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Vha.poltava@gmail.comORCID ID : <https://orcid.org/0000-0003-1852-0234>**TABACCO SMOKING AS A SOCIAL AND ECOLOGICAL PROBLEM OF HUMANITY**

The problem of smoking is almost the most common among human addictions, which is very difficult to give up. A person spends a lot of his life neglecting his health to buy cigarettes and get temporary pleasure. The issue of quality and environmental safety of cigarette components – tobacco, tissue paper and filters worries both cigarette consumers and environmentalists, doctors and others. specialists. Of course, the use of low-quality product from cigarette manufacturers harms not only the human body but also the environment.

Purpose. Determine the quality and environmental safety (presence of concentrations of heavy metals) of tobacco, cigarette paper and cigarette filters of domestic and foreign brands.

Methods. Methods of atomic absorption spectrometry using the atomic absorption spectrometer MGA 915 MD.

Results. Experimental studies by atomic absorption analysis on the concentrations of heavy metals in tobacco, cigarette filters and paper showed the presence of heavy metals: Mn, Zn, Cu, Cr, Cd, Pb. Studies of various tobacco brands have found that the highest concentrations of heavy metals were in the tobacco of the cheapest cigarettes (up to 150 mg / kg), in cigarette paper found only Mn, Zn. When comparing the content of the most toxic heavy metals Cd and Pb in the cigarettes "Parliament" and "Kyiv" and "LM" it was determined that in the tobacco of "Parliament" cigarettes HM concentrations are 7–10 times lower..

Conclusions. There is a tendency to decrease the concentration of heavy metals in the components of cigarettes depending on the price category of the tobacco product. Thus, for the most part, the components of cigarettes of domestic brands have tens of times higher concentrations of heavy metals than cigarettes of the American manufacturer.

KEYWORDS: cigarettes, tobacco, cigarette paper, cigarette filter, heavy metals

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ТЮТЮНОПАЛІННЯ ЯК СОЦІАЛЬНО-ЕКОЛОГІЧНА ПРОБЛЕМА ЛЮДСТВА

Проблема тютюнопаління є майже найпоширенішою серед залежностей людства, від якої дуже важко відмовитися. Людина все життя, нехтуючи своїм здоров'ям, витрачає значні кошти на придбання цигарок та отримання тимчасового задоволення. Питання якості та екологічної безпеки складових цигарок – тютюну, цигаркового паперу та фільтрів непокоїть як самих споживачів цигарок, так і екологів, медиків і інших фахівців. Звісно, використання неякісного продукту від виробників цигарок шкодить не тільки організму людини, а й довкіллю.

Мета. Визначити якість та екологічну безпеку (наявність концентрацій важких металів) у тютюні, цигарковому папері та фільтрах цигарок вітчизняних і зарубіжних брендів.

Методи. Методи атомно-абсорбційної спектроскопії за допомогою атомно-абсорбційного спектрометра МГА 915 МД.

Результати. Експериментальні дослідження методами атомно-абсорбційного аналізу щодо концентрацій важких металів у тютюні, цигаркових фільтрах та папері показали наявність важких металів: Mn, Zn, Cu, Cr, Cd, Pb. Дослідження різних тютюнових брендів визначили, що найбільші концентрації важких металів – в тютюні найдешевших цигарок (до 150 мг/кг), у цигарковому папері виявлено лише Mn, Zn. При порівнянні вмісту найбільш токсичних важких металів Cd та Pb у цигарках «Parliament» та «Київ» і «LM» визначено, що у тютюні цигарок «Parliament» концентрації ВМ у 7–10 разів менші.

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Висновки. Виявлено тенденцію до зменшення концентрації важких металів у складових цигарок у залежності від цінової категорії тютюнового продукту. За більшістю показників у складових цигарок вітчизняних брендів концентрації важких металів у десятки разів вище, ніж у цигарках американського виробника.

КЛЮЧОВІ СЛОВА: сигарети, тютюн, сигаретний папір, фільтр сигарет, важкі метали

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ТАБАКОКУРЕНИЕ, КАК СОЦИАЛЬНО-ЭКОЛОГИЧЕСКАЯ ПРОБЛЕМА ЧЕЛОВЕЧЕСТВА

Проблема курения почти самая распространенная среди зависимостей человечества, от которой очень трудно отказаться. Человек всю жизнь, пренебрегая своим здоровьем, тратит значительные средства на приобретение сигарет и получения временного удовольствия. Вопрос качества и экологической безопасности составляющих сигарет – табака, сигаретной бумаги и фильтров беспокоит как самих потребителей сигарет, так и экологов, медиков и других специалистов. Конечно, использование некачественного продукта от производителей сигарет вредит не только организму, но и окружающей среде.

Цель. Определить качество и экологическую безопасность (наличие концентраций тяжелых металлов) в табаке, сигаретной бумаге и фильтрах сигарет отечественных и зарубежных брендов.

Методы. Методы атомно-абсорбционной спектроскопии с помощью атомно-абсорбционного спектрометра МГА 915 МД.

Результаты. Экспериментальные исследования методами атомно-абсорбционного анализа концентраций тяжелых металлов в табаке, сигаретных фильтрах и бумаге показали наличие тяжелых металлов: Mn, Zn, Cu, Cr, Cd, Pb. Исследование различных табачных брендов определили, что наибольшие концентрации тяжелых металлов обнаружены в табаке дешевых сигарет (до 150 мг / кг), в сигаретной бумаге только Mn, Zn. При сравнении содержания наиболее токсичных тяжелых металлов Cd и Pb в сигаретах «Parliament» и «Киев» и «LM» определено, что в табаке сигарет «Parliament» концентрации ВМ в 7–10 раз меньше.

Выводы. Выявлена тенденция к уменьшению концентрации тяжелых металлов в составных сигарет в зависимости от ценовой категории табачного продукта. Так по большинству показателей в составляющих сигарет отечественных брендов концентраций тяжелых металлов в десятки раз выше, чем в сигаретах американского производителя.

КЛЮЧЕВЫЕ СЛОВА: сигареты, табак, сигаретная бумага, фильтр сигарет, тяжелые металлы

Introduction

The problem of smoking and the negative effects of smoking on the body today is familiar in every country in the world and has been relevant for several centuries. According to the World Health Organization, 1/7 of the world's population has a habit of smoking, and this is about 1 billion smokers. Even though smoking is losing popularity in many parts of the world, the total number of smokers is growing. If in the 80s of the last century about 721 million people smoked, in 2012 967 million people had a habit of smoking, as evidenced by statistics from 187 countries.

Chinese philosophers as early as the seventeenth century claimed that smoking "burns the lungs." In Bhutan in 1729, the first law was issued banning smoking in all places of worship, which is still in force today. The first study of the effects of smoking on the human body was conducted in England in 1761 by John Hill. Despite considerable experience and knowledge about the negative effects of smoking on the human body and the fight against this habit, the

number of people who smoke around the world is growing steadily [1].

Scientists around the world agree that the increase of the number of smokers is connected with general increase of population. Thus, in the last 50 years, the world's population has almost doubled to 7 billion, and as a result, more people have the habit of smoking than in the past [1]. Today, however, there is a declining trend in smokers amount around the world. Now for 10 men three smoke, and from 20 women one smokes. In the 1980s, six men smoked for 10 men and one for 10 women.

Today, the worst smoking situation is in East Timor, a country in Southeast Asia where more than 60% of the population smokes. The most difficult smoking situation is also identified in countries such as Russia, Kuwait, China, Japan, Italy, Greece, Uruguay and Ireland, where smoking consumes a very large number of cigarettes. Researchers note that the best situation for solving the problem of cigarette smoking is on the islands of the Caribbean Sea, where only 5% of the population has a habit of smoking.

Canada, Iceland, Norway and Mexico are also the best smokers. There, through legislative measures and active propaganda, the authorities were able to persuade the population not to start or quit smoking [1].

Various publications emphasize that more human lives can be saved if the postulate "space is free of tobacco smoke" was observed. But this requires a tremendous amount of work, such as raising the tax on tobacco products, severely restricting public places for smoking, developing a number of effective measures and laws to restrict the rights of smokers, and constantly conducting anti-tobacco propaganda. In total, according to researchers, in 2012, smokers burned 6.25 trillion cigarettes compared to 4.96 trillion burned in 1980 [2].

As for Ukraine, the situation is improving almost every year, but the problem of smoking remains. According to official data, every fifth person in Ukraine smokes. The negative consequences of this process raise smoking to a socio-environmental problem that needs to be addressed [1]. Our country ranks 18th in terms of cigarette consumption, but the situation is improving every year, now 23% of the adult population smokes, instead of 43% eight years ago, when Ukraine was in the top 10 countries in terms of tobacco consumption. Currently, the total number of smokers in Ukraine is 8.2 million people [3, 4, 5].

We attribute this positive trend to an increase of the tax on tobacco products, which has made tobacco products significantly more expensive, to laws restricting smoking, to actively promote healthy lifestyles and to more environmentally friendly alternatives to smoking, such as e-cigarettes or sticks [6].

During the research, the authors conducted a sociological survey among young people in Kharkiv. The results show that the most important incentive to quit smoking is the price of cigarettes, which means that the increase of the tax on tobacco products gives positive results. The price of cigarettes has more than doubled since 2016 and is projected to rise, with 20% of those polled saying they will quit if the price rises, and another 25% saying they will smoke much less. On the one hand, this is a definite plus, and on the other hand, given the above, it can be argued that most Ukrainians prefer cheaper and more affordable cigarettes, putting their health at additional risk [7].

Scientists have determined that smoking causes dry distillation and incomplete combustion of dried tobacco leaves. Slow combustion emits smoke, which is an

inhomogeneous (heterogeneous) mixture consisting of an average of 60% of different gases and 40% of microscopic tar droplets (aerosols). The gas fraction of smoke contains, in addition to nitrogen (59%), oxygen (13, 4%), also carbon monoxide (IV) (13.6%), carbon monoxide (II) (4%), water vapor (1.2%), hydrogen cyanide (0.1%), nitrogen oxides, acrolein and other substances. Aerosol fraction of smoke includes water (1.4%), glycerin and alcohols (0.1%), aldehydes and ketones (0.1%), hydrocarbons (0.1%), phenols (0.003%), nicotine (0.002%)) etc. According to the main action, harmful substances contained in tobacco smoke and affecting the body are grouped into 4 groups: carcinogenic substances; irritants; poisonous gases; poisonous alkaloids. Carcinogenic substances: aromatic hydrocarbons, benzopyrene, phenols, organic compounds (nitrosamine, hydrazine, vinyl chloride, toluidine, etc.), inorganic compounds of arsenic and cadmium, radioactive: polonium, tin and bismuth – 210. Irritant algae: (acrolein), carbon monoxide. Toxic gases: carbon monoxide, hydrogen sulfide, hydrogen cyanide, etc. Toxic alkaloids: only 12 (nicotine, nornicotine, nicotyrin, nicotine, nicotimine, etc.). Nicotine is one of the strongest poisons known to us that affect the nervous system. When a cigarette burns, it is only partially destroyed, by about 25%. The nicotine content in the smoke of the main stream of a cigarette is from 0.4 to 3 mg – only 20% of the total amount of nicotine in a cigarette. About 5% remains in the cigarette butt, and the other 50% gets into the air in the room where they smoke [8, 2].

Smoking can lead to serious disorders. The first large-scale study of the effects of smoking on the human body was conducted in 1951 in Britain. They were attended by 34,439 British male doctors. These studies have shown that smoking kills two-thirds of smokers. The same research was conducted by the American Cancer Society from 1959 to 1972. The results showed that the effect of smoking on women is much smaller than the effect on men. It was also noted that by giving up this habit, the morbidity and mortality rate decreases. Studies in the United States have shown that smoking between the ages of 15 and 70 can take more lives than drugs, homicide, suicide, AIDS, road accidents and alcohol combined [9]. In modern research, experts also agree that smoking harms the body and has no positive effects. Thus, as a result of research by I.S. Kremes to study the effects of smoking on the respiratory system, it was determined that in smokers, signs of vascular remodeling and microcirculation disorders were

detected, which were determined by endothelial dysfunction, increased bulk density and decreased capillary volume. I.A.Zakharova is also in solidarity with this issue, studying the ventilation functions of the lungs in young people. Studies have shown that tobacco smoke increases neutrophilic inflammation and leads to bronchial remodeling [10, 11, 12].

Physical and psychological dependence on nicotine develops much faster than on alcohol, says Bobko O. [13]. One of the researchers of smoking is a doctor A.V. Dzyubailo, who in 2007 conducted interesting research on the prevention and treatment of chronic obstructive pulmonary disease (COPD). The experiment involved 151 people diagnosed with COPD, 86 of them – smokers aged 18 to 79 years. The comparison group consisted of 65 people who did not smoke but had risk factors for COPD. According to research, the average age of non-smoking men and women with COPD is 60 years, and in smokers, the average age was: 41 years for women and 48 years for men. This fact suggests that smoking significantly "rejuvenates" development of bronchopulmonary pathology [14].

During smoking, 250–300 chemical compounds and substances enter the body, 50 of which are toxic, for example in tobacco, there are heavy metals (HMs) such as Cd and Pb, that accumulate in the body and are toxic. Under the influence of tobacco smoke at the respiratory, vascular and hormonal systems. Pregnant women who have been exposed to nicotine are more likely to give birth to a child with various pathologies. HMs are accumulated in the brain, liver, spleen and kidneys. Because of high concentrations of Pb, the functioning of the brain and central nervous system is disrupted, that can cause coma, convulsions and even death. Cd can also cause serious illness. As a result of its accumulation, there is unbearable muscle pain, involuntary bone fractures (Cd is able to leach calcium from the body), skeletal deformity, dysfunction of the lungs, kidneys and other organs. Finally, cadmium excess can cause malignancies [15, 16].

There is also significantly negative phenomenon as passive smoking, which is thought being even more dangerous than

conventional smoking by experts. Sofia Vankovich, while studying the effects of passive smoking, has found that it causes asthma being developed by children, wheezing and decreased lung function, increasing the likelihood of developing asthma and respiratory diseases by children whose mothers were exposed to secondhand smoke during pregnancy, as well as passive smoking increases the risk of heart disease by 25% and lung cancer by 24%. For example, traces of a potent carcinogen, NSC, were found in the urine of non-smoking workers in the inpatient department of the Canadian Veterans Hospital, where smoking is allowed. Among all of 43 known carcinogens of tobacco smoke, there was the only one that appears only because of tobacco and cannot be caused by other sources [13, 17, 18, 19].

Based on economic issues, it is clear that the quality of tobacco and production technology of expensive cigarettes is better than cheap ones. It's also appropriate to mention the fact that in the pursuit of profit, not all manufacturers (especially not very well-known brands) can't adhere to the sanitary norms at their enterprises, violate production technologies, use cheap and low-quality raw materials, falsify or even hide the real composition of cigarettes.

Finally, we it's necessary to say about other problem of smoking, purely environmental – it's household waste by numbers of cigarette butts. Estimatedly, they are emitted at 5–7 million per year. This is a separate issue that needs to be considered by specialists in the field of waste disposal in the perspective of separate disposal and the possible use of cigarette butts as secondary raw materials.

In light of all the above, it was decided to conduct laboratory studies of the quality of cigarettes of native and foreign brands to determine the presence and concentration of one of the most dangerous indicators of human health – heavy metals (HMs) in tobacco, cigarette filters and paper.

Purpose – to determine the quality and environmental safety (presence of concentrations of heavy metals) in tobacco, cigarette paper and cigarette filters of native and foreign brands.

Objects and methods of research

To study the quality of tobacco products (tobacco, filters and paper), three native brands of cigarettes were selected, identical by

availability and popularity, but different by price category. There are next cigarettes brands: Kyiv brand (UAH 25), LM (UAH 40) and



Рис. 1 – «Parliament»
(50 UAH)



Рис. 2 – «LM»
(40 UAH)



Рис. 3 – «Kyiv»
(25 UAH)

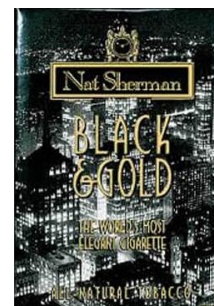


Рис. 4 – «Nat Sherman»
(500 UAH)

Parliament (UAH 50). Premium cigarettes of the American company Nat Sherman (UAH 500) were selected for comparison of the concentration of HM in tobacco (Fig. 1 – 4).

The study of heavy metal concentrations in tobacco, filters and tissue paper were perfo-

rmed in the educational-scientific laboratory of analytical ecological research of the Karazin Institute of Environmental Sciences with the help of atomic absorption spectrometer – MGA 915 MD [20,21].

Results and discussion

In the course of experimental laboratory studies, the concentration of HMs (Cr, Zn, Cu, Mn, Cd, Pb) in tobacco, cigarette paper and filters of three popular Ukrainian brands was determined: low price Kyiv trademark, middle price trademark "LM" and the high price trademark "Parliament". To compare the quality of tobacco, premium cigarettes from the American manufacturer Nat Sherman were used.

Tobacco quality. As a result of the performed researches, it was discovered that the highest concentration of Cr was in tobacco of the Kyiv brand cigarettes (0.056 mg / kg), which is 2 times more than in the the LM brand cigarettes (0.038 mg / kg) and 4 times more than Parliament brand cigarettes have (0.015 mg / kg). (Table 1) The highest concentration of Zn was found in "Kyiv" tobacco (18.446 mg / kg), which is almost 2 times higher than the concentration of "LM" (10.7454 mg / kg) and "Parliament" tobacco (8.134 mg / kg). The highest concentration of Cu was found in "Parliament"

tobacco (10.1688 mg / kg), which is 2.5 times higher than the concentration of "Kyiv" tobacco (6.457 mg / kg) and 1.5 times higher than LM tobacco (4.8835 mg / kg). The highest concentration of Mn was in "Parliament" tobacco (146,201 mg / kg), which is 1.5 times more than "LM" tobacco (88,137) and 1.15 times more than "Kyiv" tobacco (128 , 84). The highest concentration of Cd was found in " Kyiv" tobacco (1.9867 mg / kg), which is 20 times more than in "Parliament" tobacco (0.146) and 2.5 times more than "LM" (0.8801 mg / kg). The lowest concentration of Pb was found in "Parliament" tobacco (0.9645 mg / kg), which is 2 times less than the concentration of "LM" tobacco (1.9645 mg / kg) and 2.5 times less than in «Kyiv» tobacco (2.4560 mg / kg).

It was also determined that in American cigarettes HM concentrations are much lower (Cr – 300 times, Pb – 31, Zn – 233, Cu – more than 10 thousand times) than in Ukrainian, and

Table 1

The results of research of the quality of tobacco products of different brands, mg / kg

Names of tobacco products brands	Chemical elements					
	Cr	Zn	Cu	Mn	Cd	Pb
Cigarettes «Kyiv»	0,056	18,446	6,457	128,84	1,9867	2,456
Cigarettes «LM»	0,038	10,7454	4,8835	88,137	0,8801	1,9645
Cigarettes «Parliament»	0,015	8,1234	10,1688	146,201	0,146	0,9645
Cigarettes «Nat Sherman»	0,00005	0,04	0,001	-	-	0,029

Cd is not determined at all. We can say that they are almost safe and do not adversely affect health. But the price of a pack in Ukraine is about \$ 25 (625 UAH), whether they are worth the money and whether to spend such funds on cigarettes, everyone decides for himself.

Carrying out experiments allowed us to stimulate the accumulative rows for visual operational analysis through the method of identification of the priority social associations in tobacco.

Cigarettes of the «Parliament» brand,
mg / kg
Mn (146,2) > Cu (10,2) > Zn (8,1) > Cr (0,015)
> Cd (0,14) > Pb (0,9)

Cigarettes of the «LM» brand,
mg / kg
Mn (88,1) > Zn (10,74) > Cu (4,88) > Pb (1,96)
> Cd (0,88) > Cr (0,038)

Cigarettes of the « Kyiv » brand,

mg / kg
Mn (128,84) > Zn (18,44) > Cu (6,46) >
Pb (2,45) > Cd (1,98) > Cr (0,056)

Cigarettes of the «Nat Sherman» brand,
mg / kg
Zn (0,0362) > Pb (0,0290) > Cu (0,0010) >
Cr (0,00005) > Cd (0)

An analysis of the accumulative series showed that the priority HM associations in cigarettes` tobacco of native brands have appeared Mn, Zn, Cu, otherwise Nat Sherman tobacco includes Zn,Cu and P. The first indicators of the concentration of HMs are identified in US cigars and the Cd is not marked. Unfortunately, the normative indicators for HMs have not been set in tobacco.

Paper quality. The results of studies on the determination of concentrations of heavy metals in cigarette paper has showed that in the paper of all types of cigarettes were found very small concentrations of only Zn and Mn (Table 2).

Table 2

The results of research of the quality of tobacco products of different brands, mg / kg

Names of tobacco products brands	Chemical elements					
	Cr	Zn	Cu	Mn	Cd	Pb
Cigarettes «Kyiv» paper	0	0,0014	0	0,0005	0	0
Cigarettes «LM» paper	0	0,0006	0	0,0011	0	0
Cigarettes «Parliament» paper	0	0,0006	0	0,0004	0	0

For visual operational assessment of the obtained results, accumulative series were also constructed to determine the priority associations of heavy metals in the paper of cigarettes of Ukrainian brands.

Cigarettes of the «Parliament» brand,
mg / kg
Mn(0,0004) > Zn(0,0006) > Cr(0) –
Cu(0) – Cd(0) – Pb(0)

Cigarettes of the «LM» brand,
mg / kg
Mn(0,0011) > Zn(0,0006) > Cr(0) –
Cu(0) – Cd(0) – Pb(0)

Cigarettes of the « Kyiv » brand, mg / kg
Zn(0,0014) > Mn(0,0005) > Cr(0) –
Cu(0) – Cd(0) – Pb(0)

Analysis of accumulative series showed that the priority association of HM is Mn and Zn. The highest concentration of Zn was found in the paper of the cheapest cigarettes and it is 2 times more than in the paper of cigarettes of medium and high price category. The highest Mn was found in the paper of medium price cigarettes, which is 2 times more than in the paper of cigarettes of low and high price category. These Mn and Zn concentrations are so small that they can be neglected. And the concentrations of Cr, Cu, Cd, Pb of different price categories are not defined in the cigarette paper of cigarettes at all. Thus, to some extent it can be argued that the cigarette paper of the most popular brands of Ukraine of different price categories contains almost no heavy metals and can be considered safe.

Quality filters. When studying samples of filters of different types of cigarettes, it was

found that the cheapest cigarettes have only one conventional filter (without carbon) compared to cigarettes of medium and high price category. Medium and high price cigarettes use two filters: regular and charcoal. If we compare conventional filters, the content of Cr in the filters of cigarettes "LM" and "Parliament" is approximately the same, and in the filters of cigarettes of low price category – 1.5 times more; Zn content in the filters of expensive cigarettes is 2 times lower than in the filters of low-cost cigarettes and 20 times lower than in the filters of cigarettes of the middle price category. (Table 3) Cu content is the lowest in the

filters of the most expensive cigarettes. and 4 times more than the cheap ones. The content of Mn in the filters of the most expensive cigarettes is 6 times lower than in the filters of medium-cost cigarettes and almost 5 times lower than in the filters of cheap cigarettes. Cd content in all types of cigarettes is almost the same. The highest content of Pb was found in the filters of cigarettes of the middle price category, which is not much more than in the filters of expensive cigarettes and 2.5 times more than in the filters of the cheapest. And also for operative analytical assessment of

Table 3

The results of research on the quality of tobacco products of different brands, mg / kg

Names of tobacco products brands	Chemical elements					
	Cr	Zn	Cu	Mn	Cd	Pb
Cigarettes «Kyiv» ordinary filter	0,0015	2,0064	0,1384	14,756	0,8045	0,0006
Cigarettes «LM» ordinary filter	0,0009	20,164	0,01678	18,135	0,6641	0,0015
Cigarettes «LM» charcoal filter	0,00104	0,0005	0,00012	10,145	0,0008	0,0004
Cigarettes «Parliament» ordinary filter	0,001	1,112	0,0064	3,1645	0,605	0,0012
Cigarettes «Parliament» charcoal filter	0,0009	0,00083	0,0001	5,1214	0,0001	0,00012

quality of filters of the Ukrainian cigarettes of a different price category and definition of priority associations of concentrations of HM in filters of these cigarettes accumulator series were constructed.

«Kyiv» cigarette filters,
mg / kg

Mn (14.75)> Zn (2.006)> Cd (0.804)> Cu
(0.1384)> Cr (0.0015)> Pb (0.0006)

«LM» cigarette filters,
mg / kg

Mn (14.14)> Zn (10.082)> Cd (0.332)> Cu
(0.0169)> Pb (0.0019)> Cr (0.00097)

«Parliament» cigarette filters,
mg / kg

Mn (4.14295)> Zn (0.5564)> Cd (0.3)> Cu
(0.003)> Cr (0.0019)> Pb (0.00066)

The analysis of accumulator series showed that the priority association of HMs accumulation in cigarette filters of different price categories is Mn, Zn, Cd, which have the highest concentrations, and chemical elements such as Cr, Pb, close the accumulator series and have the lowest concentrations. Studies have also shown a tendency to reduce the concentration of heavy metals depending on the cost of tobacco products – the higher the price of cigarettes, the lower the average concentration of HM in the filters.

Conclusions

Smoking is a socio-environmental problem that is familiar to mankind for centuries. Among the negative consequences: the direct impact of tobacco smoke on human health, passive smoking of those who are close to the smoker, the environmental problem – significant amounts of unused cigarette butts.

Compounds in tobacco smoke, heavy metals, cause serious damage to the body and can be fatal.

Research on the quality and environmental safety of the components of tobacco cigarettes, cigarette paper and filters of three popular and affordable domestic brands of

cigarettes of different price categories "Kyiv", "LM", "Parliament" and elite American cigarettes "Nat Sherman". During the experiment, the concentration of Cr, Zn, Cu, Mn, Cd, Pb in the tobacco, filters and paper of these cigarettes was determined.

According to research, there is a tendency to improve the quality depending on the price, the higher the price, the better the quality of tobacco products. Thus, in most indicators of HM concentrations in tobacco, filters and paper. Parliament cigarettes are better than their domestic counterparts – Kyiv. "LM", this is especially

evident when comparing the concentrations of the most toxic heavy metals Cd and Pb, the concentration of which is 7–10 times lower.

Tobacco of American cigarettes "Nat Sherman" turned out to be much better than in "Parliament", and the concentration of heavy metals is tens and hundreds of times lower, and Cd was not detected at all.

So, it is safe to say that the quality of cigarettes directly depends on the price, and whether you need to spend 50 or even 500 UAH (Nat Sherman) to smoke, everyone decides for himself.

Conflict of interests

The authors declare that there is no conflict of interests regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

References

1. Lebed, R. O. (2014). The number of smokers in the world is approaching a billion. *Air Force Ukraine*. 5–6 (in Ukrainian).
2. Bugaenko, V. (2018). Through tobacco smoke into history. *The center of tourism and adventure Kherson*. (26), 2-8 (in Ukrainian).
3. Myshkin, K. K. & Vasyukha, O. V. Ecological safety of consumer goods - the quality of tobacco products. *Proceedings of the 2nd International Symposium SVED2020: Sustainable development status and prospects*. Lviv-Slavske, 2020, 2-15 December (p. 207). Lviv, Lviv Polytechnic National University (in Ukrainian).
4. Brovinskaya, M. (2019). To dispel smoke: how the Ukrainian cigarette market works. Retrieved from https://project.liga.net/projects/cigarette_market1/ (in Ukrainian).
5. In Ukraine, nearly a quarter of the population smokes. Delo.ua Retrieved from <https://delo.ua/economyandpoliticsinukraine/v-ukraine-pochti-chetvert-naselenija-kurit-issle-347877/>.
6. Musiyezdov, O. O., Lisovenko, D. O. (2015). Features environmental awareness Ukraine. *Man and Environment. Issues of Neoecology*, 23(1-2), 129-133. Retrieved from <https://periodicals.karazin.ua/humanenviron/article/view/3913> (in Ukrainian).
7. Titenko, A. V. & Shyrokostup, S. M. (2017). Approaches to the solution of solid waste disposal in the system of ecological management of territories. *Man and Environment. Issues of Neoecology*, 27(1-2), 136-142. Retrieved from <https://periodicals.karazin.ua/humanenviron/article/view/9180> (in Ukrainian).
8. Nekos, A. N., Vasyukha, O. V. & Myshkin K. K. (2019). Human ecology - factors influencing health. *Proceedings of the II International Scientific and Practical Conference: Information systems and technologies in medicine*, Kharkiv, 2019, February 28–29 (pp. 94). Kharkiv: National Aerospace University “Kharkiv Aviation Institute” (in Ukrainian).
9. Bugaenko, V. (2018). Through tobacco smoke into history. *The center of tourism and adventure Kherson*. (26), 2–8.
10. Andreeva, T. I. & Krasovsky K. S. (2004). *Tobacco and health*. Kiev: Polygraph Center TAT. Retrieved from http://ekmair.ukma.edu.ua/bitstream/handle/123456789/1238/Andreeva_Krasovsky_Tobacco%20and%20Health.pdf?sequence=1&isAllowed=y (in Russian).
11. Kremis, I. S., Bukreeva E. B., Gereng, E. A., Boyarko, V. V., Bulanova, A. A., & Zenger, G. V. (2018). Morphometric characteristics of microvasculature vessels of the bronchial tree in smokers with and without chronic obstructive pulmonary disease. *The Siberian medical journal*, 33(1). 53–54. Retrieved from <https://doi.org/10.29001/2073-8552-2018-33-1-79-85> (in Russian).
12. Zakharova I. A. (2015). The effect of smoking on the ventilation function of the lungs at a young age. *Clinical medicine*, 93(3), S. 44–48. Retrieved from <http://www.medlit.ru/journalsview/clinicalmedicine/view/journal/2015/issue-3/339-vliyanie-kureniya-na-ventilyacionnyu-funkciyu-legkih-v-molodom-vozraste/> (in Russian).
13. Bobko, O. O. & Usata V. Ya. (2011). Research of the influence of tobacco smoking on the body of VNTU students. *Proceedings of “III All-Ukrainian Congress of Ecologists with International Participation”*.

- Vinnitsia, 2011. 2, 706–709. Retrieved from <http://eco.com.ua/content/doslidzhennya-vplivu-tyutyunopalynnya-na-organizm-studentiv-vntu> (in Ukrainian).
14. Vankovich S. Smoking or a healthy future? Retrieved from <http://epl.org.ua/pravo/klinichna-programa/doslidzhennya/>
 15. Vasyukha, O.V. & Myshkin, K. K. Ecological safety and quality of cigarette filters. *Proceedings of the international scientific conference of young scientists: Ecology, neo-ecology, environmental protection and sustainable use of nature*, Kharkiv, 2019, November 28-29 (pp. 129-130). Kharkiv: V.N. Karazin Kharkiv National University (in Ukrainian).
 16. Nekos, A. N., Mishkin, K. K. & Vasyukha, O. V. (2020). Ecological safety of consumer goods on the example of tobacco products. *Materials of the All-Ukrainian competition of student scientific works*, Poltava, 2020, March 18–20 (p.44). Poltava, National University «Yuri Kondratyuk Poltava Polytechnic» (in Ukrainian).
 17. Passive smoking: how tobacco smoke "kills" people's health. (2019). Institute of Education. Retrieved from https://24tv.ua/pasivne_kurinnya_yak_tyutyunoviy_dim_vbivaye_zdorovya_lyudey_n1123735 (in Ukrainian).
 18. Sereda, S. (2019). Smoke is an invisible killer ": why is passive smoking a health risk ?. *Radio Liberty*. Retrieved from <https://www.radiosvoboda.org/a/pasyvne-kurinnia-ryzyk-dlia-zdorovja/29836738.html>
 19. Is passive smoking harmful?(2020). Докторпро+ <https://doctorpro.ua/uk/articles/chi-shkidlive-pasivne-kurinnya> (in Ukrainian).
 20. Dzubailo, A. V. (2006). Psychology of the treatment process of nicotine addiction in smokers with chronic obstructive pulmonary disease. *Bulletin of SamsU*. 4–5 (in Russian).
 21. Nekos A. N. & Garbuz A. G. (2012). Ecological assessment of environmental objects and food products. Kharkiv: V.N. Karazin Kharkiv National University (in Russian).

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