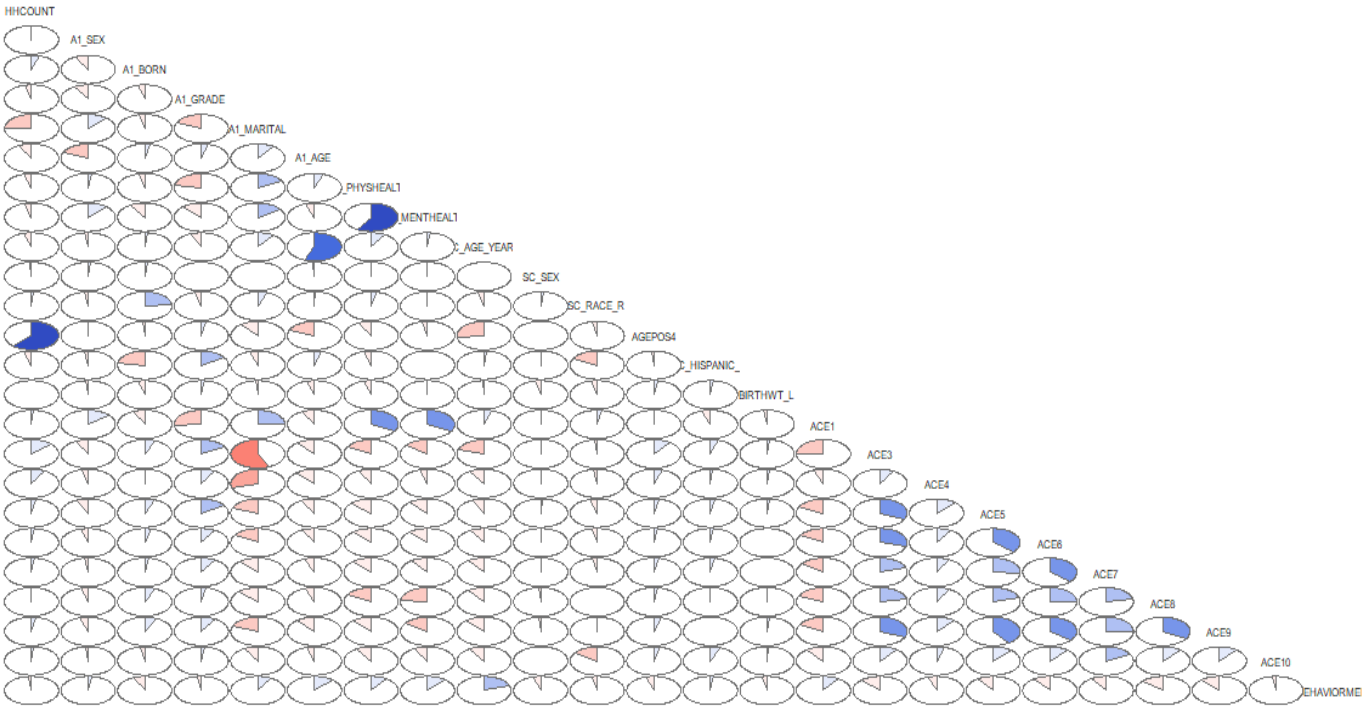

Figure 1. Emotions Concentration Behavior Medication Among Children in 2017 National Survey of Children's Health. Matrix of correlations between variables

According to the logistic regression, children born outside of the USA were less likely to have Emotions Concentration Behavior Medication (OR = 0.468). When the first adult had worse mental health, the children were more likely to have Emotions Concentration Behavior Medication (OR = 1.328).

When children's age increased by 1 year, the children were more likely to have Emotions Concentration Behavior Medication (OR = 1.152). Female children were less likely to have Emotions Concentration Behavior Medication (OR = 0.747). Children with normal birth weight has less likelihood to have Emotions Concentration Behavior Medication (OR = 0.714).

Children in a family which is hard to Cover Basics Like Food or Housing were more likely to have Emotions Concentration Behavior Medication (OR = 1.085). Children who experienced adults Slap, Hit, Kick, Punch Others less likely to have Emotions Concentration Behavior Medication (OR = 0.701). Children who lived with mentally ill were less likely to have emotions concentration behavior medication (OR = 0.652).

Table 1.– Logistic Regression

	Estimate	**Std. Error**	**z value**	**Pr(> |z|)**	
(Intercept)	–0.404	0.902	–0.448	0.654	
HHCOUNT	–0.054	0.049	–1.110	0.267	
A1_SEX	0.139	0.091	1.524	0.127	
A1_BORN	–0.759	0.175	–4.338	0.000	***
A1_GRADE	0.033	0.023	1.423	0.155	
A1_MARITAL	–0.011	0.038	–0.285	0.775	
A1_AGE	0.008	0.005	1.589	0.112	
A1_PHYSHEALTH	0.078	0.056	1.383	0.167	
A1_MENTHEALTH	0.284	0.056	5.105	0.000	***
SC_AGE_YEARS	0.141	0.011	13.015	< 2e–16	***
SC_SEX	–0.291	0.079	–3.688	0.000	***
SC_RACE_R	–0.068	0.026	–2.595	0.009	**
AGEPOS4	0.106	0.057	1.844	0.065	.
SC_HISPANIC_R	–0.068	0.137	–0.498	0.618	
BIRTHWT_L	–0.337	0.132	–2.553	0.011	*
ACE1	0.081	0.050	1.616	0.106	
ACE3	–0.375	0.108	–3.463	0.001	***
ACE4	–0.290	0.185	–1.566	0.117	
ACE5	–0.268	0.146	–1.833	0.067	.
ACE6	–0.355	0.148	–2.398	0.017	*
ACE7	–0.212	0.165	–1.280	0.201	
ACE8	–0.427	0.117	–3.650	0.000	***
ACE9	–0.145	0.126	–1.150	0.250	
ACE10	0.398	0.217	1.836	0.066	.

The area under curve was 0.7699. The optional cutoff time is 0.6637. The mis-classification error was 0.0778. The sensitivity rate is about 0.41% and the specificity is 99.98%.

4. Discussions

About 8.06% of 18905 children had Emotions Concentration Behavior Medication, about 9.23% among 9719 male children and 6.81% among 9186 female children.

According to the logistic regression, children born outside of the USA were less likely to have Emotions Concentration Behavior Medication (OR = 0.468). When the first adult had worse mental health, the children were more likely to have Emotions Concentration Behavior Medication (OR = 1.328).

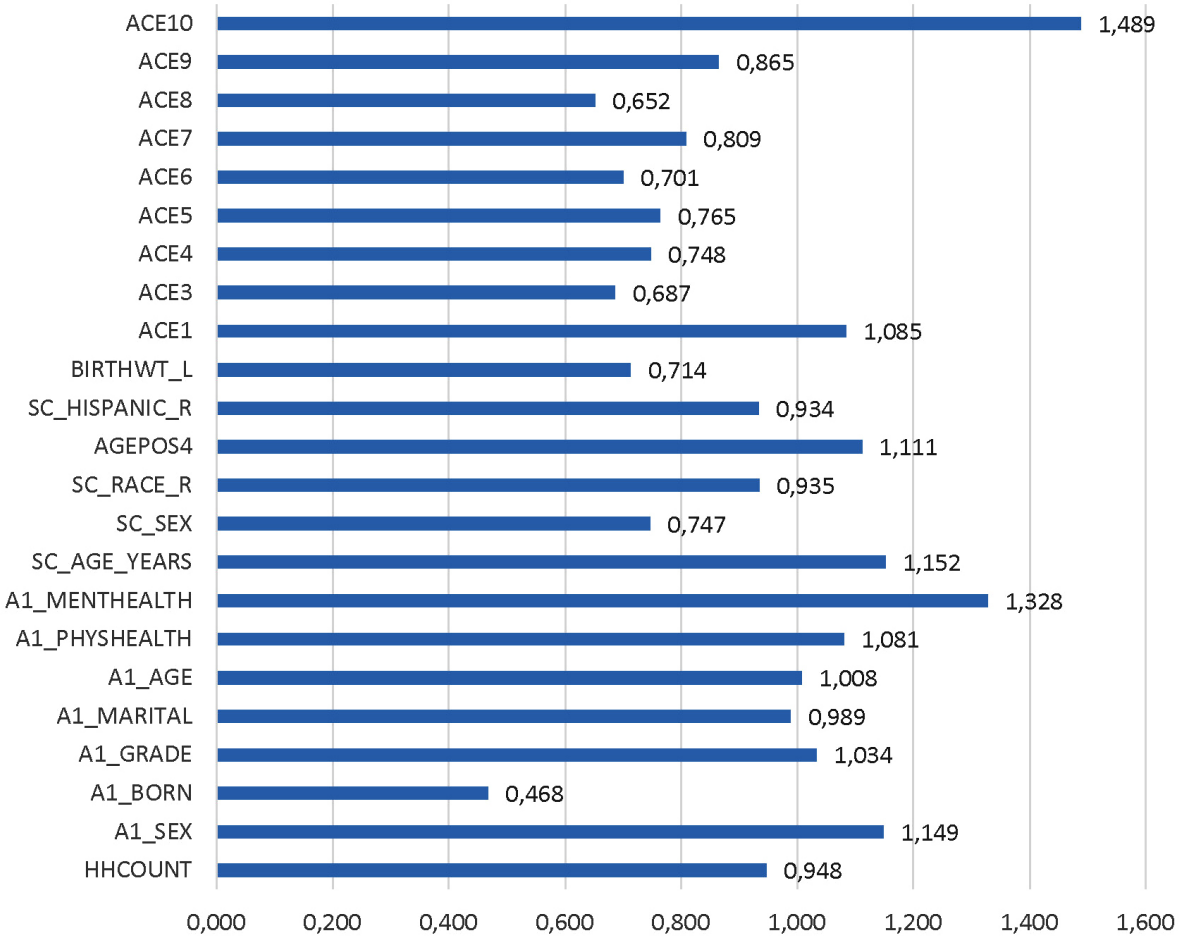

Figure 2. Odds Ratio Figure

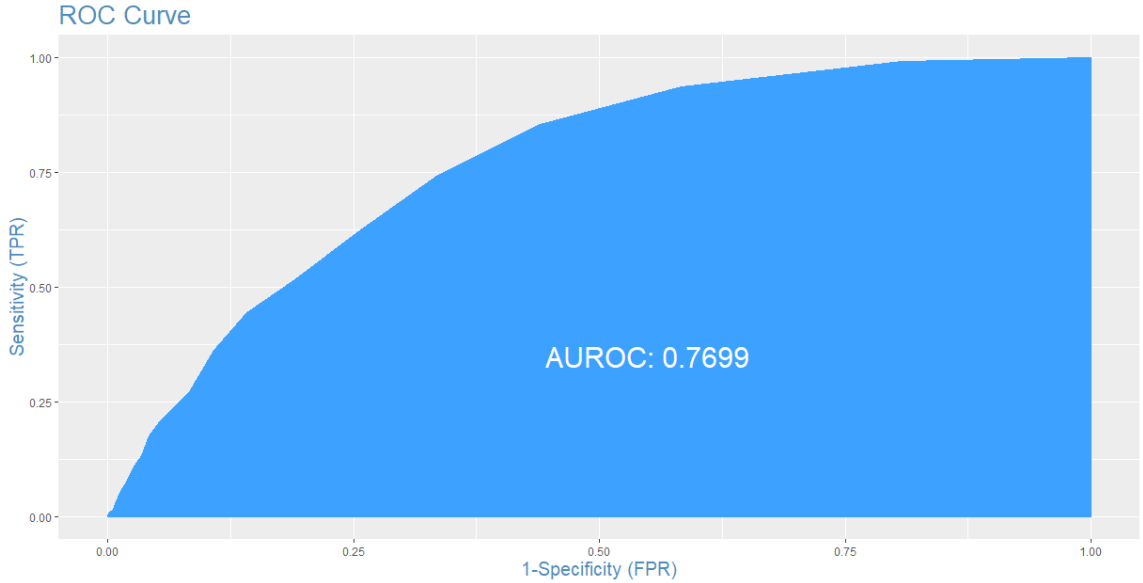

Figure 3. ROC in testing sample for Logistic Regression

When children's age increased by 1 year, the children were more likely to have Emotions Concentration Behavior Medication (OR = 1.152). Female children were less likely to have Emotions

Concentration Behavior Medication (OR = 0.747). Children with normal birth weight has less likelihood to have Emotions Concentration Behavior Medication (OR = 0.714).

Table 2.

Cut-off	sensitivity	specificity
0.1	8.8%	97.8%
0.3	1.1%	99.7%
0.5	0.13%	99.99%

Children in a family which is hard to Cover Basics Like Food or Housing were more likely to have Emotions Concentration Behavior Medication (OR = 1.085). Children who experienced adults Slap, Hit, Kick, Punch Others less likely to have Emotions Concentration Behavior Medication (OR = 0.701). Children who lived with mentally ill were less likely to have emotions concentration behavior medication (OR = 0.652).

The area under curve was 0.7699. The optional cutoff time is 0.6637. The mis-classification error was 0.0778. The sensitivity rate is about 0.41% and the specificity is 99.98%.

Having another disorder is most common in children with depression: about 3 in 4 children aged 3–17 years with depression also have anxiety (73.8%) and almost 1 in 2 have behavior problems (47.2%). For children aged 3–17 years with anxiety, more than 1 in 3 also have behavior problems (37.9%) and about 1 in 3 also have depression (32.3%). For children aged 3–17 years with behavior problems, more than 1 in 3 also have anxiety (36.6%) and about 1 in 5 also have depression (20.3%) [3].

Among children aged 2–8 years, boys were more likely than girls to have a mental, behavioral, or developmental disorder. Among children living below 100% of the federal poverty level, more than 1 in 5(22%) had a mental, behavioral, or developmental disorder [4].

Conclusions: In this study, we identified important of predictors of Emotions Concentration Behavior Medication among children, for example children age, sex, mental health of adults, and financial status of the family.

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Section 7. Chemistry

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THIOCARBONIC ACID AMIDES AS OXIDATION INHIBITORS

Abstract. The synthesized amides of thiocarboxylic acids have been studied as oxidation inhibitors. It has been established that their antioxidant effect is mainly due to their reaction with hydroperoxides, accompanied by the ion-catalytic decomposition of the latter and the termination of oxidation chains.

Keywords: Antioxidants, oxidation inhibitors, thioamides, hydroperoxides.

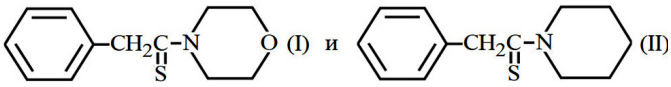
Introduction. Thionic substances–thiocarbamates, xanthates, thioamides and others are widely used in polymers, lubricating oils and other organic materials as additives that improve their antioxidant, anticorrosive and other performance properties [1, 35]. However, the selection of these substances is often empirical. In order to create a scientific basis for the selection of the most effective compounds, it is important to study the kinetics and mechanism of the antioxidant action of sulfur-containing heterofunctional compounds-thioamides of different structures in the reactions of inhibition of cumene oxidation (model reaction) and the reaction with cumyl hydroperoxides (HPC) and tertiary butyl (HPTB). The latter reaction attracts special attention of researchers because sulfur-containing compounds exhibit an antioxidant effect due to the ion-catalytic decomposition of hydroperoxides, that is, they exhibit the properties of preventive antioxidants [2, 338–344].

Experimental part. Chlorobenzene (solvent), cumene (RH), hydroperoxides were purified according to known methods [3, 29]. The reaction of the inhibitor with hydroperoxides was carried out in a chlorobenzene solution until the hydroperoxide was completely decomposed. The concentration was controlled by iodometric titration in a certain time interval. It was assumed that, since the initial concentration of hydroperoxide is 3–4 orders higher than that of the inhibitor, the latter is completely converted into the final product by the end of the reaction. Oxidation of cumene was carried out on a standard pressure gauge. The reaction of thiamides with

hydroperoxides was carried out at a temperature of 100 °C. The synthesis of phenylthioacetoamides was carried out according to the Wilgerodt – Kindler reaction with the interaction of acetophenone, sulfur and various amines [4, 299–302].

$$C_6H_5C(O)CH_3 + S + HNR_1R_2 \rightarrow$$
$$\rightarrow C_6H_5CH_2C(S)NR_1R_2 + H_2O$$

We selected thioamides with heterocyclic radicals–phenylacetothiomorpholide (I) and phenylacetothiopiperidide (II) as objects of study. The synthesis was carried out by



stirring the equimolar (0.3 m) ratio of acetophenone, sulfur and amines at temperatures of 90–95 °C for 5 hours. Next, the reaction mixture was dissolved in benzene, the solution was washed with water, dried and, after distilling off benzene, the main product was subjected to vacuum distillation, which was then recrystallized from ethanol, M.p. I = 74–75 °C, M. p. II = 77–78 °C. In the PMR spectrum of II, signals of δ 1–2 ppm ($-CH_2CH_2CH_2-$), δ 3.7 ppm were found. ($-CH_2NCH_2-$), δ 4.2 ppm ($C_6H_5CH_2-$) and δ 7.2 ppm (C_6H_5-). The IR spectra of I and II revealed absorption bands in the 1100–1300 cm^{-1} region, characteristic of the C = S bond in the thioamide fragment.

The discussion of the results. The reaction of thioamides with hydroperoxides was carried out in an appropriate cell at a concentration of the latter 0.16––0.6 mol/L. The concentration of thioamides varied in the range $5 \cdot 10–5^{-5} \cdot 10^{-4}$ mol/L. To derive the kinetic equation of the reaction, the dependence of the rate on the concentration of the reacting substances was studied. It was found that the reaction is of the first order with respect to both inhibitor (I and II) and hydroperoxides (ROOH). $W = k \cdot [InH] \cdot [ROOH]$. The kinetic curves of the decomposition of hydroperoxides in the presence of thiamides are S-shaped, characteristic of autocatalytic processes (figs. 1 and 2).

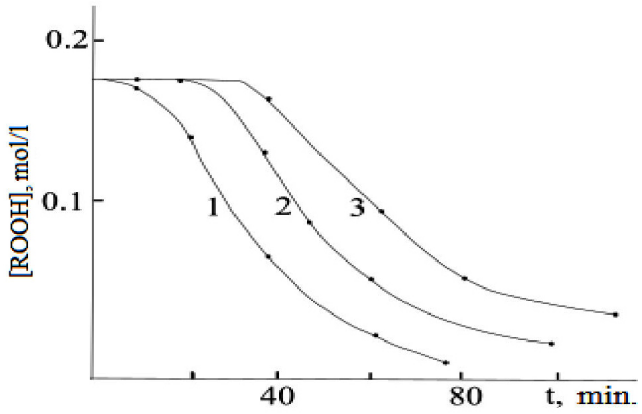


Figure 1. Kinetic curves of decomposition of HPTB in the reaction with I. [HPTB] = 0.17 mol/l; [I] = $3 \cdot 10^{-4}$ mol/l $^{-1}$; $1 \cdot 10^{-4}$ mol/l $^{-2}$; $7 \cdot 10^{-5}$ mol/l $^{-3}$

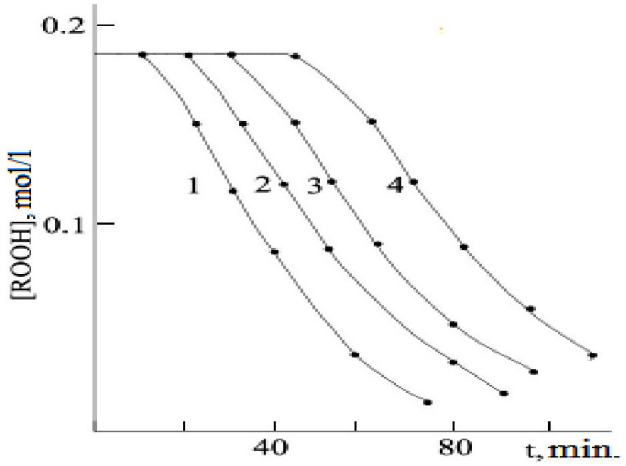


Figure 2. Kinetic curves of HPC decomposition in reaction with II. [HPC] = 0.18 mol/l; [II] = $5 \cdot 10^{-4}$ mol/l $^{-1}$; $1 \cdot 10^{-4}$ mol/l $^{-2}$; $8 \cdot 10^{-5}$ mol/l $^{-3}$; in the presence of [ionol] = $8 \cdot 10^{-5}$ mol/l $^{-4}$

As can be seen from the curves, the process of decomposition of hydroperoxides has three stages: the first is slow, the second is fast, and the third is final. With an increase in the concentration of inhibitors, the first stage is expected to decrease, which is obviously the stage of formation of an active product, which further effectively destroys the hydroperoxide. The nature of the curves and the behavior of the inhibitors unambiguously indicate the autocatalytic nature of the process, which consists of a slow stage of oxidative transformation of thioamide and further rapid decomposition of hydroxides (second stage) by reaction with this prod-

uct. The stoichiometric coefficient (V) of these reactions was calculated from the ratio of the consumed hydroperoxide to the inhibitor concentration

$$V = ([ROOH]_o - [ROOH]_{fin})/([InH]_o).$$

Where $[ROOH]_o$ is the initial concentration, $[ROOH]_{fin}$ is the final concentration of hydroperoxides, $[InH]_o$ is the initial concentration of the inhibitor. The values of stoichiometric coefficients tend to increase with decreasing concentration of the inhibitor and indicate the complex nature of the process. The averaged values of the coefficients $V_I \approx 1.3 \cdot 10^3$ and $V_{II} \approx 1.4 \cdot 10^3$ unambiguously indicate the autocatalytic nature of the process, i.e. the process of decomposition of thousands of molecules of hydroperoxides proceeds under the influence not of the initial molecules, but of the products of their oxidative transformations. Since the products of the transformations of thiamides in reactions with hydroperoxides were not isolated and investigated, the task was set to study the nature of their transformation and properties. For this purpose, the influence of the free radicals accentor-2,6-di-tert.butyl-4-methylphenol-ionol on the studied reaction was investigated. Moreover, ionol was introduced both at the beginning of the reaction and at the second fast stage. Ionol introduced into the reaction medium at the beginning of the reaction at a concentration equimolar to the inhibitor lengthens the induction period (fig. 2, curve 4). This indicates the radical nature of the reaction of the inhibitor with hydroperoxide. However, the introduction of ionol into the reaction cell at the second, fast stage of the process has no effect on the process. Based on this, it was assumed that at the first slow stage, free radical oxidation of the inhibitor occurs with the formation of a substance that catalyzes the decomposition of hydroperoxide by the ion-molecular mechanism (second, fast stage).

To study the acid-base properties of the product, the conversion of thioamides, pyridine was introduced into the reaction medium as a base in a concentration equimolar with thioamide. The introduction of pyridine both at the beginning of the reaction and in the developed process completely inhibited the reaction, which proves the acidic nature of the conversion products of thioamides, which are responsible for the ion-catalytic decomposition of hydroperoxides. It is obvious that the free radical oxidation of thioamides leads to the formation of some sulfonic (sulfinic) acids, which catalyze the decomposition of hydroxides by the ionic mechanism. This assumption is consistent with similar studies early obtained for other classes of sulfur-containing preventive antioxidants [5, 40–43].

We have studied the effect of thioamides on the autooxidation process of cumene. As is known, one of the most important reactions of liquid-phase oxidation of hydrocarbons is the reaction of radical decomposition of the formed peroxides and hydroperoxides $R\,OOH \rightarrow RO^{\cdot} + {}^{\cdot}OH$. The alkoxyl and hydroxyl radicals formed by this reaction promote branching and accelerate the chain oxidation process. If the assumptions about the ionic-catalytic nature of the decomposition of hydroperoxides obtained in the model reaction are correct, then they should have been confirmed in the process of autooxidation of cumene in the form of an antioxidant effect.

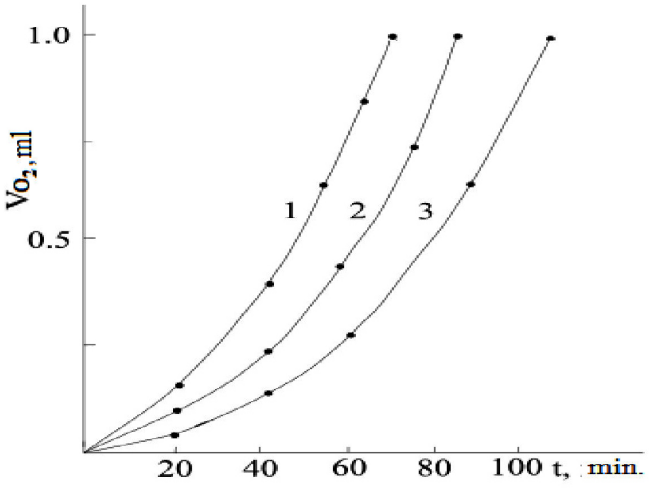


Figure 3. Kinetic curves of autooxidation of cumene (110 °C) in the presence of II: 1– without inhibitor; 2– [II] =$1 \cdot 10^{-5}$ mol/l; 3– [II] = $5 \cdot 10^{-5}$ mol/l

The study of the autoxidation of cumene in the presence of thioamides I and II (figure 3) showed

that the latter exhibit an inhibitory effect, which can be explained by the participation of thioamides in the ionic (non-radical) decomposition of hydroperoxide and thus inhibition of the formation of free radicals.

We also studied the effect on the autoxidation of cumene of the product of the conversion of thioamide I by the reaction with HPTB. For this, after completion of the reaction of I with HPTB, a small amount of the product was removed from the reaction medium and introduced into a cell with cumene to study autoxidation. It should be noted that neither the solvent, chlorobenzene, nor the decomposition products of HPTB could affect the oxidation process. The results are shown in figure 4.

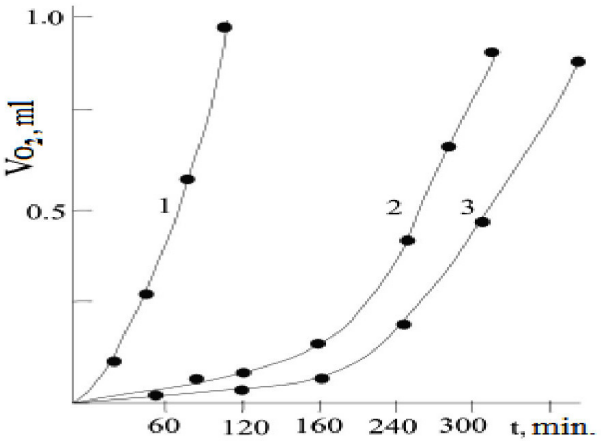


Figure 4. Kinetic curves of autooxidation of cumene (110 °C) in the presence of conversion products of I by reaction with HPTB: 1– without inhibitor; 2– [I] =1 · 10^{-5} mol/l; 3– [I] = 5 · 10^{-5} mol/l

As can be seen from the presented data of autooxidation of cumene in the presence of the products of the conversion of thioamide I by reaction with HPTB, the reaction is inhibited to a much greater degree (figure 4) than in the presence of the starting thioamide (figure 3). The induction periods of cumene oxidation (τ) in the presence of equal concentrations of the reaction products are 3–4 times longer than in the presence of the starting thioamide. Since the solvent chlorobenzene and the products of the decomposition of HPTB could not affect the rate and period of induction of oxidation, this effect can be associated with the products of oxidative transformations of thioamide. Based on the presented data, we assumed that, as in the case of phenolsulfides [6, 418–422] and other sulfur-containing compounds, thioamides exhibit the properties of preventive antioxidants. In the initial stages of oxidation, they do not exhibit a pronounced antioxidant effect by reaction with peroxide radicals, that is, they do not behave like "classical" antioxidants such as phenols and aromatic amines. Subsequently, as hydroperoxides accumulate, thioamides react with the latter, oxidize to form oxygen compounds of tetra and hexavalent sulfur – sulfoxides, sulfinic and sulfonic acids, which, by the molecular catalytic mechanism, destroy hydroperoxides, thereby preventing the radical decomposition of hydroperoxides and thus exhibiting inhibiting the effect. This behavior unambiguously indicates that thioamides of various structures can be classified as effective preventive antioxidants.

Conclusions. The study of the antioxidant effect of two thioamides of phenylthioacetic acid by their reaction with hydroperoxides and autooxidation of cumene showed that they are effective preventive antioxidants.

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