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## Section 1. Biology

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### METHODS OF MICROBIAL DECONTAMINATION OF INSECT SURFACE

**Abstract.** The use of molecular genetic methods to study the composition of insect microbiome faces the problem of differentiating microorganisms that contaminate the surface structures of insects (adults, nymphs, chrysalis and eggs) and microorganisms that make up the intestinal microbiome. The article presents modern methods used in the food industry and scientific research to carry out microbial decontamination of food and insect surfaces.

**Keywords:** microbiota, insects, microbial decontamination.

#### Introduction

Today, to study the microbial communities of insects, researchers use the whole range of known molecular genetics methods – “meta-omics” [1], which include such methods as meta-genomics, meta-transcriptomics, meta-proteomics and metabolomics. These methods, in addition to providing knowledge about the taxonomic composition of insect bacterial communities, reveal their functional and metabolic capabilities. This information is essential for understanding the role of bacterial communities in interacting with insect hosts and for possible applications in biotechnology.

The small size of insects and the used sample preparation methods do not allow differentiating microorganisms contaminating the insect surface from representatives of the intestinal microbiota. This leads to an erroneous idea of the qualitative composition of the intestinal microbiota. Such differentiation is necessary for diagnosing the ways and mechanisms of infection transmission when

conducting epidemiological studies and monitoring studies of the translocation of pathogenic bacteria into natural ecosystems. Therefore, the development and application of effective methods for decontamination of the surface of insects is one of the urgent tasks facing researchers.

All known methods of decontamination of surfaces (food, insects...) can be divided into disinfection using disinfectant solutions, exposure to temperature and the use of non-thermal food sterilization methods. Heat treatment is a traditional and effective microbial decontamination method that is still used effectively to kill pathogens. The two main convection thermal processes are pasteurization and sterilization. Pasteurization is a heating process in the temperature range of 60–80 °C. The result is cytolysis of microorganisms and inactivation of enzymes. Sterilization is carried out at temperatures above 100 °C to kill spores or spore-forming bacteria. Pasteurization mainly destroys vegetative cells, but not spores. Perhaps these methods will be effective in reducing microbial contamination of the surface of

insects, but as a result, the microorganisms that make up the intestinal microbiome of insects will also die, which is not desirable.

Insects are rich in nutrients and moisture and provide a favorable environment for the growth of microorganisms [2]. Therefore, for insects eaten, immersion in hot water of 80–100 °C or frying is recommended.

So, eaten in African countries – *Gonimbrasia belina* (Westwood, 1849) (*Lepidoptera: Saturniidae*), also known as the mopani worm, traditionally goes through a 24-hour fasting period (the number of microorganisms in the intestine decreases), blanching 15–30 minutes and from one to three days of drying in the sun before eating [3]. Fresh insects have a high bacterial load of Enterobacteriaceae and spore-forming bacteria. Microwave blanching kills vegetative cells but not spores [4].

A number of studies [5] have shown that blanching (10 min for *Tenebrio molitor* or 5 min for *Acheta domesticus*) effectively destroys bacteria. In addition, the bacterial load of the intestines of edible insects may be higher than the bacterial load of their surface [6]. Thermal treatment of insects for 10–15 minutes in a water bath at 90 °C significantly reduced the total number of aerobic bacteria on the surface of the insects, but did not affect the spore-forming bacteria and mycelium. There are no standardized protocols for handling insects for food [7].

Freeze drying can be considered as an effective method of microbial decontamination of insect surfaces. However, this method mainly inactivates the vegetative forms of the bacteria. Freeze drying is not effective against spore-forming bacteria and mycelium.

Sterilization of insects by autoclaving has proven to be more effective than blanching and freeze-drying. Insects were ground in a universal blender and inoculated into 5% NaCl solution. The solution was autoclaved for 16 min at 120 °C. This mode of autoclaving contributed to the reduction of microbial contamination of insects up to 93%. It is possible that additional treatment with acetic acid solution can reduce the bacterial load [8].

Recently, several non-thermal methods of food preservation have been proposed that can also be used for microbial decontamination of the surface of insects – high pressure processing [9], ultrasound [10], pulsed electric field [11], ultraviolet light [12], high-intensity pulsed light [13], gamma irradiation [14], and cold plasma [15].

While these non-thermal food preservation methods have minimal impact on food taste, nutrients, aroma, and freshness, they do not have a 100% bactericidal effect on bacteria that contaminate food surfaces.

The high pressure processing (HPP) is one of the promising methods of disinfection in agriculture and the food industry. Thus, high pressure processing (HPP) of spores of *Fusarium graminearum*, a pathogenic microorganism that causes wheat fusarium wilt, in the mode (380 MPa, 60 °C, 30 minutes) completely inactivates spores [16]. When high pressure processing (HPP) spores of *Aspergillus niger* and *Penicillium expansum*, in the mode (300 MPa, 60 °C, 30 minutes), they were completely inactivated. This method can be used in the food industry, both to inactivate spores on foodstuffs and on the surface of edible insects. Although high pressure processing (HPP) can be used to decontaminate insect surfaces, how it will affect the gut microbiome remains unknown.

Another non-thermal food preservation method is high intensity ultrasound (HIU). High intensity ultrasound (HIU) locally creates a high pressure and temperature gradient with power (20–100 kHz). It destroys cell membranes and DNA, which causes a cytolytic effect that helps reduce the number of bacteria [17]. The mechanism of action of ultrasound is based on the phenomenon of cavitation. Low-intensity ultrasound may not have a lytic effect on the bacterial cell due to poor formation of cavitation bubbles [18]. In most studies using high intensity ultrasound (HIU), cells inoculated in liquid were used to create a cytolytic effect, which is of fundamental importance for the cytolysis of a microbial cell. The cytolytic effect of ultrasound (42 kHz) on *Escherichia coli* cells increased with increasing exposure time:

60 min (99.6%), 75 min (99.7%), 90 min (99.8%) [19]. Sonication (20 and 40 kHz) of *Escherichia coli* and *Klebsiella pneumonia* inoculated in phosphate buffered saline (PBS) reduced the number of living cells [20]. However, the use of ultrasound at a higher frequency of 580 kHz did not affect the destruction of cell membranes, but promoted cell deagglomeration. The use of high intensity ultrasound (HIU) in the range of 20–40 kHz significantly reduced the number of viable gram-negative bacteria *Salmonella spp.*, *Escherichia coli*, but to a lesser extent, ultrasound had an effect on *S. aureus* cells. At the same time, the duration of exposure to ultrasound on bacterial cells was more important than its intensity. High intensity ultrasound (HIU) is being considered for use in the food industry to sterilize liquid foods.

Irradiation with ultraviolet light at a wavelength of 254 nm is a powerful method for disinfecting surfaces. Light in the wavelength range of 250–260 nm is lethal to microorganisms [21]. The mechanism of action of ultraviolet light is based on its ability to damage the DNA of microorganisms, forming thymine dimers. They block DNA replication, which causes the death of microorganisms. UV irradiation reduced the amount of *Escherichia coli* in beef by  $(1.0 \pm 0.2) \log_{10}$  CFU/mL after 5 minutes of exposure. In chicken and pork, the amount of *Escherichia coli* decreased by  $(1.6 \pm 0.7) \log_{10}$  CFU/mL and  $(1.6 \pm 0.4) \log_{10}$  CFU/mL after 4 and 10 min of irradiation, respectively [22]. These results indicate that irradiating food or insect surfaces with ultraviolet light will kill microorganisms only on the surface without penetrating deeply. The presence of folds or furrows on the surface, which is characteristic of the cuticle surface of beetles, will significantly reduce the effectiveness of UV light treatment. Therefore, surface texture will have a significant impact on the effectiveness of microbial decontamination of insect surfaces with ultraviolet light.

Another of the modern non-thermal methods of food preservation is the processing of food at low temperatures and a short time interval, the so-called cold plasma technique (CP) [23]. Plasma is an ionized

gas containing reactive oxygen species (ROS: O, O<sub>2</sub>, ozone (O) and OH), reactive nitrogen species (RNS: NO, NO<sub>2</sub> and NO<sub>x</sub>), ultraviolet radiation (UV), free radicals and charged particles. Typically, plasma is generated when electrical energy is applied to a gas present or flowing between two electrodes with a high electrical potential difference causing the gas to ionize due to the collision of free electrons with these gas molecules.

The cold plasma (CP) method is used in the food industry to reduce microbial contamination, inactivate toxins, allergens and enzymes. This method has proven to be effective for surface decontamination and can be used for microbial decontamination of insect surfaces.

In work [24], 11 protocols for surface disinfection of *Alphitobius diaperinus* (Panzer) (Coleoptera: Tenebrionidae) beetles were studied. The effect of a combination of substances (hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>), 95% ethanol (EtOH) and sodium hypochlorite (NaOCl) on microbial decontamination of the beetle surface was studied. For each protocol, the tube into which the beetle was immersed was covered with a barrier film, inverted three times and sonicated in for 2 minutes (40 kHz). Sonication was used to ensure standardization of bacterial load to compare protocols. As a result of the experiments performed, it was shown that the most effective surface treatment protocol for beetles was a protocol that included a primary surface treatment with 95% EtOH (ethanol) and further treatment with 20% H<sub>2</sub>O<sub>2</sub> or 7.35% H<sub>2</sub>O<sub>2</sub> / 0.23% acetic acid. This protocol resulted in 100% microbial decontamination of the beetle surface. A possible explanation for the effectiveness of the 95% EtOH (ethanol) surface pre-treatment is that the outside of the cuticle is covered by a thin layer of epicuticle which serves as to minimize water loss from the beetle's body. The epicuticle consists of several layers – a superficial waxy or lipid layer of long-chain hydrocarbons and esters of fatty acids and alcohols. It inhibits surface drying and reduces the effectiveness of H<sub>2</sub>O<sub>2</sub> and NaOCl surface disinfection. EtOH pre-treatment improved the efficiency of H<sub>2</sub>O<sub>2</sub> and NaOCl disinfection.

In the study of the mechanisms of infection of adults and larvae of beetles, it is often necessary to establish the place of translocation of the pathogenic microorganism on the surface of the beetle or in the intestine of the insect. Therefore, to study the translocation of bacteria and conduct monitoring studies of the duration of microbial contamination of the surface of beetles, an important condition is the complete sterilization of the surface of adults, larvae and eggs of beetles.

In addition, it must be taken into account that the number of bacteria carried by each individual beetle before disinfection varies greatly. The bacterial load depends on many factors, but sometimes bacteria are not sown from the surface of the beetle, despite the fact that it has been in the same cage with other beetles for a long time. Perhaps this is due to the individual features of the structure of the beetle cuticle and its self-purification. In addition, surface disinfection of beetles with EtOH or NaOCl is detrimental to beetles, but after treatment with H<sub>2</sub>O<sub>2</sub>, beetles usually survive.

## Conclusions

An analysis of the methods of microbial decontamination of the surface of insects and food products shows that there is no single highly effective method that would inactivate microorganisms in 100% of cases. The effectiveness of microbial decontamination of the surface of insects and food products is associated with the use of a set of methods that allow decontamination of certain groups of microorganisms (bacteria, fungi, spore-forming bacteria, viruses) at each stage. For example, sonicating the surface of insects will promote the destruction of bacterial cells and may increase the effectiveness of disinfection solutions. Treatment of the surface of insects with multicomponent solutions, stages of treatment (using a group of solutions with different physical and chemical properties + surfactants) and treatment time can be the most effective way of microbial decontamination of the surface of insects. However, this method of processing will undoubtedly reduce their survival rate.

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## Section 2. Materials science

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### **INFLUENCE OF THE SURFACE CONDITIONS ON THE PROPERTIES OF THE OXIDE PHOTOCATALYSTS**

**Abstract.** Optical studies of micro- and nano-sized powders of titanium dioxide of various modifications and nano-sized powders of zinc oxide have been conducted in the paper. It is established that in the optical transmission spectra of nano-sized powders there is a drop in the visible light region in the wavelength interval between of 550–750 nm. This indicates an enhancement of light absorption in this area, an increase in the use of visible light energy for photocatalysis, and an improvement in the efficiency of photocatalysis. Oxide vacancies are suggested to be the cause of the observed effect. EPR studies confirm this opinion.

**Keywords:** TiO<sub>2</sub> photocatalysts, magnetic cocatalysts, oxide vacancies, improvement of the photocatalyst efficiency, EPR spectra of photocatalysts.



## Introduction

Photocatalysis is a phenomenon when the action of light activates the redox chemical reactions. Special substances called photocatalysts are used in the process of photocatalysis. Photocatalysts are substances that cause the activation of oxidation-reduction responses in the environment by the action of light. They can split water into oxygen and hydrogen under the influence of sunlight, which can be used as an environmentally friendly fuel [1]. Photocatalysts can also destroy harmful substances which exist in the environment, including bacteria and viruses [2]. Thus, creating efficient photocatalysts is connected to solving the most important energy and environmental problems. The main problem that prevents the widespread practical use of photocatalysts is their low efficiency [3; 4]. Photocatalysis proceeds as follows: under the influence of light, pairs of electrons and holes are formed in the semiconductor. They move to the surface, interact with water molecules and cause their decomposition into oxygen and hydrogen through oxidation-reduction reactions. The low efficiency of photocatalysts is mainly caused by two reasons: 1) Electrons and holes created by light participate in small amounts in the reaction due to their recombination [4] and; 2) Visible rays participate weakly in the reaction; Since the existing stable photocatalysts have a large value of the energy gap, only high-frequency rays can induce charges in these substances; Although, theoretically, the energy of the charges, which are induced by low-frequency rays (e.g. red light), is sufficient to split water molecules [5]. Different strategies are used to solve these problems, e.g. various impurities are used for modifying the energy gap of photocatalysts as they reduce its size and improve the inclusion of visible light in the reaction [4; 5]. To reduce the recombination of electrons and holes, a method of deposition of smaller clusters on the surface of photocatalytic nanopowder grains is used, which captures electrons or holes and reduces their recombination [6–8]. Some progress has been made in improving the efficiency of photocatalytic

reactions, but the desired results are not achieved yet. Therefore, it is essential to look for and use new strategies. The presented study serves this purpose.

## Materials

Studies of certain photocatalytic properties of titanium dioxide (TiO<sub>2</sub>) and zinc oxide (ZnO) powders have been done. Photocatalytic powders of anatase and rutile modification of TiO<sub>2</sub> and ZnO of different sizes were selected for the research, as well as the so-called P25 – which is a mixture of these two modifications and is characterized by higher photocatalytic activity than pure modifications. The materials were purchased from Us-nano and were used without any further purification.

The morphology and elemental composition of the powders were determined by ESM, EDS and XRD studies. ESM studies determined the particle sizes of the investigated powders, and EDS studies investigated the elemental composition of the powders. It was determined that the purchased powders were of high purity, and the total content of impurities was less than 1%. XRD analysis determined that the anatase-modified titanium dioxide was crystallographically pure, as it consisted of 100% anatase modification, and the rutile-modified sample was not pure, as it consisted of 95% rutile and 5% anatase modification. As for P25, it has been found that P25 consists of 86% anatase and 14% rutile modifications.

## Results and discussions

As a result of the study of the optical spectra of the photocatalytic powders, it was found that in the transmission spectra of the nanosized powders, the drop in the visible light region in the wavelength interval of 550–750 nm is noticed. Figure 1 shows the optical transmission spectrum of P25 in the wavelength range of 240–800 nm. The picture shows a drop in the wavelength range between 550 and 750 nm. This indicates an enhancement of light absorption in this area and thus improves the use of visible light for photocatalysis, causing an increase in photocatalysis efficiency.

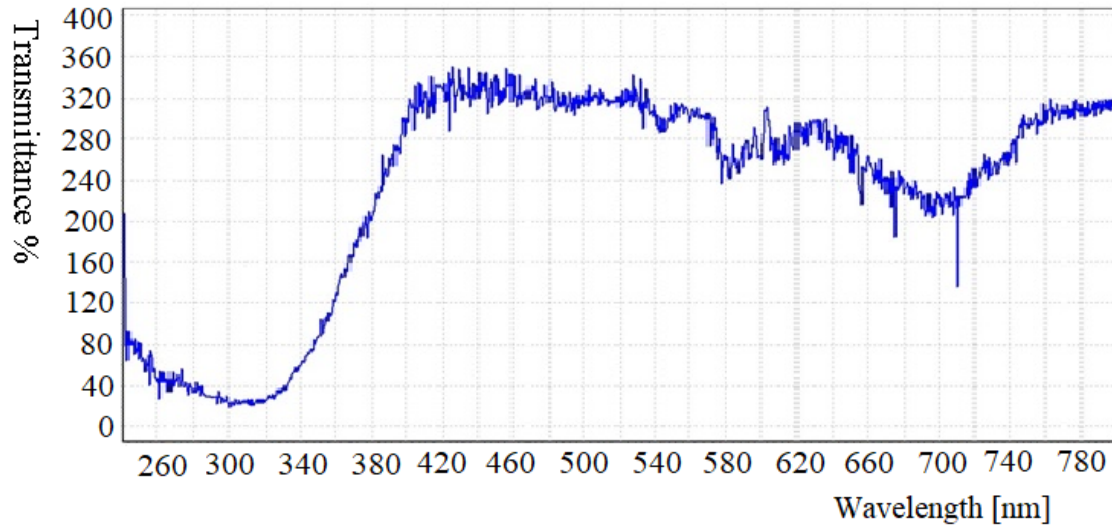


Figure 1. Optical transmission spectrum of P25

Said drop is invisible in the optical transmission spectra of the micro-sized powders. The results of the experiments indicate that the observed phenomenon can be connected to surface effects since the main difference between micro- and nano-sized powders lies in the differences in the amounts of the surface areas of these powders.

Research has also established that the said drop in the visible region of the transmission spectrum disappears even in spectra of nano-sized powders when the surface of their grains is decorated with

cobalt or nickel clusters. The clusters were layered with the simple and inexpensive non-electrical technology developed at the E. Andronikashvili Institute of Physics [9]. Figure 2 shows the optical transmission spectrum in the wavelength range between 240 and 800 nm for P25 nanopowder. The surfaces of P25 nanopowder nanograins are decorated with cobalt clusters. The image shows the disappearance of the drop in the transmission spectrum in the visible region, which is the result of decoration.

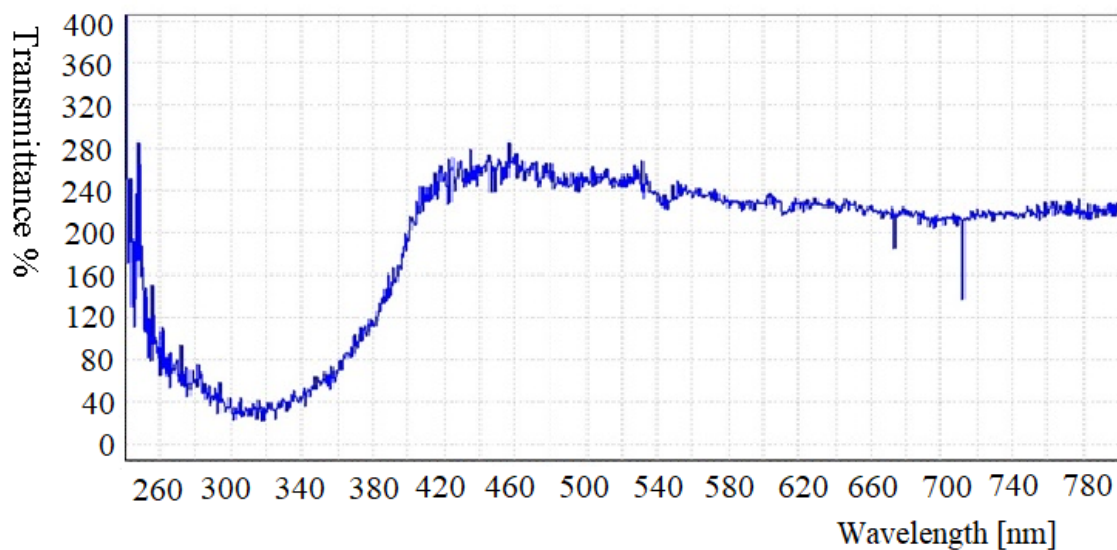


Figure 2. Optical transmission spectrum of nanopowders P25 with nanograins decorated with Co clusters

This confirms that the observed phenomenon is related to surface effects. It must be noted that the disappearance of the drop in the spectrum is not caused by the deterioration of light penetration into the powder grains, which could seem to be a result of the deposition of clusters but it is not. As (Figure 1) and (Figure 2) show, another drop in the ultraviolet region of the transmission spectrum, associated with the gap in the main energy spectrum of this substance, does not change after the deposition of clusters.

Experiments conducted on ZnO nanopowders showed that the transmission spectra of ZnO nanopowders also show a drop in the wavelength interval between 550 and 750 nm. This indicates that the observed phenomenon is connected not to metal but to oxygen atoms, most likely, to the vacancies of these atoms.

EPR studies have shown that titanium dioxide micro-powders do not have an EPR signal. The EPR signal appears in the free radical region of the spectrum only if the grain size is nano-sized. (Figure 3) shows the EPR spectrum of titanium dioxide nano-size powder P25 with an average grain size of 25 nm. The spectrum represents a narrow singlet ( $g = 2.0017$  and  $\Delta H = 0.705$  mTl) placed between the 3rd and 4<sup>th</sup> components of the  $Mn^{2+}$  standard; this narrow singlet is usually attributed to electrons trapped by

oxygen vacancies [10]. Numbers 1,2,3,4,5 indicate  $Mn^{2+}$  (standard) components.

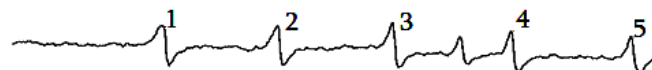


Figure 3. EPR spectrum of P25 ( $g = 2.0017$ ,  $\Delta H = 0.705$  mTl); Numbers 1,2,3,4,5 indicate  $Mn^{2+}$  (standard) components

The EPR spectra of photocatalytic nanopowders were also studied after their grain surfaces have been decorated with metallic clusters. Figure 4 shows the EPR spectrum of titanium dioxide P25/Co decorated with cobalt clusters. It is a broad asymmetric singlet ( $g = 2.2023$  mTl and  $\Delta H = 78.2$  mTl), which most likely appears as a result of the interaction of cobalt atoms with oxygen atoms and also with oxygen vacancies, since the signal of oxygen vacancies, which was observed before deposition, disappears at this time. This indicates that, as a result of depositing clusters on the surface of photocatalyst nanoparticles, isolated oxygen vacancies pass into other complexes, which leads to the disappearance of the effect of oxygen vacancies in the EPR spectrum and probably also the disappearance of the drop in the light transmission spectrum, which is associated with oxygen vacancies.

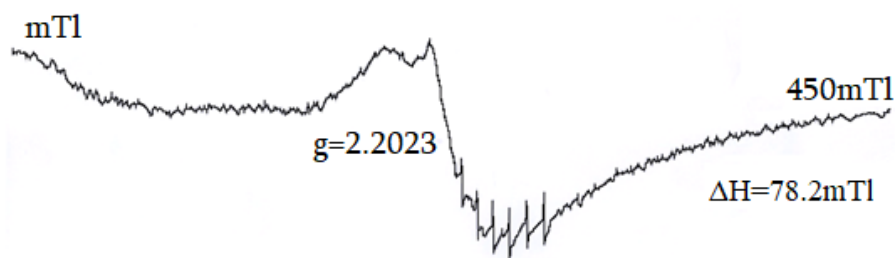


Figure 4. EPR spectrum of P25 decorated with cobalt clusters ( $g=2.2023$ ,  $\Delta H=78.2$  mTl); Similar results were obtained for other photocatalytic nanopowders as well

### Conclusion

In the presence of oxygen vacancies on the surface of titanium dioxide nanopowder grains, these vacancies can enhance light absorption in the visible region in the wavelength interval between 550 and 750 nm. Therefore, oxygen vacancies increase

the efficiency of oxide photocatalysts from the point of view of solar energy conversion.

As a result of decorating the surfaces of oxide photocatalysts with metallic co-catalytic clusters, the absorption of light in the visible wavelength range between 550 and 750 nm disappears, since the surface vacancies interact with the atoms of the

clusters and form complexes that do not absorb in this region.

According to EPR spectra, before the deposition of clusters, electrons are in oxygen vacancies and give a signal with a factor of  $g=2.0017$ , and after the de-

position of clusters, new complexes are formed and electrons give a signal with a factor of  $g = 2.2023$ .

**Acknowledgement:** This work was supported by Shota Rustaveli National Science Foundation of Georgia (SRNSFG) [grant № FR-21-9263].

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## Section 3. Engineering sciences in general

<https://doi.org/10.29013/ESR-23-5.6-13-20>

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### SECURITY OF FIRE PREVENTION AND FIGHTING FOR SEAPORTS IN VIETNAM MEETS REQUIREMENTS FOR INTERNATIONAL INTEGRATING

**Abstract.** Ensuring the safety of fire prevention and fighting for seaports has a meaning and an important role to meet the requirements of socio-economic development of the country as well as international integration. The article focuses on the results of research on the characteristics of seaports related to the management; practice of ensuring safety in fire prevention and fighting here as well as making recommendations with conclusions to contribute to ensuring safety and creating motivation for sustainable economic development.

**Keywords:** Seaport; fire prevention and fighting; international integration.

#### 1. Make a problem

Vietnam has a sea area of over 1.0 million square kilometers, three times the land area; The coastline is over 3,260 km long with many peninsulas, protected bays and waves, great natural depth, and a project on the busiest maritime route in the world... From the advantages of the sea, the birth of a seaport is inevitable and closely associated with all production activities and people's lives, in which, seaports play the role of a constituent part of seaports, contributing to the development of logistics, transportation and infrastructure (wharfs, warehouses, yards, factories, headquarters, traffic...) at seaports [3]. Also from the advantage of the sea, the economy of seaport exploitation and shipping has formed and is increasingly playing a particularly important role in the development of the marine economy and the international integration process of the country.

According to statistics, Vietnam currently has 296 seaports stretching from North to South, in which, concentrated in some localities such as [1]: Quang Ninh province (14 seaports); Hai Phong city (52 seaports); Da Nang city (08 seaports); Quang Ngai province (07 seaports); Binh Dinh province (04 seaports); Khanh Hoa province (16 seaports); Ho Chi Minh City (43 seaports); Ba Ria – Vung Tau province (47 seaports); Dong Nai province (18 seaports); Can Tho city (21 seaports) ... To develop the above advantages, the Government has issued many documents to promote the development planning of seaports and seaports, typically: Decision No.1579 /QD-TTg dated September 22, 2021 of the Prime Minister approving the master plan on development of Vietnam's seaport system in the period of 2021–2030, with a vision to 2050 [10]. Accordingly, it is necessary to develop the seaport system and modern on a par with the region and the world, meeting

green port criteria; fully and effectively meeting the country's socio-economic development needs, is the main pillar that plays the role of driving force, leading and successfully developing the maritime economy.

## **2. Research results discussed**

### ***2.1. Studying the characteristics of seaports from the perspective of state management***

– Regarding the object of state management of fire prevention and fighting for seaports: Based on legal documents on fire prevention and fighting, related legal documents to determine the object of state management of fire prevention and fighting for seaports, avoiding the tendency to identify rampantly or omit subjects subject to fire prevention and fighting management at seaports and operating facilities in the seaport area. On that basis, the object of state management of fire prevention and fighting for seaports is fire prevention and fighting activities of enterprises, organizations and individuals investing in the construction and trading of technical infrastructure of seaports, trading, transportation facilities... in the seaport area. Pursuant to the 2001 Law on Fire Prevention and Fighting (amended and supplemented in 2013), Decree No.136/2020/ND-CP... to specify the objects of state management of fire prevention and fighting for seaports and facilities in seaport area.

In the state management of fire prevention and fighting for seaports and business and exploitation establishments in seaports, it is necessary to always focus on improving the fire prevention and fighting responsibility of the Maritime Port Authority for business and exploitation activities at seaports; The port authority's responsibility for fire prevention and fighting is considered a special object in the object of state management of fire prevention and fighting at seaports and facilities in the seaport area. Because, this is the entity responsible for operating and managing the entire operation of the seaport, and at the same time, the subject is responsible before the law for all such activities. In particular, the organization and maintenance of fire prevention and fighting ac-

tivities at seaports under their management is one of the mandatory requirements that the law on fire prevention and fighting has specified in legal documents, standards and regulations, technical standards on fire protection.

– The entity directly assigned the task of performing state management of fire prevention and fighting for seaports and facilities operating in seaports is the Fire and Rescue Police force, which is specifically led by the Fire and Rescue Police Department – the provincial-level Public Security Administration. The Provincial-level Police Department of Fire and Rescue shall perform the tasks and powers according to Article 2 of the Decision No.2413/QĐ-BCA dated April 9, 2019 of the Ministry of Public Security defining the functions, tasks, powers and organization. organize the apparatus of the Police Department of Fire Prevention and Fighting and the Central High Commission of the Public Security of the provinces and centrally-run cities to carry out the contents of state management of fire prevention and fighting specified in Article 57 of the Law on Fire Prevention and Control; also perform the functions and tasks of state management of navigation at seaports as the Maritime Port Authority (according to Circular No.19/2021/TT-BGTVT dated September 14, 2021 of the Ministry of Transport, providing regulations on the organization and operation of the Maritime Administration).

– State management tools on fire prevention and fighting for seaports are the provisions of law related to the assurance of fire prevention and fighting safety in seaports. The legal system on fire prevention and fighting and other laws related to seaports, standards and technical regulations on fire prevention and fighting in general and for seaports and facilities in seaports in particular; planning and planning, aimed at setting goals and establishing the means to achieve them; organize the state apparatus and the state mobilizes social organizations in general and in the state management of fire prevention and fighting for seaports and facilities in the seaport area in particular,

fully and uniformly, Scientific, feasible and appropriate conditions will create favorable conditions for competent state agencies in the state management of fire prevention and fighting for seaports and facilities in seaports. At the same time, create clear legal regulations for investors and contractors when investing and exploiting at seaports.

– Methods of state management of fire prevention and fighting are methods and measures affecting the activities of subjects under management in the field of fire prevention and fighting. The State can use its power to issue mandatory orders and decisions, or to encourage and encourage the participation of other actors in fire prevention and fighting activities. For seaports and facilities in seaports, too, the state stipulates requirements and safety conditions for fire prevention and fighting, responsibilities of the head of the facility, etc. through legal documents. laws, standards, technical regulations on fire prevention and fighting and other legal documents related to seaports. These are mandatory regulations that when participating in legal relations on fire prevention and fighting at seaports and facilities in seaport areas, they must strictly comply [4; 5].

– The objective of the state management of fire prevention and fighting for seaports is to minimize the occurrence of fires and damage caused by fires at seaports, contributing to the protection of human lives and health. people, protect property of the State, organizations and individuals, protect the environment, ensure security and social order and safety; bringing fire prevention and fighting activities step by step to meet the requirements of socio-economic development, effectively serving the cause of industrialization and modernization of the country and international integration.

## ***2.2. Research on ensuring fire prevention and fighting safety at seaports***

– On the side of seaports [6; 8]: Being aware of the importance of fire prevention and fighting work at seaports, the governing agencies, management and operation units of seaports have paid attention to the

work of ensuring safety. in exploitation and operation. The management units have fully fulfilled the responsibilities of the agencies and heads: Organizing propaganda and dissemination of knowledge on fire prevention and fighting; building a movement of all people to participate in fire prevention and fighting; establishment and maintenance of fire prevention and fighting teams according to the provisions of law; To promulgate according to its competence regulations and measures on fire prevention and fighting; Organize the implementation, inspection and supervision of the observance of regulations on fire prevention and fighting; Ensuring funds for fire prevention and fighting activities, using fire prevention and fighting funds for the right purposes; equip and maintain the operation of tools and means of fire prevention and fighting; prepare conditions for fighting; formulating and organizing practice of fighting plans; ensure conditions for professional training on fire prevention and fighting; organizing fighting and overcoming consequences caused by fire; Perform other tasks on fire prevention and fighting as prescribed by law. In which, it is clear that 100% of seaports have regulations and rules on fire prevention and fighting; have a fire fighting plan; Fully equipped with fire protection equipment. Along with that, at seaports, there was interest in establishing specialized fire prevention and fighting teams or grassroots fighting teams (*Figure 1*). Typically, in Hai Phong, this is the locality with the most seaports in the country, 100% of seaports have specialized fire protection teams. Along with that, through surveys at seaports, the arrangement of goods on the gathering yards is always concerned, arranged, and ensured a safe distance from fire protection. In particular, goods at risk of fire and explosion have been arranged and arranged in a separate area. Fire protection work here always meets the requirements of ensuring safety during the import and export of goods.

– On the side of the Fire and Rescue Police force [2]: This is the main force in performing the functions and tasks of state management of fire prevention and

fighting at seaports. Through the survey, in localities with many seaports, along with the attention of all levels, branches, the Fire and Rescue Police have fully fulfilled their responsibilities in management. 100% of seaports have been carried out basic survey, management votes have been drawn up; all seaports already have fighting plans prepared by the Fire and Rescue Police force; Every year, there is a practice of fighting plans, including a large fighting drill with the participation of clusters of seaports, with situations close to reality. Besides, the propaganda and dissemination of laws and knowledge on fire prevention and fighting at

seaports are always interested and invested (*Figure 2*). Clearly identifying this is an important task, thereby creating a change in awareness for the Management Board, the heads as well as officials and employees here. On the other hand, in order to detect loopholes and shortcomings in fire prevention and fighting work here, every year, there is a serious inspection and inspection of fire safety (*Figure 3*). The Fire and Rescue Police force also regularly pays attention to training the grassroots fire prevention and fighting teams as well as specialized fighting teams in terms of knowledge, expertise as well as initial fighting work.

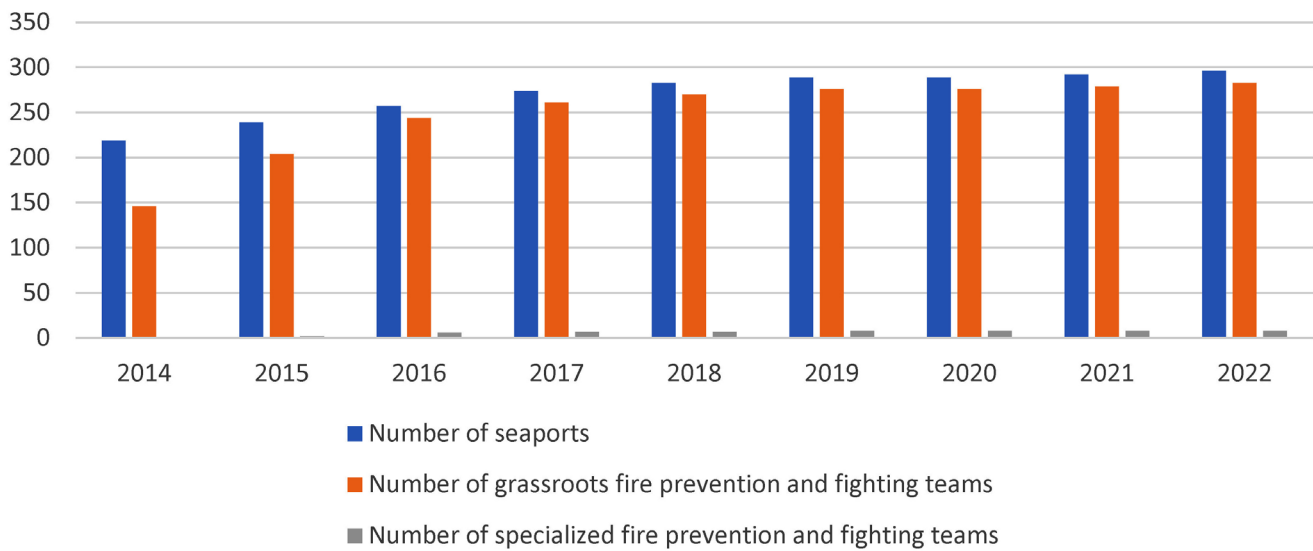


Figure 1. Number of grassroots and specialized fire prevention and fighting teams at seaports

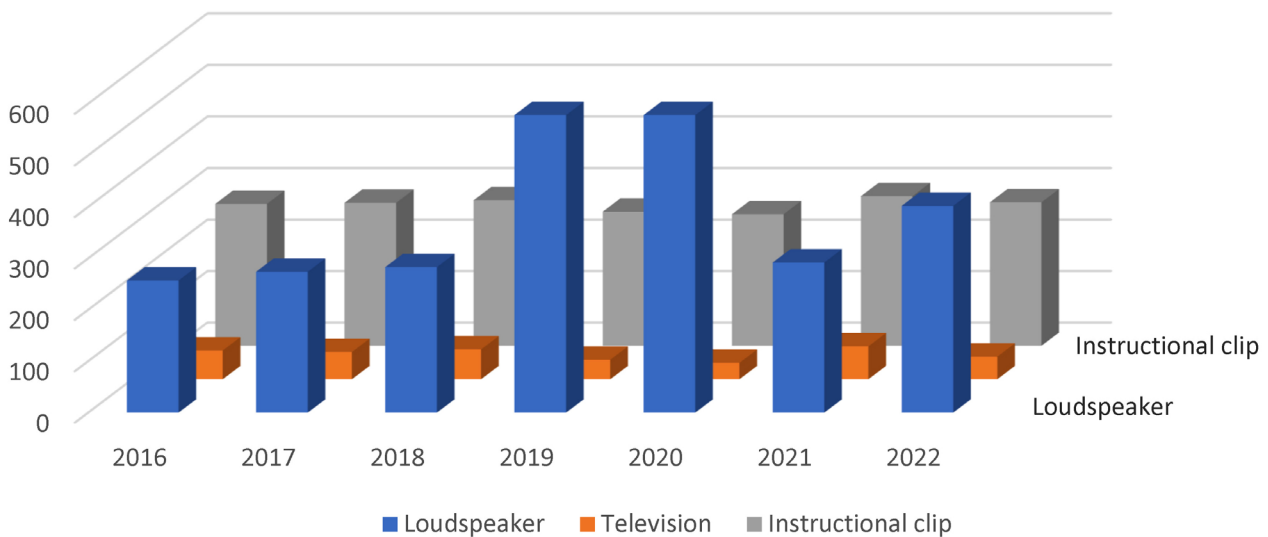


Figure 2. Number of propaganda on mass media



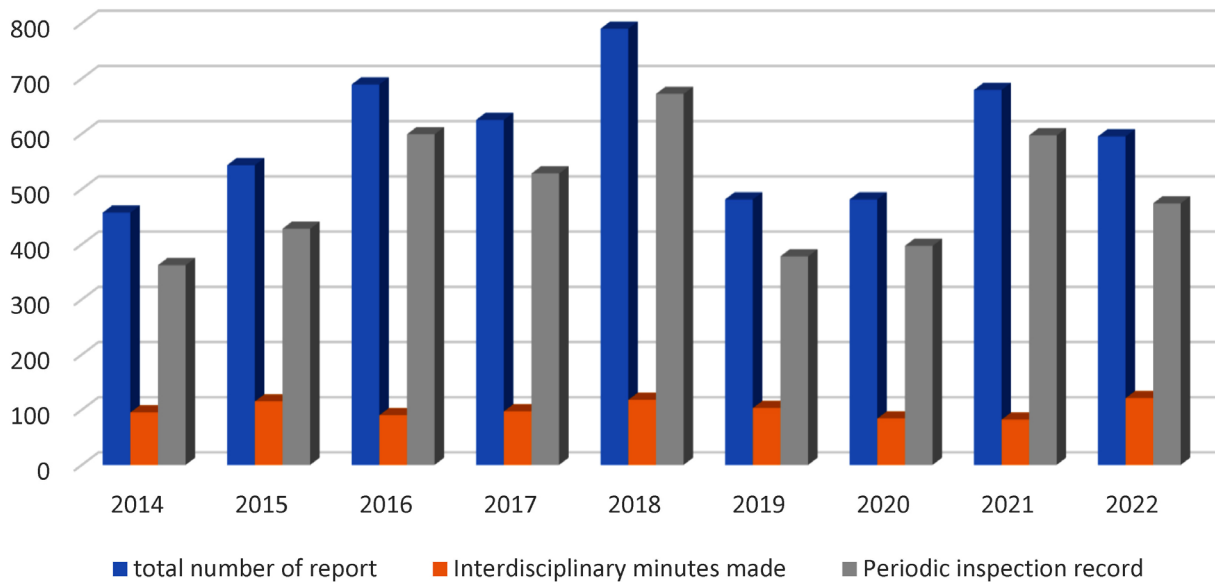


Figure 3. Statistics of fire safety inspection for sea harbour

### 3. Some conclusions and recommendations

#### 3.1. Advise and propose to competent state agencies to promulgate documents related to the state management of fire prevention and fighting

At the central level: The Ministry of Public Security, which is directly the Fire Prevention and Fighting Police Department, is the standing agency assisting the Minister of Public Security in performing the functions and tasks of state management of fire prevention and fighting throughout the country... At the same time, it is the agency that directly guides and directs in terms of expertise and professionalism in fire prevention and fighting for the fire prevention and fighting police forces in the police of local units.

In the locality: The Fire Prevention and Fighting Police Department and the Provincial Police Department need to seriously study, absorb and effectively apply the provisions of the law, standards, technical regulations on fire prevention and fighting, and professional guidance. of the Ministry of Public Security, of the Fire Protection and Rescue Police Department.

#### 3.2. Renovate contents and forms of propaganda, dissemination and education of the law on fire prevention and fighting for seaports

\* About the content: Completing the content of propaganda, disseminating the law and knowledge

on fire prevention and fighting suitable for seaports. The purpose of the propaganda is to make the seaport management and operation board, the owners of facilities and means of operation in the seaport understand and grasp the provisions of the law on fire prevention and fighting [7]. Contents of propaganda materials at seaports, which are built, must ensure the general structure, including the following parts:

- Introduction: An overview of the status and development of seaports;
- Part I: Actual situation of fire prevention and fighting work at seaports, seaport fire situation and related issues;
- Part II: Documents on Fire Protection Law; regulations, regulations and standards related to seaports;
- Part III: Basic knowledge of fire prevention and fighting for seaports;
- Part IV: Personal techniques, how to use fire-extinguishing means on the spot and handle situations when fire occurs;
- Part V: Escape skills when a seaport fire occurs.

\* In terms of form: In order to do well in propagating and disseminating the law and knowledge on fire prevention and fighting for seaports, it is necessary to research and select many forms of communication

to use at the same time and the content must be Distilled and built in a rich way will attract many propagandists and participants. At the same time, based on the actual conditions, the propaganda method is new, modern and attractive to the people being propagated, and chooses the appropriate form to build the point propaganda model.

**Model description:** The propaganda model operates based on the internal broadcasting system at seaports, in order to transmit information on legal knowledge, fire prevention and fighting operations (can be integrated with advertising programs). advertising, breaking news to avoid boredom, ensure continuous broadcast time, collect funding through advertising, etc.), broadcast time at all hours of the day, program content is change by month, quarter.

**Selection of propaganda form:** General propaganda.

**Propaganda method:** Propaganda through the internal broadcasting system at seaports.

**Program content development:** Based on propaganda content compiled to serve the propaganda and dissemination of laws, knowledge of fire prevention and fighting at seaports, staged into skits, building reportages. The short video introduces lectures on fire safety for seaports, how to use fighting equipment on site, and disseminates legal knowledge and skills to handle when a fire occurs at a seaport.

**Funding for implementation:** Mobilizing facilities operating in seaports to contribute and use the funds for propaganda on fire prevention and fighting of the Seaport Management and Operation Board, the funding source through advertising contracts broadcast on the system. internal broadcast; or deduct from the annual service fee of the seaport... on the basis of promoting the socialization of propaganda, law dissemination and knowledge on fire prevention and fighting at seaports.

**Developing a plan:** Coordinating in building and deploying a propaganda model on fire prevention and fighting through the internal broadcasting system at seaports.

**Exploiting organization:** After the complete model is handed over to the Seaport Management and Operation Board for exploitation and use, based on the tasks of the relevant units, it will provide propaganda content, check the implementation of the proposed plan.

### ***3.3. Standardization of contents, requirements, order and procedures for design appraisal, approval and acceptance of fire prevention and fighting for seaports***

Comply with regulations, order and procedures as prescribed by legal documents. Accordingly, the Fire Police force strictly implements decentralization in the work of fire prevention and fighting appraisal for seaports according to the provisions of Clause 12, Article 13 of Decree No.136/2020/ND-CP dated November 24/2020 of the Government and Circular No.149/2020/TT-BCA dated December 31, 2020 of the Ministry of Public Security.

Promote reform of administrative procedures in the work of design appraisal, acceptance and acceptance of fire prevention and fighting in the direction of simplification and application of science and technology to the organization performing this work. Systematize the list of administrative procedures and put them on the online public service platform; receive and process applications for approval through a system of machinery and technology to help transparency and shorten processing time.

### ***3.4. Well organize the inspection and handling of violations of fire prevention and fighting at seaports***

Do well the work of grasping the situation, basic investigation in service of making a complete list and accurate classification of facilities in the seaport, without omitting or omitting facilities; and at the same time make and register a dossier of management of fire prevention and fighting work for the facility in accordance with the provisions of the Fire Protection and Rescue Police Department.

Seaports are invested and equipped with infrastructure, including a foundation of digital technol-

ogy for operation and management at seaports, so the process of safety inspection on fire prevention and fighting and staff safety. State management of fire prevention and fighting needs to research and effectively apply information technology to solve administrative procedures related to order and procedures for inspection, making and approving minutes of fire safety inspection. for seaports.

### **3.5. Improve the operational quality of the fire prevention and fighting forces in place of seaports**

According to the survey results, with 283 grassroots fire prevention and fighting teams consisting of 1094 members and 08 specialized fire prevention and fighting teams with 222 members at 296 seaports, it can be said that the grassroots and specialized fire protection forces at seaports hold the highest position. In order to contribute to improving the quality of operation of this force, in the coming time, it is necessary to focus on the following contents:

Advising on promulgating and proposing the Seaport Management and Operation Board, the leaders of the Maritime Department to issue regulations and safety rules on fire prevention and fighting.

Regularly review, consolidate and organize the contingent and apparatus of grassroots and specialized fire prevention and fighting teams at facilities operating in seaports. The regular maintenance of the structure and members of the grassroots and specialized fire prevention and fighting teams is both a requirement of the law on fire protection and an important condition in the development and improvement of the operational efficiency of the grassroots fire prevention and fighting teams. department, specialty.

### **3.6. Develop fighting plans and organize practice of fighting plans to meet requirements at seaports**

For the facility's fighting plan, i.e. the fighting plan of the facilities in the seaport, follow the form No. PC17 issued together with the Decree No. 136/2020/ND-CP dated November 24, 2020. government.

The grassroots and specialized fire protection teams at seaports should actively advise the heads of seaports and seaport management boards to organize learning fighting plans for operating units and individuals. working in seaports. All the people mobilized to participate in the practice of fighting plans must grasp the content of the hypothetical situations and their tasks in each specific situation.

For the fighting plan of the Fire Prevention and Fighting Police force, the police of local units built for the seaport, it is necessary to coordinate and assign specific tasks to the facilities in the seaport when participating in the construction of the seaport. practice fighting plan for the whole seaport. The fighting plan of the Fire Prevention and Fighting Police force for the seaport will be a plan with the coordination and mobilization of many forces and means to participate in the exercise, in which, the on-site fire prevention and fighting force at the wharf. seaport.

### **4. Conclusion of research problem**

Construction, planning and development of seaports are the goals and directions that the Government, ministries, branches and local authorities pay attention and invest in to promote the local and national economy. To ensure synchronous and sustainable development, ensuring fire safety is an important factor that directly affects the normal operation of seaports in general, including seaports, meeting international integration requirements.

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## Section 4. Philology and linguistics

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### LEXICAL-SEMANTIC FEATURES OF DIRECTIVE VERBS IN UZBEK AND FRENCH LANGUAGES

**Abstract.** This article discusses directive (expressing directed action) verbs in the French language, their lexical-syntactic and comparative features. The analysis of these verbs involved in the conjugation of nouns from a certain object to a subject is presented by examples.

**Keywords:** Object, Subject, Action, Space, Action Verbs, Directed Verbs, Intensity, Concretization, Orientation to the Place, Distance from the Object, Approach to the Object.

#### 1. Introduction

In world linguistics, linguistic typology has become one of the promising fields of modern linguistics, which is constantly developing. A lot of scientific research is being carried out by linguists of the world on the comparative and comparative study of languages, in particular French grammar and lexis. During the period of rapid integration of new Uzbekistan into the world community, the interaction between the Uzbek and French languages has become widespread, and the interaction of the two languages, comparative studies, problems of translation studies, and issues of comparative literary studies require special attention. It is natural that any comparative linguistic research on the verb system of the Uzbek and French languages will mainly (ultimately) contribute to the improvement of relations between societies and the harmonization of language and culture issues with practical activities. In this sense, this research work aimed at studying the functional, semantic and syntactic interpretation of directive verbs in Uzbek and French languages is also relevant.

Based on the principles of development, based on the need to “stimulate scientific research and innovation activities, to create effective mechanisms for the implementation of scientific and innovative achievements”, verbs expressing the meaning of directed action in different systematic languages are now comparatively studied.

Directive, that is, verbs expressing directed action, reflecting the directed action realized under the influence of the subject, take part in paralyzing the meanings of moving away from the object and approaching the object to the subject. For example, the verb “jeter” which reflects the spatial movement of the object moving away from the subject, which means an intensively directed action, is lexically semantically used in Uzbek language *to burn, throw on the fire, throw into the water, throw on the bed, drop a letter in the mail, to throw it someone face, throw stones, to lay on the table, to cluttering up the home, to push down, to fall from a horse, to put the load on the ground, to spill, to throw on the person, to throw on the counter, to shine, to put on a ship, to give a purse, to scatter the lust of death, to hand out, to look at, to befall many misfortunes on the head, to*

*capture one's imagination, to blow the blue, to provoke affection, to scream* are given by lexemes with variants of meaning and are characterized by each other.

When the dynamic orientation of the verb “*jeter*” expresses the intensity of the action, it is given to the Uzbek language by lexemes to throw and throw. In this case, the dynamic aspect of greater movement intensity takes the leading place. The remote targeting feature can be targeted near and far:

*Le coeur tremblant, mais cependant résolu à périr ou la voir, il jeta de petits sailloux contre le volet, point de réponse [6].*

*Although he pulled his heart behind him, but decided to either die or meet the lady, he started throwing stones at the window, but there was no response [6].*

*Elle jeta tout par terre, et me sauta au cou en me disant: – Je paye mes dettes, je paye mes dettes! C'est la loi des Calés! [11].*

*Carmen threw the things in her hand to the house and said: “I will pay off my debt, I will pay off my debt! This is the law of the Kales,” he said.* In the first example, the verb “*jeter*” expresses the meanings of directive causation, separate orientation, near-distance orientation, localized strong dynamic movement. For example, in French, “*de petits cailloux contre le volet*” reflects the connection of the locum with the directed object, while “*il jeta*” reflects the activity of the active subject directing the action. In the Uzbek language, the object to which the lokum is directed and the intensive dynamic action are expressed” [1; 2].

## 2. Literature Review

A number of scientific researches on the issues of comparative language learning have been conducted in our country. Among them, D.J. Buranov, G. Kh. Bakieva, A. A. Abduazizov, M. D. Dzhusupov, M. T. Scientists such as Iriskulov, D. U. Ashurova, M. E. Umarkhodjaev, U.K. Yusupov, J. A. Yakubov, Sh. Safarov, T. Bushuy, F. Rozikov have carried out research on the comparative study of languages. The main part of the scientific research conducted in this regard corresponds to the contribution of foreign experts. Among the scientists who conducted the most effec-

tive research in this direction: Sh. Bally, Ch. E. Bazel, Yu. V. Rozhdestvensky, B. Yu. Gorodetsky, R. A. Budagov, S. D. Katsnelson, V. G. Gak, T. Milevskiy can be included [1; 2]. In recent years, the boundaries of typological research have expanded dramatically, covering areas of typological research with different characteristics and directions. The inclusion of various categories of consistent comparison of languages with different construction systems into these branched areas has had a positive effect on the increase of the scientific and practical value of typological research, and on the effectiveness of research in various directions in the field of typological research.

The initial phase of the movement is expressed in the Uzbek language. Stones started throwing. In the second example, the pronoun *tout*, which begins with the verb “*jeter*”, acts as a referring object. “*Par terre*” reflects directed movement towards locum. In the Uzbek language, the phrase “*things in my hand*” acts as a directional object, “*to the house*” acts as a lokum, “*to throw*” shows an intensive dynamic action directed at a short distance.

In the Uzbek language, a forceful, violently directed action is given more by the verbs to throw, toss, and toss. In French, the verb “*jeter*” is used in all cases.

*Je lui jetais les cartes à la figure [8].*

*I threw the card at him.*

*Duroy se mit à ricaner, et ramassant une chemise tombée à terre, il jeta sur la couche en criant:*

1. – *Allons donc... levez-vous... [10].*

*Durois laughed and picked up the shirt lying on the floor and threw it on the bed.*

2. *It's okay!... Stop!... he shouted [8].*

*Lady! Il faut que l'autre qui parle tout seul lui donne son adresse. L'homme à redingote, intendait cette decision souvent répétée, jeta au nez de Julien cinq ou six cartes [6].*

*That's right. Let the shouting person give him his address. When the man in the vest heard this exclamation, which he repeated several times, he pushed five or six business cards towards Julien's face.*

### 3. Results and Discussion

In speech situations, the verb “jeter” can be adapted to the verb to throw. In such situations, discarding means giving up a certain thing as unnecessary and useless, not paying attention to its value and necessity, signs of indifference find their reflection.

*Elle mangeaient d'une manière délicate, en tenant l'écaillé sur un mouchoir fin et en avançant la bouche pour ne point tacher leurs robes. Puis elle buvaient l'eau d'un petit mouvement rapide et jetaient la coquille à la mer [9].*

*The women put the oyster on their thin tablecloths, stretched out their lips to drip it on their dresses, immediately took a bite, drank the contents, and threw the shells into the sea.*

*Elle écrasa le sac entre ses mains et le jeta dans la cheminée [8].*

*He crumpled the package and threw it into the fireplace.*

*Elle se leva, jeta sa sèbile, et mit sa mantilla sur sa tête comme prête à partir [11].*

*He stood up, threw off his cloak, and, as if setting out on the road, covered his head with his mantilla.*

In situations of mutual identification between the languages being compared, semantic complementation, semantic addition transformation may occur. For example, we encounter this phenomenon in translations from French to Uzbek. The Uzbek language clarifies the content by introducing the lokum as an additional component in order to fill in the content and make it more concrete:

*Je jetai mon paquet et j'essayai de le prendre [11].*

*I put my luggage on the floor with the intention of taking Romendada.*

*In particular, “je jetai mon paquet” in French is translated into Uzbek as “I put my luggage on the ground”. Although the word er, meaning locum, does not exist in French, it is added as a supplemental component. In this case, the word ground specifies the direction of movement. Reveals the direction property. It also reflects the fact that there is a difference in word choice between languages even in my “mon paquet” load. In this regard, the Uzbek language chooses a generalized nomination.*

If the same typological allomorphy selects the initial aspect of the action process, the Uzbek language names the final resulting part:

*M. Pirard avait reçu et jeté au feu quelques lettres timbres de Dijon [6].*

*Julien did not know that Monsieur Pirard had taken several letters bearing the Dijon stamp and burned them.*

In some cases, the Uzbek verb “jeter” is used instead of “throw” and “throw”.

Functionally, the expansion of the scope of expression of words that have undergone the phenomenon of semantic shift is affected by the breadth of general content application:

*Au retour, il throws a large package covered with papier gris on the table [6].*

*When he returned from Besançon, he dropped a large knot wrapped in gray paper on the table.*

*Alors le Normande, radieux d'une joie muette de vieux paysan, se releva, et pour son plaisir, coupa la gorge du cadavre. Puis, il, le traîna jusqu'au fosse et l'y jeta [6].*

*Then the old peasant from Normandy was inwardly happy, got up, unable to contain his joy, strangled the corpse to finish the job, then dragged it and threw it into the ravine.*

It is the directed action that gives rise to the semantic analogy in the expression. For example, the verb “jeter” can be used instead of the verb pousser in some speech situations:

*Je reculai, et d'un coup de coude je jetai Dorothee à la renverse; puis comme le lieutenant me poursuivait, je lui mis la pointe au corps, et il s'enferra [13].*

*I threw myself back and pushed Dorothea down with my elbow, and then, seeing that the puruchik was attacking me, I stabbed him with a sword.*

In terms of meaning, the verb “pousser” reflects the meaning aspects of directive causation, contiguous direction, intensity of dynamic action.

It is given to the Uzbek language by the following lexemes: *to take aside, to hit, to press, to push, push to open, to stick up, to sigh, to jump out, to open, to drive away, to*

*transfer, to scatter around, to round, to push the door jamb, to move forward.* These aspects of meaning are clearly expressed in both languages under comparison:

Une femme, qui voulait fuir plus vite que les autres, le poussa rudement, il tomba [6].

One of the women stepped forward and pushed him hard, and the young man fell down.

Elle repousse avec une force vraiment extraordinaire [6].

The woman pushed him with an unnatural force.

“Une femme le poussa rudement” in the first example clearly shows the dynamic intensity of the directive causally directed movement. Here, “pousser” and “rudement” implicitly and explicitly express a high level of intensity. The phrase “il tomba” reflects the high intensity of action.

In the Uzbek language, the above-mentioned aspects of meaning are clearly expressed in the sentence “one of the women pushed him hard”. A similar situation is observed in the second example. In particular, the fact that the directed action is performed at a high level of intensity, through the meaning of the verb *repousser*, also serves to reveal the extremely high intensity of the action “avec une force vraiment extraordinaire”.

#### 4. Conclusion

In the same way, although the verb *pushed* in Uzbek means a sign of internal intensity, the phrase “with an unnatural force” exaggerates it even more.

In more speech situations, the verb “*pousser*” expresses a forceful action. In most cases, these actions take place in relation to the subject:

Après son dîner, Charles Montait. Il poussait devant le feu la table et il approchait son fauteuil. Il s’asseyait en face [14]. *Charles would go there after dinner. He would push a round table in front of the fireplace, bring out Emma’s chair, and sit down opposite her.*

Quand ils furent arrivés devant son jardin, Madame Bovary poussa la petite barrière, monta les marches en courant et disparut [14].

When she reached her garden, Mrs. Bovary pushed the door, ran out of the pillory and disappeared behind the door. In French, verbs denoting directed motion reflect the properties of unidirectional and vector direction.

They are able to maintain the expression of direct and figurative movement. The above-mentioned typological differences are reflected in the factual basis of the comparative materials of the Uzbek language.

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## Section 5. Economics and Management

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### THE IMPACT OF E-COMMERCE DEVELOPMENT IN AZERBAIJAN ON CONSUMER FOOD MARKET MANAGEMENT

**Abstract.** The article considers the impact of e-commerce on the management of the food consumption market, at the same time, the need to use e-commerce technologies in the food consumption market and issues of organizing an effective structure of e-commerce platforms.

**Keywords:** e-commerce, consumer, food, market, communication, technology.

Lack of effective laws to regulate processes and organise good governance in society, as well as the weakness of the executive authorities in the imple-

mentation of the adopted laws indicate a weakening of the influence of the system of state power. However, it should be noted that the weakness of official

state bodies does not mean that processes are not under control. In such cases, management is transferred to other structures, and in fact, the powers of the authorities are carried out according to unwritten laws and rules. This situation applies to all sectors of the economy and better reflects the situation in the food market. The e-commerce system allows its participants to fully use the services of buying and selling food. In fact, the e-commerce system acts as a tool for building a civilized market. One of the important issues is that this mechanism is also used in other countries, and in these countries have realised the importance and promising possibilities of using e-commerce in the full sense of the word. For this reason, the use of this system for the formation of effective food trade relations between regions and states will lead to serious achievements in the development of the country's economy in the literal sense of the word [2]. The system of e-commerce in food products should also develop in our country.

As the reasons for the need for the development of e-commerce in the food market, the following should be particularly noted [4]:

- Partner search and transferring payments into systems enables potential economic growth to be achieved electronically;
- State regulation and self-regulation of the regional wholesale market creates conditions for the absolute circulation of goods and finance and the formation of balanced market prices;
- Reduce budget expenditure when procuring goods for state and municipal needs;
- Increase in budget revenues in absolute figures;
- Creates an opportunity for organizations and entrepreneurs, as well as state and municipal entities to enter e-commerce on equal terms.

The purchase of food products ordered by the state through e-commerce will ensure the expeditious movement of goods in the country generally, and the efficient use of central national and regional budgets. In addition to the above mentioned, this will make

it possible to widely use information and communication technologies in the process of interaction between state bodies and business entities [3].

For these purposes, the creation of e-commerce will automate these processes in all executive authorities, reduce the costs of government customers during tenders, and also prevent cases of losses and abuse [1]. A unified set of hardware and software tools used in e-commerce has been created for government customers. According to our calculations, after the implementation of this system, budget savings amounted to 15%. Saving money has become possible mainly due to lower transportation costs and more efficient organization of trade turnover. The establishment of regional information centers, irrespective of the forms and ownership, will enable state structures and enterprises to more effectively use of e-commerce potential and market opportunities for the sale of goods and services.

Product manufacturers and consumers will have constant access to trade and marketing information, and at the same time they will be able to take advantage of advanced and cutting-edge technology in their daily work. E-commerce with food products creates new opportunities for businesses and organizations to improve their operations by changing their operations, creating a closer interaction with customers when buying and selling all sorts of goods and services [6]. Internet technologies allow you to use the advantages of e-business, realizing the possibility of participating in the work of electronic trading platforms.

E-commerce with foodstuffs lead to the following consequences:

- creation of new revenue channels by increasing sales volume;
- transaction and invoice costs are reduced;
- service improvement and full customer satisfaction;
- full repayment of investment costs and increase in income.

The Internet makes it possible to conduct business operations where it was previously impossible. Work-

ing around the clock, companies gain access to national and regional markets with greater speed and scale.

Placing an order via a marketplace is a more convenient form of trading for business partners. By selecting the product range required for delivery, the customer receives confirmation of their order immediately and has the opportunity to track its movement. Working through the e-commerce platform, partners can place orders for product delivery and shipment at the touch of a button.

As a result, electronic documents, delivery schedules and sales-related documents are prepared in the salesroom [5]. Errors as well as communication and telecommunication costs are reduced when documents are executed using traditional methods. Errors, as well as communication and telecommunication costs, are reduced when documents are executed using traditional methods.

Each manager establishes his or her own business relationships based on personal working hours, strengthens the company's market position and gains new opportunities and product distribution channels.

In our opinion, the main purpose of establishing an electronic trading platform in the Republic of Azerbaijan should be as follows:

- create a more efficient system for marketing agricultural products;
- ensuring the safety of food products;
- adjustment of prices for food products across economic districts;
- development of effective inter-regional relations for the purchase and sale of food products.

In this regard, an “Azexport” portal has been established by the decree of the President of the Azerbaijan Republic. Through this portal, national food consumers have the opportunity to export their goods to more than 100 countries [7]. The e-marketplace will allow participants to connect to an inter-regional food supply chain, and will also lead to increased revenues for the budget as a result of full transparency of transactions and their control [1]. Some modules (semi-systems) can be implemented

within the framework of the e-commerce platform, they perform additional, important functions. The billing subsystem is used by the operator and ETP (Electronic trading platform) participants, making calculations in the trading system itself, and also with counterparties of wholesale markets in exchange for various paid ETP services.

The information and analytical module is used for local news delivery and includes information from analytical and business news agencies. News profile, the trading party on the trading platform can submit an application independently, the movement of goods is managed automatically or by the trading platform administrator.

The module of analytics, statistics, forecast is based on the operational analysis of various data about the participants of the trading platform. Based on the synthesis of information, the module provides analytical information. It is worth noting that analytical information refers to the most popular product groups, average prices, regions and participants' activity on the trading platform. The search module is used to quickly find relevant information within the e-commerce platform. The “forum” module allows participants to receive information on current industry issues, news and events related to the electronic trading platform online.

Finally, the administrative module is designed to implement the function of accessing the system, setting system parameters and managing the system by users and clients. The module attracts attention as a tool for online shop operators.

The role of the relevant competent authorities of the Republic of Azerbaijan in the preparation and use of the platform for the purpose of food trade is as follows:

- Organising the work of electronic trading platform operators;
- Enabling food wholesalers to conclude trade deals;
- Organise the relationship with the regional administration;

- Identify the nomenclature of food items sold by section;
- Preparation of criteria determining the quality of products sold;
- Official involvement of retail warehouses of the electronic trading platform in transactions;
- Assistance in organising the certification of trading warehouses of electronic trading platforms;
- Accreditation of certified warehouses to use the above payment mechanisms.

**Conclusion:** The implementation of the possibility of Internet technology participation in electronic trading platforms makes it possible to take full advantage of e-business. The Internet makes it possible to trade in places where it was previously impossible to conduct sales. Operating around the clock, companies gain access to national and regional markets at greater speed and scale.

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## IMPROVING CUSTOMS PRACTICE OF IDENTIFICATION OF GOODS IN DETECTION OF VIOLATIONS RELATED TO INTELLECTUAL PROPERTY RIGHTS

**Abstract.** The article analyzes the activities of the customs authorities of the Republic of Uzbekistan in recent years to protect the rights to intellectual property objects and provides facts of identifying cases related to illegal trafficking in counterfeit products. The author investigated the issue of identifying goods in detection of violations related to the right of intellectual property and proposed methodological as well as practical measures to improve customs practice in the context of the integration of the national economy into the world economy.

**Keywords:** customs authorities, intellectual property objects, protection of intellectual property rights, ex-officio, the Customs Register of intellectual property objects, identification of goods, automated risk management system.

### I. Introduction

The protection of intellectual property is becoming increasingly important around the world. Because in ensuring the safety of human health, the quality of the goods produced and the prevention of their counterfeiting is of great importance. Of course, the protection of the interests of entrepreneurs and the use of opportunities in accordance with the law, as well as the observance of the legitimate interests of authors and entities, related rights will serve to further liberalize the investment environment and material support for the activities of private business and small businesses.

The protection of rights to intellectual property objects by customs authorities is carried out on the basis of the requirements of chapter 56 of the Customs Code of the Republic of Uzbekistan [1] and Resolution of the President of the Republic of Uzbekistan “On additional measures for the further development of the sphere of intellectual property” [2].

Customs authorities, within their competence, take measures to protect the rights to intellectual property objects. To ensure the protection of the rights to intellectual property objects imported into the customs territory and under customs control, the customs authorities may suspend the release of goods containing signs of violation of the rights to intellectual property objects for a period of 10 days, as well as cancel the decision to suspend the release of goods containing intellectual property objects. The suspension of the release of goods containing signs of violation of the rights to intellectual property objects is carried out in order to appeal to the copyright holder or his authorized representative to the judicial authorities and provide the customs authorities with a court ruling on the appointment of the case to the trial. Intellectual property objects, in respect of which a decision has been made to apply measures to protect the rights to intellectual property objects, are entered by the customs authority into the Customs Register of intellectual property objects [1].

To date, goods with signs of violation of intellectual property rights are identified during customs control and registration, as well as using an automated risk management system.

## II. Literature Review

Based on the norms of international treaties in the field of intellectual property and the norms of the Agreement on Trade Aspects of Intellectual Property Rights (TRIPS), a draft regulatory document on the introduction of the “ex officio” procedure into customs legislation has been prepared regulating the legal protection of intellectual property within the framework of the WTO.

Thus, the term *ex-officio* means “by duty (of a court or other official), regardless of the request of the parties”. This means that customs officials, on their own initiative, take measures to protect intellectual property rights, in particular the suspension of customs clearance of goods, regardless of whether there is an application with a request from the copyright holder or not. Procedure *ex-officio* is provided for by the main international documents aimed at protecting the rights of intellectual property [3]. Thus, article 58 of TRIPS, which was the result of the desire of developed countries to tighten the struggle with piracy and counterfeiting, recognizes the legitimacy of the actions of the customs authorities to suspend the processing of goods on its own initiative, but only if they have *prima facie* evidence that the right of intellectual property is violated [4].

## III. Analysis and Results

Between May 2016, a total of 472 trademarks were entered into the Customs Register of intellectual property objects [5]. Active activities of customs authorities in the field of protection of rights to intellectual property objects prove the following facts of identification of cases related to illegal trafficking of counterfeit goods:

During 2022, customs authorities identified 1685 cases related to the import of counterfeit products unsuitable for use, in the amount of 40.8 billion sums

(of which 20.6 billion sums of detected cases are associated with the turnover of medicines and medical products, 1.0 billion sums — food products, 4.8 billion sums — tobacco products, 0.7 billion sums of alcoholic products and 13.7 billion sums of other types of products), at the same time, the products were destroyed in accordance with the law, and part of them was re-exported [6].

Large-scale operational measures were taken to identify and preventing the sale of goods “secret shops” intended for the manufacture of counterfeit products manually using trademarks (brands). Counterfeit detergents, cleaning products, perfume products, as well as raw materials and equipment used in their manufacture in the amount of 1.3 billion sums of 20 items were seized and destroyed.

During the customs inspection of the vehicle, the total amount of goods not reflected in the shipping documents amounted to 48.8 million soums, namely, 10,635 units of goods of 8 types of names were found “SR”, 5505 units of goods of the name “AS”, 9719 units of the name “Tide stis Innovatsion in 1996”, 9924 units of goods of the name “Stepano Ricci”, 5245 units of goods of the name “Prada Milano dal 1913 MA”, 5000 units of goods of the name “Prada”, 15981 units of goods of the name “Armani” and 15129 units of other goods similar to the trademarks of foreign enterprises.

These goods received as the subject of the offense were destroyed in an appropriate manner, which was obtained as counterfeit goods. Also, in 2022, customs authorities carried out 19 propaganda measures to comply with intellectual property rights among participants in foreign economic activity. In addition, every year customs authorities also take part in round tables, conferences led by the World Intellectual Property Organization (WIPO), trainings, international events in order to improve the knowledge and skills of customs officials in the field of intellectual property rights protection.

Uzbekistan has now joined 14 WIPO Treaties. For example, in February 2019, country joined two

WIPO Treaties — on copyright and on performances and phonograms. Uzbekistan has six laws (Laws of the Republic of Uzbekistan “On inventions, utility models and industrial designs”, “On the legal protection of computer programs and databases”, “On selection achievements”, “On trademarks, service marks and names of places of origin of goods”, “On the legal protection of integrated circuit topologies”, “On copyright and related rights”) governing intellectual property relations.

Based on WIPO standards, the country is consistently implementing comprehensive measures to improve the mechanisms for introducing innovations in the economic sector, ensuring its competitiveness, creating conditions for the development of active entrepreneurship and innovation, and ensuring reliable legal protection of intellectual property.

A study in the field of identification of goods in detection of violations related to intellectual property rights made it possible to draw attention to the fact that areas of increased risk for customs control should be identified, consisting of such types of risk as loss of tax revenues for the country, security threats, safety violations, indirect contributions to organized crime, drug transportation, environmental pollution and other emerging risks.

The economic side of this issue requires attention to the following risks: loss of investment in the local economy; serious threat to health and safety; social and ethical costs. Moreover, violations related to intellectual property rights are in close contact with other crimes, such as human trafficking; drug trafficking; “money laundering”; corruption; terrorism and others. The identification of goods in detection of violations related to intellectual property rights provides for a risk assessment based on the inspection of the goods. Since, it is certain risk identifiers that allow you to determine the characteristics of a particular article.

In the field of identification of goods in detection of violations related to intellectual property rights

in recent years, the following general trends are observed in international customs practice:

- transportation in personal luggage;
- logos of brands, trademarks are sent separately from the product;
- sending small batches;
- unauthorized border crossing.

Thus, in our opinion, we should pay attention and examine the following indicators when identifying goods in order to identify counterfeit goods:

- price;
- trading channel;
- printout (printing methods used, printing errors, content)
- font used;
- images;
- spelling errors;
- packing (printing instead of embossing; color differences; absence of “gloss”, etc.)

#### **IV. Conclusion and Discussions**

The above results of the study and analysis of the activities of customs authorities in the field of identification of goods in detection of violations related to intellectual property rights made it possible to develop a number of methodological and practical proposals for improving customs practice in the context of the integration of the national economy into the world economy, the intensification of foreign economic activity and the development of international trade:

1. Cooperation of the customs authorities with the copyright holders of intellectual property rights.
2. Studying the range of prices for a specific assortment line of branded goods according to catalogs announced by the owning manufacturers in the media.
3. Organization of trainings in order to increase the skills of customs officials in the field of intellectual property rights protection.
4. Update existing risk profiles of the automated risk management system during customs control and registration of goods.

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## IMPORTANCE OF FOREIGN TRADE IN THE COMPETITIVENESS OF THE REGIONAL ECONOMY

**Abstract.** This article discusses the competitive advantages of objects in the competitiveness of the regional economy. Their existing classifications are analyzed in order to develop the main directions for searching for the sources of their formation. Methods for determining the competitive advantages of regional producers, classification of foreign trade theories are presented. Methods for realizing the competitive advantages of objects according to classification features and classification schemes are proposed.

**Keywords:** competitiveness, resources, foreign trade, sustainable development, national economy.

The results of the analysis of their existing classifications are of great importance for further studying the nature of the competitive advantages of objects and developing the main directions for searching for the sources of their formation. It is possible to classify the competitive advantages of objects according to different criteria, and domestic researchers have proposed several classification schemes.

The classification of the competitive advantages of the socio-economic system is divided into two groups: main and auxiliary. The advantages of the first group include natural resources, labor resources and their qualifications, scientific and managerial personnel, production base, and the second group includes the business environment, the quality of the management apparatus, labor force and infrastructure. In our opinion, it is important to divide the competitive advantages of objects into main and auxiliary groups, since this objectively reflects their true functional nature.

When determining the competitive advantages of regional producers, it is divided into five: resource, technological, innovative, global and cultural. At the same time, under the competitive advantage, the manufacturer understands active, the involvement of which and the economic turnover allows you to

create a consumer influence and generate income. The competitive advantages of producers owning resources include not only the availability of natural resources, their availability and favorable conditions for access to them, the convenient location of transport and communication routes, infrastructure, but also the advantages that affect the impact of products on consumers. due to tax characteristics and price characteristics.

The technological competitive advantages of manufacturers are related to the availability and use of resource-saving technologies by firms, mass production, economies of scale, and increased consumption efficiency related to the price characteristics of products purchased by consumers. Innovative competitive advantages of manufacturers are formed due to the implementation of research and development results in production, which allows for rapid updating of the nomenclature and assortment of products, thereby increasing the consumer impact related to its quality indicators. The global advantages of producers are related to the formation of external economic (environmental, social standards) economic activity and their implementation in firms and state policies. The cultural competitive advantages of manufacturers are related to the cultural similarities (differences)

of countries, which allow firms to maintain trade and resource markets in countries with similar cultures.

All the diversity of the historical experience of the development of different countries of the world shows that economic stability for any country, no matter how stable it is, is impossible without its active inclusion in the system of world economic relations. The current level of the international division of labor hardly shows any country on the world map whose economic life is separated from the world economic processes and closed within narrow national borders.

The Republic of Uzbekistan is located in the center of the Eurasian continent, between Amudarya and Syrdarya. It borders Kazakhstan, Turkmenistan, Tajikistan, Kyrgyzstan, and Afghanistan, and its area is 447.4 thousand square kilometers. Uzbekistan includes the Republic of Karakalpakstan and 12 regions: Andijan, Bukhara, Jizzakh, Kashkadarya, Navoi, Namangan, Samarkand, Surkhandarya, Syrdarya, Tashkent, Fergana, Khorezm.

The constant increase in the role of foreign economic relations in the economic development of national states, especially in recent decades, has led to the fact that foreign trade is traditionally considered as a relatively independent sector of the national economy, the main task of which is the purchase of material resources and goods.

One of the important stages of ensuring the true sovereignty of the republic legally is the constitutional consolidation of Uzbekistan as an independent subject of international relations, the right to join international organizations, collective security systems and international structures that define foreign policy in terms of its interests.

To date, 165 countries have recognized Uzbekistan. Official diplomatic relations have been established with more than 120 countries of the world. Uzbekistan is a full member of the most prestigious international organizations, cooperates with major banking and financial institutions, state, and non-state organizations. 88 accredited foreign representative offices, 24 intergovernmental organizations and

13 non-governmental organizations operate in the republic. Our country has joined many important international conventions.

Establishing and developing diplomatic, political, trade-economic, cultural, humanitarian relations of the Republic of Uzbekistan with foreign countries is carried out in two main directions:

- bilateral and multilateral relations at interstate, inter-governmental, inter-parliamentary and non-governmental levels.
- relations in the system of international organizations and structures, in particular, in the UN, CIS, EU, MDX, ICT and others.

During the years of independence, the Republic of Uzbekistan became a full-fledged member of the world community and an active participant in international relations recognized by foreign countries.

As a full-fledged subject of international law, Uzbekistan is a member of major international organizations. On March 2, 1992, the republic became a member of the United Nations (UN), was admitted to specialized UN agencies such as the International Labor Organization (ILO), the World Health Organization (WHO). He became an active member of the United Nations Educational, Scientific and Cultural Organization (UNESCO), the Organization for Security and Cooperation in Europe (OSCE) and other international organizations.

Natural and geographical conditions, differences in the scope of production of the national economy, achieved levels and existing possibilities of the division of labor within the country have a significant impact on the volume and structure of the republic's foreign trade, and the level of its participation in the international division of labor. The relative narrowness of domestic markets, the limited possibilities of internal division of labor, the weak diversity of natural resources, which narrows the possibilities of development of various industrial sectors, serves as an important incentive for individual national economies to participate more actively in international trade, the specialization of production directed to foreign pro-

duction increases its importance. An example of this is the economy of several countries with a small area and population, such as the Netherlands, Belgium, and Ireland, where the level of export quotas is in the range of 50–70%. Countries with virtually no domestic natural resources and a few small market economies with global economic ties, including re-export operations, are characterized by export and import quota levels that exceed 100% of GDP (Hong Kong, Singapore). At the same time, countries with a relatively large territory and population have the ability to create a large internal market and a more complex structure of the national economy, and they are less dependent on internal markets for their economic growth. However, it should be noted that the role of foreign trade in economic development in these states has increased significantly in recent decades.

It should be noted that the importance of foreign trade as an indirect factor of economic growth depends on the general strategy of this growth. For example, in the conditions of extensive growth achieved by constant production efficiency and characterized by economic isolation tendencies, the role of external factors is usually relatively small, because in this case economic growth is mainly provided at the expense of internal resources, surplus products are sold through external economic relations, and for one or another reason Necessary goods that are not produced in one country are bought. In such cases, the development

of the country's foreign economic relations is mainly based on import needs, and export serves as a means of obtaining foreign exchange resources necessary for import. The extensive path of economic growth, in contrast to the intensive type, is based on the increase in the volume of production through changes in the quality of the factors of production (increasing the level of labor and facilities, the level of the workforce, the improvement of the organizational parameters of production, etc.), which implies an increase in the volume of production and mainly achieved by increasing social productivity. In such conditions, foreign trade, and foreign economic relations in general will have a new, incomparably greater importance for the entire process of national reproduction.

Historically, foreign trade was the first and most important form of international economic relations, and mainly determined the structure of economic relations between individual countries. With the growth of the world market into the world economy, such forms of international economic exchange as capital export, labor migration, technology transfer, etc. began to play an increasingly important role. These other forms of international economic relations, which initially developed in many ways to serve foreign trade, gradually began to strengthen their influence on the direction and essence of foreign trade between individual countries and the scale of the world economy as a whole.

Table 2. – Classification of foreign trade theories

No.	Theory	Reasons for international trade
1.	Mercantilism	Favorable trade conditions created by the state
2.	Theory of absolute and comparative advantage (A. Smith, D. Ricardo)	Resources and geographic preferences
3.	Theory of surplus factors of production (Heckscher, Olin)	Production and creation of the resource base of the country
4.	Leontief paradox	Quality of production factors
5.	Life cycle stage theory (R. Vernon, P. Krugman)	The stage of the product life cycle in the markets of different countries
6.	International competition theory (Porter)	Efficiency of use of production factors

The first theoretical system that tried to understand the importance of foreign trade for the state economy was the doctrine of mercantilism, which appeared at the first stage of the development of capitalist production. At that time, the leading role in the economy was occupied by trade capital, therefore, foreign trade (specifically export) was regarded as practically the only source of the country's wealth. Mercantilists saw strict import regulations as a means of creating new jobs and increasing national income. The mercantilist approach, in fact, assumed that the gains from foreign trade, understood as an increase in exports and restrictions on imports, could only be carried unilaterally at the expense of other countries.

Only during the period of the industrial revolution, when the machine-building era began, which required a comprehensive expansion of access to raw material sources and sales markets for its effective operation, new theoretical bases regarding the role of international trade in economic development appeared, and foreign trade without restrictions was considered beneficial for all countries participating in it. A. Smith and Ricardo in their scientific work provided the theoretical foundations of international trade preferences.

In the theory of absolute superiority A. Smith, since each nation has absolute advantages in the production of certain goods compared to its trading partners, and to this extent the volume of products

sold for export is equal to what should be bought abroad, foreign trade is free, that is, based on the principles of the free market. At the same time, the question arises as to how countries that do not have absolute advantages over others will behave in the world market.

A. Smith's theoretical approaches are another classic of English political economy. It was further developed in the works of Ricardo, who put forward the theory of "comparative advantages". Ricardo justified the profitability of foreign trade for any country, even for any country that does not have absolute advantages over other countries or, on the contrary, has advantages in all goods. According to Ricardo's theory, each country has a comparative advantage in the production of certain types of products, rather than being able to produce only different goods.

Due to the existence of international trade, each individual country can specialize in areas in which it has a comparative advantage, and therefore export products whose production costs are relatively lower than those of other countries, while importing the products of these countries. Industries where production costs are relatively higher than other states. Thus, the main factor determining the structure and scope of trade between individual countries is the difference in production costs, that is, according to the labor cost theory, wage costs.

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## Section 6. Legal studies

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### THE SITUATION OF FIRE, EXPLOSION, INCIDENTS, ACCIDENT IN VIETNAM AND ISSUES POSED IN THE ASSIGNMENT OF MANAGEMENT RESPONSIBILITIES ON FIRE AND RESCUE

**Abstract.** In recent times, the situation of fires, explosions, incidents, accidents in Vietnam has become complicated, and the damage caused by fire is increasing day by day. The article focuses on researching, analyzing and clarifying the situation of fire, explosion, incidents, accidents in Vietnam and the problems posed in the assignment and decentralization of management responsibilities for fire and rescue.

**Keywords:** Vietnam; fire and rescue; situation of fire, explosion, incidents, accident.

#### 1. Research results on fire, explosion, incidents, accidents in Vietnam

##### 1.1. Fire and explosion situation

From 2001 to 2022, there were 59.878 fires and explosions nationwide (of which 49.724 fires occurred in factories, factories, warehouses, agencies, schools, hospitals, people's houses...; 344 explosions and 9.810 forest fires), killing 1.910 people, injuring 4.434 people; on assets estimated at 26.152 billion VND and 61.138 hectares of forest with economic value. Through the statistics of fire and explosion data, it shows that the socio-economic development of the country and the complicated situation of climate change lead to the frequency of fires, explosions, incidents and accidents. In particular, comparing the period 2012–2022 with the period before 2001–2011, the number of fire and explosion cases increased by 13.5% (31.828 cases in the period 2013–2022/28.050 cases in the period 2001–2011), damage human damage increased by 39.4% (1.112 people in the period 2013–2022/798 people in the period 2001–2011), property damage increased by

382.4% (21.661.3 billion VND in the period 2013–2022/4.490), 6 billion in the period 2001–2011.

In the past 10 years (2013–2022), there were 29.596 fires nationwide (including 26.699 fires in houses, facilities, vehicles and 2.897 forest fires). The damage caused by the fire killed 860 people, injured 1.662 people, preliminary property damage was estimated at 13.349 billion VND and 13.439 hectares of forest. 297 explosions occurred, killing 168 people, injuring 435 people, preliminary damage to property was estimated at 6.891 billion VND.

On the basis of the fire and explosion situation, the following aspects can be analyzed:

- Regarding the cause of the fire: due to system and electrical equipment failure 13.465 cases (accounting for 45.5%); due to careless use of fire and heat sources 7.717 cases (accounting for 26.1%); due to violations of regulations on fire prevention and fighting safety 513 cases (accounting for 1.7%); due to technical problems 784 cases (accounting for 2.6%); due to the impact of natural phenomena 95 cases (accounting for 0.3%); 50 cases of

spontaneous combustion (accounting for 0.2%); traffic accidents 981 cases (accounting for 3.3%) and other causes 3,190 cases (accounting for 10.8%). Currently investigating 1,853 cases (accounting for 6.3%).

– In the area where fires occurred: 15,798 cases occurred in urban areas (accounting for 53.4%); 10,901 cases occurred in rural areas (accounting for 36.8%).

– Regarding the type of fire occurrence: 10,151 fires in residential houses (accounting for 34.3%); 8,580 fires in warehouses, production and business establishments (accounting for 29.0%); 2,897 forest fires (accounting for 9.8%); 2,397 traffic vehicle fires (8.0%); 1,127 house fires combined with business (accounting for 3.8%); 136 apartment fires (accounting for 0.5%); 195 fires in markets, supermarkets and trade centers (accounting for 0.7%); 210 workplace fires (accounting for 0.7%); 67 bar and karaoke fires (accounting for 0.2%); 73 fires in educational institutions (accounting for 0.2%); 104 fires at power plants and substations (accounting for 0.4%); 40 medical facility fires (accounting for 0.1%); 05 fires at ports, railway stations and bus stations (accounting for 0.02%); and 3,632 fires of other types of establishments (accounting for 12.3%).

In addition, there have been thousands of small fire-related incidents (not subject to statistics, causing insignificant damage or shutting down without needing to be repaired, short-circuiting of electrical equipment on electric poles, in houses). people and burning grass, garbage...).

From the above research results, through analysis and research, it is shown that about the situation of large fires, fires causing serious damage: 352 fires occurred causing great damage to property (accounting for 1.2%), estimated at 8,399.2 billion VND (accounting for 87.8% of the total damage caused by fires); concentrated mainly in localities with rapid economic development and urbanization, with many industrial parks, export processing zones, markets and trade centers.

Nationwide, there were 439 fires causing serious damage to people (accounting for 1.5%), killing 860 people and injuring 1,662 people. Concentration mainly occurs in residential areas, especially the type of individual houses, houses combined with production and business, establishments with large concentration of people (karaoke bars, bars, discos ...).

Some typical fires are:

The fire of Phu Tai Bioenergy Joint Stock Company in Binh Dinh on August 12, 2019; the fire of Phu Lam Import-Export Co., Ltd., Hai Phong on May 15, 2019; Tuyen Quang General Construction Joint Stock Company fire on December 28, 2017; the fire of Green Farm Company Limited in Binh Dinh on October 23, 2018; the fire of Texhong Ngan Long Science and Technology Co., Ltd., Quang Ninh on April 4, 2018 and the fire of Soc Son Market, Hanoi on June 21, 2018; the fire of Rong Hoa Thai Co., Ltd on January 6, 2018, the fire of Kangna Textile Industry Co., Ltd on April 29, 2018 in Tien Giang...; The fire of the ISIS Karaoke bar on August 1, 2022, at Quan Hoa Street, Cau Giay, Hanoi caused 03 Fire and Rescue Police officers to die while on duty; An Phu karaoke bar fire on September 6, 2022, in Thuan An city, Binh Duong province killed 32 people; house fire on April 21, 2022 in Kim Lien ward (Dong Da, Hanoi) causing 5 deaths; The Carina Plaza Apartment fire in Ho Chi Minh City killed 13 people and injured 51 people; the fire on December 21, 2018 at Ruby Restaurant in Dong Nai province killed 07 people; the fire on December 7, 2019 at Ba Lau restaurant in Vinh Phuc province, killing 04 people; ...

### ***1.2. Situation of incidents and accidents***

From 2013 to 2022, the Fire Protection and Rescue Police force directly participated in organizing 20,857 fire incidents; organization saved 6,468 people, found 3,129 victims' bodies (due to traffic accidents, drowning, suicide, etc.) were handed over to the authorities for handling. In addition, through monitoring the situation, there are hundreds of other small incidents and accidents organized by the people and forces on the spot, but there is no report

to the Fire Protection and Rescue Police agency for organizing. statistical office.

On average, each year, the fire prevention and fighting police force and the Central High Commission have directly participated in organizing 2.086 fire incidents; The organization saved 617 people, found 313 bodies and handed them over to the authorities for handling. Incidents and accidents organized by the Fire Protection and Rescue Police force, of which: 13.613 incidents and accidents in the fire (accounting for 65.3%); 3.260 drowning accidents in rivers, streams, waterfalls, lakes, ponds, wells, deep pits with water, beaches (accounting for 15.6%); 1.042 incidents of road, railway and inland waterway traffic accidents (accounting for 5.0%); 383 incidents, accidents with people trapped in the house; construction; overhead (accounting for 1.8%); 319 cases in caves, tunnels, wells; underground works (accounting for 1.5%); 361 incidents, accidents, collapse, collapse of buildings, constructions, equipment, machinery, trees, landslides, rocks, in tourist areas, amusement parks (accounting for 1.7%); 1.879 other incidents and accidents (accounting for 16.4%).

## **2. Results of research and analysis of state management of fire and rescue**

### ***2.1. Summary of some of the results achieved***

In order to improve the effectiveness of State management over fire prevention and fighting, the Government, Prime Minister, ministries and branches have focused on developing legal documents guiding the implementation of the Law on Fire Prevention and Control. Up to now, the issues stipulated in the Law on Fire Prevention and Control have been basically guided by documents under the Law, the timely formulation and issuance of guiding documents for the implementation of the Law on Fire Prevention and Fighting has created a uniformity. consensus in organizing the implementation of the Law on Fire Protection. The promulgated legal documents have contributed to improving the effectiveness of the State's management of fire prevention

and fighting, creating a legal corridor for each aspect of professional fire prevention and fighting work. In the locality, chairpersons of provincial and district People's Committees have issued many documents directing the strengthening of fire prevention and fighting work. This result is really a direct factor that has a positive impact on the effectiveness and efficiency of the Law in recent years.

Over the past 20 years, the Government has issued 12 Decrees on fire prevention and fighting work; The Prime Minister has issued 05 Decisions and 04 Directives on fire prevention and fighting work; Ministries have coordinated to develop and promulgate 44 circulars and joint circulars on fire prevention and fighting. In fact, the effectiveness of state management of fire prevention and fighting has been significantly improved; Leaders at all levels and branches have paid more attention to fire prevention and fighting, contributing to ensuring political security and social order and safety.

Implementing the policy of the Government, the ministries, branches and localities have directed the departments, agencies and sectors to carry out the reform of administrative procedures in the fields, in which the Ministry of Public Security has directed the implementation of implemented and 100% of police units and localities have implemented to handle administrative procedures in the field of fire prevention and fighting, level 3 and level 4 on the Public Service Portal of the Ministry of Public Security, including: Certificate of practice in consulting on fire prevention and fighting; Appraisal of designs on fire prevention and fighting; Acceptance of fire prevention and fighting; issue a certificate of eligibility for fire prevention and fighting service business; issue certificates of professional training in fire prevention and fighting; issue a certificate of training in rescue operations; issue the certificate of inspection of fire prevention and fighting equipment...). At the same time, it has simplified administrative procedures and shortened the time limit for granting the above licenses.

## **2.2. Inadequacies in the assignment of responsibilities in the management of fire and rescue**

In general state management, the assignment of management responsibilities is particularly important, based on consistent and consistent principles; promote the autonomy and self-responsibility of ministries, branches and local authorities at all levels and ensure no overlap; in accordance with the characteristics and practical capabilities; ensure a close combination of management by sector, field with management by administrative unit; be suitable to the conditions, management level and ability to receive assignments and decentralization of ministries, branches and localities, ensuring the principle of efficiency; enhance publicity, transparency and responsibility for inspection and examination.

However, in practice, the assignment and decentralization of state management of fire prevention and fighting has not been uniform and highly synchronous. The assignment has been legislated (Article 58) but still lacks mechanisms and policies to implement synchronously and ensure effective implementation:

The responsibilities of ministries, ministerial-level agencies and government-attached agencies have not yet been specified and fully defined in coordinating with the Ministry of Public Security to perform unified state management of fire and rescue.

There are no specific regulations on the responsibilities of the People's Committees at all levels in performing the state management of fire prevention and fighting in the locality.

According to Article 58 of the Law, the assignment of responsibilities in the state management of fire prevention and fighting is prescribed as follows:

The Government performs the unified state management of fire prevention and fighting.

The Ministry of Public Security is responsible before the Government for performing the state management of fire prevention and fighting.

Ministries, ministerial-level agencies and Governmental agencies shall, within the ambit of their

tasks and powers, coordinate with the Ministry of Public Security in organizing the implementation of regulations on fire prevention and fighting.

The Government shall prescribe the coordination between the Ministry of Public Security and the Ministry of National Defense in organizing the implementation of fire prevention and fighting for defense establishments, and between the Ministry of Public Security and the Ministry of Agriculture and Rural Development in organizing the implementation of fire prevention and fighting activities. forest fire prevention and fighting.

People's Committees at all levels shall, within the ambit of their tasks and powers, perform the state management of fire prevention and fighting in their localities.

In addition, in a number of other provisions, the Law also directly stipulates the responsibilities of: Vietnam Fatherland Front (Article 7), Information and propaganda agencies (Article 6), State management agencies on education (Article 6) and related organizations and individuals.

After the Law on Organization of Local Government in 2015, amended and supplemented in 2019 and the Law on Government Organization in 2015, amended and supplemented in 2019 were promulgated, the assignment and decentralization of state management said In general, the state management of fire prevention and fighting and social reform in particular are governed by these two laws. Practice also shows that effective water management in terms of assignment and decentralization is associated with decentralization, while the decentralization of powers to local authorities must be specified in the law. Therefore, some content on decentralization of management on fire prevention and fighting and social engineering is difficult to implement in practice.

The lack of specific regulations on management assignment and decentralization has led to the phenomenon that, in some cases, it is difficult to identify and assign specific responsibilities to each organization and individual in the state management of state



management. Fire prevention and fighting and social reform, leading to the situation that the work of fire prevention and fighting has not yet strongly affirmed its position, role and value in social life.

### **3. Discuss the goal of solving and propose to solve the problem of assignment of responsibilities**

#### **3.1. Problem solving goals**

On the basis of practical requirements and relevant legal regulations, to complete the provisions of the Law on Fire and Rescue to unify the assignment and decentralization of state management of fire prevention and fighting in the direction of synchronous, specific and clear responsibilities. responsibilities, have enforcement mechanisms:

Implement assignment and decentralization to ensure the principles of assignment and decentralization on the basis of relevant laws. In particular, there are specific provisions on the content of decentralization of powers to local authorities at all levels.

Clearly prescribe mechanisms and principles for coordination between ministries, ministerial-level agencies, government-attached agencies and the Ministry of Public Security in the state management of fire and rescue.

#### **3.2. Suggested solutions to solve the problem**

*Solution 1:* Maintain the regulations on assignment and decentralization in the Law on Fire Prevention and Fighting.

*Solution 2:* Amending, supplementing and perfecting regulations on assignment and decentralization on the basis of practice and relevant legal regulations to complete the provisions of the Law on Fire Prevention and Fighting and Social Sciences to unify the assignment and decentralization of management. State management of fire prevention and fighting in the direction of synchronous, specific, clear responsibilities, ensuring effective enforcement mechanism:

Further concretize the content of assignment, decentralization and regulations on examination, inspection and control of the implementation in the guiding Laws and Decrees.

Clarify responsibilities for state management of fire prevention and fighting and social reform in Chapter VII State management of fire prevention and fighting and social reform: Government; Police; Ministries, ministerial-level agencies, agencies attached to the Government; People's Committees of provinces and centrally run cities.

Specific and clearer regulations on the content, state management responsibilities, tasks and powers of the government People's Committees of provinces/cities, districts and communes on fire prevention and fighting and social engineering within the administrative area main; is responsible for promulgating regulations on fire prevention and fighting, as well as regulations on assignment and decentralization of fire prevention and fighting management, ensuring the principles of consistency, democracy, transparency, creating favorable conditions for agencies, organizations, individuals working in the field of fire prevention and fighting.

Further concretize the content of regulations on inspection, inspection and control of the implementation of the provisions of the Law on Fire Prevention and Control and the guiding documents.

#### **3.3. Assess the impact of solutions on those directly affected by the policy and other related subjects**

*Solution 1:* Maintain the regulations on assignment and decentralization in the Law on Fire Prevention and Fighting.

Positive impact:

Economic impact: there is no cost for the development of legal documents for the State.

Social impact: no new impact on society.

Impact on the legal system: no new provisions of the law arise.

Impact on administrative procedures: no administrative procedures arise.

Gender impact: no gender impact.

Negative effects:

Economic impact: if the regulations on assignment and decentralization are maintained, in some cases, it is difficult to clearly and specifically define

the responsibilities and powers of organizations and individuals, the Human Resources Committee and the People's Committee. people at all levels... in the state management of fire prevention and fighting and social reform. Therefore, the efficiency and effectiveness of state management is not effective, it is easy to make mistakes or push responsibility, while fire prevention and fighting work is determined to ensure the safety of fire prevention and fighting, contributing to part to ensure political security and social order and safety to serve the cause of sustainable economic and social development. Doing the wrong thing or pushing the responsibility also means not creating more favorable conditions for the fire prevention and fighting and high-tech sectors, thereby reducing the attractiveness of the investment environment of foreign investors in Vietnam.

**Social impact:** not creating more favorable conditions in the field of fire prevention and fighting and social engineering. It is difficult to encourage and attract social forces to participate in the field of fire prevention and fighting.

**Impacts on the legal system:** the legal system on fire prevention and fighting is not guaranteed to be complete and feasible due to many issues that have not yet been adjusted or adjusted, but are no longer suitable with regulations. current practice.

**Impact on administrative procedures:** although option 1 does not give rise to administrative procedures, in reality there will be no legal basis to implement the assignment and decentralization in a unified direction, making it difficult to assign specific responsibilities. possible for organizations and individuals in the state management of fire prevention and fighting.

**Gender impact:** no gender impact.

**Solution 2:** Amending, supplementing and perfecting regulations on assignment and decentralization on the basis of practice and relevant legal regulations to perfect the provisions of the Law on Fire Prevention and Fighting and Social Sciences to unify the assignment and decentralization of management.

State management of fire prevention and fighting and social reform in the direction of synchronization, specificity, clear responsibilities, ensuring an effective enforcement mechanism.

**Positive impact:**

**Economic impact:** the completion of regulations on assignment and decentralization in the state management of fire prevention and fighting will create a legal basis to promote activities in the field of fire prevention and fighting and hi-tech in association with economic development – local society. Ensuring fire safety and good socialization will ensure political security and social order and safety, effectively serving the cause of socio-economic development; increasing the attractiveness of the investment environment of foreign investors in Vietnam.

**Social impact:** the completion of regulations on assignment and decentralization of fire prevention and fighting management and fire prevention and control will create more favorable conditions for state management of fire prevention and fighting, and encourage, attract and mobilize mobilize social forces to participate in the field of fire prevention and fighting.

**Impact on the legal system:** the legal system on fire prevention and fighting is completed, ensuring the consistency, synchronism, completeness and feasibility; overcome limitations and inadequacies in current legal regulations and solve inadequacies in law enforcement practice.

**Impact on administrative procedures:** (1) overcome the inadequacies in current administrative procedures; (2) for administrative procedures will clearly assign state management agencies in the fields in charge: the full regulation of administrative procedures will create clarity and transparency in the order, implementation methods, dossiers and requirements, and conditions for dealing with specific jobs related to individuals and organizations. On the other hand, due to the goal of administrative reform, the regulations on administrative procedures will be stipulated in the direction of simplification for organizations and individuals to implement.

Gender impact: no gender impact.

Negative impact

Economic impact: none.

Social impact: none.

Impact on the legal system: none

Impact on administrative procedures: this solution does not generate administrative procedures.

Gender impact: no gender impact.

### **3.4. Proposing alternative solutions**

Comparing the above two solutions, solution 2 is the one that brings the greatest positive impacts, obtains the best economic benefits and social impacts, and has the most positive impact on the legal system. and bring positive impact on administrative procedures. Therefore, it is proposed to choose solution 2

for the development of the Law on Fire Prevention and Control and the Social Security Administration. The promulgating authority is the National Assembly.

### **4. Conclusion**

**4.1.** The article has assessed and analyzed the situation of fires, explosions, incidents and accidents from 2001 (since the Law on Fire Prevention and Fighting was enacted) up to now, thereby showing that the above situation is complicated, posing many issues that need to be studied. research, including issues of assignment and decentralization.

**4.2.** The article has explained the management results as well as the inadequacies in the assignment of management responsibilities, from which to analyze and propose solutions in the coming time.

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## Section 7. Chemistry

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### ANTICORROSIVE COATINGS BASED ON COOLIGOMERS MODIFIED BY AN AMIDE GROUP

**Abstract.** Modern oligomer technology is focused on developing a new generation of oligomer materials with specific functional properties, showing promising applications in various cutting-edge fields. A key aspect in achieving this objective is the advancement of film-forming material production techniques that enable the creation of films and coatings possessing exceptional mechanical, electrical insulation, adhesion, and thermal characteristics. This approach to polymer material development opens up new prospects for the creation of advanced technical solutions. Films and coatings made from these materials can find applications in diverse fields such as electronics, aviation, medicine, the automotive industry, and others, where high functionality and reliability are prerequisites.

**Keywords:** Corrosion resistance, surface treatments, chemical modification, coating formulations, polycondensation, epoxy-phenolic oligomers, polyimide copolymer.

Modification of oligomers with the aim of obtaining materials with improved not only physico-chemical but also physicochemical properties is possible through the introduction of various functional groups. These groups include methylol, carboxylic, hydroxyl, amine, amide, epoxy, and others. The presence of functional groups in oligomers enhances their elasticity, resistance to aqueous environments, and frost resistance, and contributes to achieving improved dielectric properties.

The most well-known methods for obtaining oligomers involve the introduction of -OH, -COOH, -NH<sub>2</sub> groups through polycondensation or copolycondensation with various organic monomers, as discussed in the referenced works [1–3].

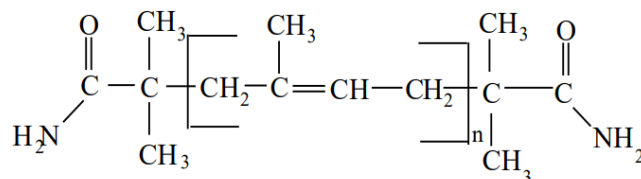
Modifying the nature of the terminal functional groups in oligomers leads to variations in their physi-

cochemical properties, thereby enabling a wider range of composite materials to be obtained for use in various industrial sectors. Good adhesion, enhanced dielectric characteristics, high moisture resistance, and resistance to chemically aggressive environments can be achieved with nitrogen-containing oligomers as the base [4–7].

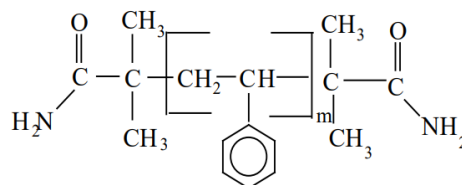
In recent years, the synthesis of oligomers using amide groups has made it promising due to the formation of additional physical bonds due to the presence of the polarity of the amide groups themselves. Using monomers such as isoprene and styrene synthesis of oligomers and co-oligomers with amide groups at the end, it is possible to increase the yield of the main product up to 60%, depending on the initiator, the nature of the monomer and, importantly, on the ratio of the initiator.

In the study, 2,2'-azobis-isobutyramide is used as the initiator in a methanol solution at a temperature of 100 °C, with a minimum contact time of 10 hours.

The study demonstrates the synthesis of oligoisoprene and oligostyrene, as well as their copolymers with varying contents of amide groups.



A



B

Where n- 50–60, m- 90–100

The mentioned characteristics of the synthesized oligomers with amide groups indicate that the molecular weight depends on the ratio of monomer and initiator concentrations. The obtained oligomers are predominantly bifunctional. In terms of physical properties, the synthesized oligomers are viscous liquids, soluble in benzene, toluene, acetone, and cyclohexane, but insoluble in water.

The structural features of the starting reagents and the final products are studied using infrared spectroscopy. The specific heat resistance and curing temperature of the obtained samples are determined in the presence of dry nitrogen within the range of 100 to 250 °C. The physicochemical properties are investigated using the differential thermal analysis (DTA) method within the range of 100–600 °C.

The use of bisamidocarboxylic acid as a modifier for the epoxy oligomer is attributed to the presence of functional carboxylic and amide groups in the polyamide acid molecule. Experimental results have shown that solutions of polyamide acid containing 4,4'-diaminodiphenyl oxide and pyromellitic dianhydride readily mix with solutions of epoxy oligomers in dimethylformamide. These mixtures do not separate upon prolonged storage and exhibit

minimal viscosity changes over time (within 2–24 hours). Moreover, it was found that films can be successfully formed from these mixtures. The synthesized composite materials exhibit high adhesive strength to various substrates. Interestingly, the film-forming ability of the compositions is maintained even with the addition of the modifier at concentrations up to 5%.

The curing process of epoxy resin-based coatings involves a polycondensation reaction [9]. The degree of conversion into a three-dimensional oligomer is directly related to the curing time and temperature. The curing conditions are of particular importance for coating materials that transform into an oligomer directly on the surface of the substrate. The more complete the conversion, the higher the adhesion and protective properties of the resulting coating film. Studies have been conducted to determine the optimal curing conditions for the developed compositions to achieve the best properties of the coatings widely used in shipbuilding and mechanical engineering. According to the obtained data, the optimal curing temperature is 100 °C, with a duration of 2 hours and 40 minutes. Adhering to these conditions achieves an optimal combination of physicochemical

properties for the developed epoxy compositions. The main focus of this study was on the ED-41r epoxy resin, which is the result of the polycondensation of low-molecular-weight ED-40 epoxy resin with diphenylol propane. In a free state in a thermal chamber, the compositions containing a solution of ED-45 polyamide resin in xylene underwent curing for two-time intervals: 1 hour and 1 hour 20 minutes.

Experimental studies have shown that the dependence of the aforementioned parameters on the concentration of polyamide acid exhibits a pronounced extremal character. The optimal mechanical, adhesive, deformation-strength, and protective properties of epoxy compositions are achieved at a concentration of polyamide acid in the range of 1–3%. Even the addition of just 1% of polyamide acid to the ED-41r-ED-45 epoxy system increases the adhesive strength of the coating by 3 times, impact strength by 11 times, and material hardness by 18%.

During the curing of the developed epoxy composition with polyamide acid as a modifier, competing and interdependent reactions take place. On one hand, polyamide acid can interact with the epoxy oligomer, promoting the formation of a three-dimensional structure. The interaction between the epoxy group and the amide group of the polyamide oligomer and polyamide acid leads to the formation of chemical bonds. On the other hand, during curing at elevated temperatures, partial conversion of polyamide acid into polyimide may occur, accompanied by the formation of imide cycles and the release of water. The presence of a small amount of water in the oligomer accelerates the curing process.

Additionally, the polyimide copolymer has a significant influence on the structure and properties of epoxy coatings. The polyimide enriches the epoxy matrix, enhancing its mechanical strength and deformation resistance. This allows for the creation of coatings with increased resistance to mechanical loads, impacts, and abrasion.

Furthermore, the polyimide modifier promotes the formation of dense and strong bonds with the

surface of the coating, ensuring high adhesion to various materials. This is particularly important in shipbuilding and mechanical engineering, where coatings need to securely bond to metals, wood, and other substrates. Due to its chemical structure, the polyimide modifier also improves the protective properties of the coatings. It can form barrier layers that prevent the penetration of moisture, aggressive chemicals, and corrosion.

This significantly extends the service life of coatings and enhances their resistance in extreme conditions. Thus, the polyimide copolymer in epoxy coatings is not only a modifier but also a key component that imparts improved mechanical properties, high adhesion, and effective protection to the coatings. Moreover, protective coatings based on oligomer matrices of various compositions are one of the most effective methods for safeguarding the technological equipment of chemical production facilities against corrosive degradation.

To achieve the required characteristics of such oligomer coatings, functional modifiers are introduced into their composition, enhancing their strength, tribotechnical, thermophysical, and other properties. Composite materials based on oligomers, such as epoxy, polyether, and phenol-formaldehyde oligomers, are widely used in industry due to their diverse raw material base, relatively low cost, and ability to provide quality surface protection for equipment. Further improvement of the compositions of composite protective materials with the aim of enhancing their properties is highly relevant.

In the studies mentioned in references [10–11], it has been demonstrated that epoxy binders cured with novolac phenol-formaldehyde oligomers (NFO) exhibit high physico-mechanical properties. Typically, the block copolymer formed by the interaction of epoxy and novolac oligomers is cured at temperatures above 120 °C in the presence of curing agents for a duration of 0.5–6 hours.

Curing of epoxy-phenolic oligomers without the addition of curing agents or catalysts occurs at

temperatures of 160–180 °C through the interaction between epoxy and hydroxyl phenolic groups. Interaction between the epoxy group and the secondary hydroxyl group is also possible. At higher temperatures above 200 °C, condensation reactions can occur between the alkyd and phenolic hydroxyl groups of the macromolecules in the epoxy-phenolic oligomer. Epoxy-phenolic polymers exhibit the following characteristics: hardness ranging from 190 to 220 MPa and a glass transition temperature of approximately 95 to 100 °C.

Furthermore, the conducted research has shown that increasing the duration of thermal treatment of epoxy-phenolic oligomers also improves the wear resistance of the coatings. This is attributed to the formation of a denser and stronger oligomer structure through additional thermal processing. However, excessive thermal treatment can lead to the breakdown of the oligomer network and a deterioration of the mechanical properties of the coatings. Therefore, optimal technological thermal treatment conditions need to be carefully determined to achieve the best tribotechnical characteristics and wear resistance of coatings based on epoxy-phenolic oligomers.

Experimental studies [12] also emphasize the importance of considering the interlinking segment  $M_c$  when developing coatings based on epoxy-phenolic oligomers. As the interlinking segment  $M_c$  decreases, the ability to form a highly elastic layer diminishes. This can result in a reduction of the protective properties of the coatings, as a highly elastic layer is capable of absorbing and dissipating mechanical loads, preventing damage to the substrate. When optimizing the composition of coatings and the processes of their treatment, it is necessary to consider the interrelation between the interlinking segment  $M_c$ , mechanical properties, and wear resistance of the coatings. Understanding these relationships helps in developing coatings with the best tribotechnical characteristics and ensuring long-lasting protection against wear and damage to surfaces.

Further research in this area allows for a better understanding of the mechanisms of interaction between copolymers, the interlinking segment, and the formation of a protective layer, which, in turn, contributes to the development of more efficient coatings with increased wear resistance and resistance to mechanical impacts.

The conducted study was dedicated to investigating the influence of the molecular weight of the block copolymer obtained from the interaction of epoxy binder and phenolic oligomer SF-010 on the structural network of the binder, measured by the value of  $M_c$ .

It has been found that changing the interaction time of the components within the range of 0.5 to 5 hours leads to an increase in the average molecular weight of the oligomer from 1050 to 2100. This indicates that the duration of the interaction affects the formation of the block copolymer and its molecular structure.

The variation in the molecular weight of the cooligomer can influence the mechanical and chemical properties of the oligomer, including its strength, elasticity, thermal stability, and other characteristics. Further research can provide a deeper understanding of the impact of molecular weight on the properties of the cooligomer and optimize the processes of its synthesis to achieve desired properties and characteristics of oligomer materials. It is possible to use modified coatings with thermoplastic oligomers having a combined matrix as a base for composite protective materials. In this case, it is recommended to use a thermoplastic modifier with high wear resistance comparable to the wear resistance of the structured matrix. The presence of a thermoplastic component in the combined matrix contributes to a reduction in wear intensity. Thermoplastic oligomers exhibit good plasticity and deformation capability under mechanical loads. This allows them to absorb and dissipate friction and wear forces, leading to improved coating durability.

The selection of a thermoplastic modifier with suitable mechanical properties is an important as-

pect in the creation of composite protective materials. Such a modifier should provide wear resistance comparable to that of the matrix and contribute to the overall durability of the coating.

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