РЕЗЮМЕТА НА НАУЧНИ ТРУДОВЕ
НА ДОЦ. Д-Р АЛЕКСАНДЪР НИКОЛОВ ДИМИТРОВ

за академичната длъжност „Професор"
по научна област 4. Природни науки, математика и информатика,
в професионално направление 4.2 Химически науки,
по научна специалност „Екология и опазване на околната среда"

Група В /съгласно ПУРПНСЗАД в БДУ „Проф. д-р Асен Златаров"/

В 3.1. Йорданка Ташева, **Александър Димитров** – *„Екологично използване на природни и синтетични горива и отпадъци от тях"*, Монография, изд. Либра Скорп, Бургас, 2024 г.

Представената монография разглежда замърсяването на околната среда, което води до нарушаване на екологичните норми. Установено е, че от всички източници на енергия 40% се получава от нефта, при което 20% от замърсителите на планетата са от нефтени продукти. Бавното, но сигурно унищожаване на околната среда е причина за иновативен подход при производството на горива. Като научен принос може да се отбележи, разглеждането на въпроса за внедряването на иновативни методи и инсталации за преработване на твърди горива, нефтени продукти и отпадъци от тях, както и отделянето на минимални количества вредни емисии (CO$_2$), което ще доведе до опазване на околната среда. От друга страна за първи път се разглеждат възможностите за оползотворяване на алтернативна суровина – синтетичен нефт, както по отношение на опазването на околната среда, така и по отношение на получаването на допълнително количества енергийни средства и горива и не на последно място, като научно-приложен принос може да се отбележи, прилагането на термичните процеси за получаване на допълнителни количества горива или техни компоненти от преработване на отпадъци и горива от отпадъци.

В 4.1. Dimitrov A., N. Todorov, M.A. Dimitrova, D. Gogov, 2020. *Purification of ventilation air from volatile solvents - method for estimation of some values,* Oxidation Communications, 43 (1), pp. 30-38.

The adsorption method for capture of the steams from volatile solvents is most appropriate for air basin and human health protection. Particular model for purification of steam – air mixture from ethyl alcohol is developed. The adsorption isotherms of different type's activated carbon using as an adsorbent standard substance benzene and ethyl alcohol are drew up. The choice of the adsorbent – activated carbon, make ARB, reduction type is made on their base. The following values are estimated: the quantity of adsorbent in solid and gas phase, the basic elements of the static layer – porosity, specific geometric surface and fictive length of the adsorbent layer, mass transfer and diffusion coefficient, etc. On their base a practical method is developed, for determination of the height of the adsorption layer as well as duration of the adsorption process. Using this method, it is possible to make prompt choice of the dimensions of the adsorbents and to choose rational cyclic working regime assuring the continuity of the adsorption purification of ventilation flows.

В 4.2. Ivanova D., Z. Nikolaeva, **A. Dimitrov, 2022**. *Study of the concentration of heavy metals in silt loading from transport arteries in the city of Burgas, Bulgaria.* Oxidation Communications, 45 (2), pp. 390-397.

In Bulgaria, the levels of heavy metal pollution in silt loading deposited on the road surface have not been studied. This article reports results for concentrations of heavy metals in the silt loading samples from main and secondary transport arteries from the territory of the transport network of the city of Burgas. The content of the elements As, Cd, Cu, Cr, Ni, Pb, Zn and Co was studied with the help of ICP MS mass spectrometer

B 4.3. Ivanova D., **A. Dimitrov**, Y. Tasheva, **2022**. *Contemporary trends in evaluation and calculation of dust in the world.* Oxidation Communications, 45 (3), pp. 550-561.

Recently, there has been growing public concern about air quality in urban areas in all over the world. Considerable attention has been focused on particulate matter (PM) produced from paved road and construction activities because of its adverse effects on potential air quality. In the present paper is considered the contemporary trends in evaluation and calculation of dust and new techniques for assessment of particulate matter from roads.

B 4.4. Petrov M., Z. Nikolaeva, **Al. Dimitrov, 2023**. *Cyclical aspect of the complex factors of anthropogenic activity on the global ecosystem.* Oxidation Communications, 46 (2), pp. 509-518.

The state of the Biosphere is influenced by a series of complex factors as well as by its constituent components. The composition of the components of the Biosphere is undergoing a variable dynamic process of both proper composition and structure. The anthropogenic activity that has a reference point to ensure the growing demands of the population has a generally negative impact at the current stage upon the state of the climate that comes as a result of the emissions of polluting green house gases as well as polluting particles in the form of aerosols. Consecutive effectswith their states in the form of steps are described by a special diagram that can be called the cyclic diagram of anthropogenic activities. This diagram shows the current real representation of the actual state of the Biosphere as well as the measures that could be taken to improve the state of the Biosphere.

B 4.5. Petrov M., Z. Nikolaeva, **Al. Dimitrov, 2023**. *Spontaneous global wildfires as the consequence of climate variability.* Oxidation Communications, 46 (2), pp. 519-546.

This paper describes the current state of the initiation of the global spontaneous fires and the reasons of their apparitions. Their spontaneity probably is related to the presence of the pollutants in the atmosphere such as methane and fuel particles. Moreover, methane is the precursor of ozone. Ozone, in its turn, is the factor that leads to the destruction of flora and the transformation of flora into the fuel. It is also clear that the complex processes that take place in the Biosphere with the presence of polluting gases and the occurrence of fires lead to the development of the states of extreme temperature variations, drought and floods. Increasing albedo values have an increasing influence on the development of extreme temperatures and other natural cataclysms. An empirical method based on the thermodynamic laws of ignition point with fire cascade processes is elaborated. The empirical expression of the albedo variation as the function of concentration of green house gas also is elaborated and suggested.

B 4.6. Naydenova St., St. Popov, **A. Dimitrov**, D. Petkov, V. Stoyanov, S. Sotirov, **2024**. *Influence of fine particulate matter concentration and relative humidity on upper respiratory tract diseases in childhood and adolescence. Part A: Ruse.* Journal of Environmental Protection and Ecology, 25 (5), pp. 1728-1744.

Air quality is an important condition for a healthy environment as it directly and indirectly
affects all its components. Air pollution by fine particulate matter (PM), combined with relative humidity, is of great interest and concern to the public and institutions responsible for environmental protection and human health. This publication aims to investigate and correlate the influence of PM concentration and relative humidity in Ruse, on upper respiratory tract diseases in childhood and adolescence. The observation period considered in the article covers five years (2017–2021) and the data are divided into quarters. For finding dependencies between the fine particulate matter concentrations, the relative humidity and the morbidity, two techniques were used: correlation analysis and linear regression which were performed individually for the PM10 and PM2.5, respectively. Correlation quantifies the strength of the linear relationship between a pair of variables, whereas regression expresses the relationship as an equation. Python programming language and its statistical libraries were used for performing the analyses and visualising the results.

В 4.7. Naydenova St., St. Popov, **A. Dimitrov**, D. Petkov, V. Stoyanov, S. Sotirov, **2024**. *Influence of fine particulate matter concentration and relative humidity on upper respiratory tract diseases in childhood and adolescence. Part B: Burgas.* Journal of Environmental Protection and Ecology, 25 (5), pp. 1745-1759.

The quality of a healthy environment has direct and indirect impacts on everyone. Of particular importance is the quality of the atmospheric air and, in particular, the content of fine dust particles combined with relative humidity. This has attracted the attention of the general public and institutions responsible for protecting the environment and human health. The purpose of this study was to investigate the influence of FFP concentration and relative humidity in the city of Burgas on diseases of the upper respiratory tract in childhood and adolescence. The study period covers five years (2017–2021), with data distributed by quarter. Two techniques were used to determine dependencies: correlation analysis and linear regression, which were performed individually for PM10 and PM2.5, respectively. Correlation quantifies the strength of the linear relationship between a pair of variables, whereas regression expresses the relationship in the form of an equation. Python programming language and its statistical libraries were used to perform the analyses and visualise the results.

В 4.8. Tasheva Y., St. Popov, **A. Dimitrov, 2025**. *Correlation and Linear Regression Analyses as Assessment Instrument of Ecological Point of Gasoline Emissions.* Recent Contributions to Bioinformatics and Biomedical Sciences and Engineering, Lecture Notes in Networks and Systems, v., Springer.

Economic growth and rising living standards unfortunately have a negative impact on the environment. In the countries of the European Union, during the period 2020-2030, average annual economic growth of the order of 2-3% is expected, which is associated with about a 30% increase in road transport. Road transport is a major source of carbon monoxide (CO), nitrogen oxides (NOx), particulate matter (soot) and non-methane volatile organic compounds (NMVOCs).

Група Г /съгласно ПУРПНСЗАД в БДУ „Проф. д-р Асен Златаров"/

Г 6.1. Александър Димитров – *„Антикорозионно действие на модифицирани с азотна киселина нефтени въглеводороди"*, Монография, изд. Либра Скорп, Бургас, 2024 г. (от ОНС Доктор).

Представената монография разглежда основната задача на съвременната нефтопреработвателна промишленост - да се произвеждат смазочни материали е повишени екологични и експлоатационни показатели. Този въпрос трябва да се решава в условията на съществуващите инсталации, съвременни технологии, максимални икономии и рационално използване на суровините и енергийните ресурси и опазване на околната среда. Повишаване качеството на смазочните материали, чрез използването на високоиндексни базови масла, в които се внасят съответните композиции от добавки, позволява не само да се подобри ефективната и безаварийна експлоатация на използваната техника, да се намалят разходите на метал и енергия, да се получи съществена икономия от използваното гориво и увеличаване на ресурсите, с което да се повлияе върху здравето на хората и опазването на екосистемите. Като научен принос - установено е влиянието на обработени с азотна киселина нефтени фракции, съдържащи предимно алкано и циклоалканови въглеводороди, получени при ректификация на нефт, както и на синтезираните на тяхна основа добавки, върху качествата на смазочните материали. Изследвано е действието на различните по природа и структура индивидуални съединения, както и на изолираните от нефтени фракции продукти, със съдържащи азот и кислород функционални групи, при формиране на защитен филм върху металните повърхнини. Като научно-приложен принос – получени са комплексни инхибитори на корозия за минерални масла, съдържащи анодни, катодни и екраниращи компоненти, които защитават черни и цветни метали. Получените комплексни инхибитори на корозия са приложени в необходими за практиката стокови продукти.

Г 7.1. Dimitrov A., **2020**. *Preparation of the alkyd resin on the base crude sunflower fatty acids methyl esters and crude glycerol*, Oxidation Communications, 43 (1), pp. 135-144.

Transesterification of sunflower oil with methanol to form fatty acid methyl esters (FAMEs) using a NaOH catalyst was carried out. Two phases were obtained. The lighter phase contains the main product fatty acids methyl esters, which was used without purification. The heavier phase (glycerol phase) was purified by acidification with phosphoric acid to give crude glycerol with a glycerol content of 81%. Two medium oil alkyds were prepared – one based on sunflower fatty acids methyl esters, crude glycerol and phthalic anhydride and one reference based on sunflower oil, crude glycerol and phthalic anhydride. The results of the studies showed that the alkyd based on sunflower fatty acids methyl esters was obtained at a lower temperature for almost two times less time and its properties exceed the properties of the reference alkyd.

Г 7.2. Dimitrov A., 2020. *Study of the effect of magnesium oxide as cathodic catalyst in single chamber bioelectrochemical system*, Oxidation Communications, 43 (2), pp. 204-212.

Bioelectrochemical systems (BES) are innovative technologies which generate energy from contaminated water flows. The design of the cathode and the mass transfer are key parameters determining the effective performance of these systems. For the present study, a BES laboratory was developed with air cathode and catalyst magnesium oxide (MgO) the amount of which was determined using the coefficients of mass transfer. The values obtained for the BES power were in the range from 137.1 to 410.1 mW without catalyst and from 317.2 to 568.8 mW with catalyst MgO. The organics removal for 498 h operation was 78% for the reactor without catalyst and 84% for the reactor where MgO was added. These results demonstrate the improvement of the redox processes and the diffusion of oxygen through the cathode which has positive effect on the power generated and the efficiency of BES.

Г 7.3. Midyurova B., **A. Dimitrov**, S. Sotirov, T. Petkov, **2022** (2020). *Performance prediction of a microbial fuel cell based on artificial neural networks*. Contemporary Methods in Bioinformatics and Biomedicine and Their Applications, Lecture Notes in Networks and Systems, vol. 374, Springer 2022, pp. 202-209.

This study integrates artificial neural network processing with microbial fuel cell - based on the electricity generation. Innovative treatment of wastewater flows is being applied to the Microbial fuel cell. It is a typical bioelectrochemical system where chemical energy containing in organic matter is converted in electricity by bacteria activity. The study is focused on monitoring the operational stability of a cell with a VITO air-cathode and an anode carbon brush. The process is controlled by the potential created through an open circuit potential (OCP) and closed circuit potential (CCP). The obtained voltage is in the range of 45.7 mV - 43.9 mV at CCP, while it is 202.5 - 201.5 mV at OCP. The extent of the chemical oxygen demand (COD) removal during the run is 78.6%. The data obtained were used to train the Neural Network and to predict the generated voltage by the Microbial fuel cell.

Г 7.4. Prokopov Ts., M. Nikolova, D. Taneva, **A. Dimitrov**, S. Tasheva, **2022**. *Kinetics study on total phenols extraction from onion processing waste*. Oxidation Communications, 45 (2), pp. 262-273.

The extraction of total phenols from onion processing waste by using of different solvents was studied. The kinetic parameters such as degree of extraction, reaction constant, energy of activation, order of the reaction, rate constant, half-life and reaction rate were calculated. The molecular internal diffusion coefficients were determined according to the Minosyan's equation, as well as according to the Willi-Chang and Stokes-Einstein equations. The effective diffusion coefficient for extracting total phenols from studied raw material was determined, too.

Γ 7.5. Semerdzhieva A., H. Fidan, **A. Dimitrov**, S. Tasheva, **2022**. *Determination of the vapour-liquid equilibrium diagrams and cohobation column height of the essential oil-water systems*. Oxidation Communications, 45 (2), pp. 341-349.

The aim of the present paper was to study two of the Lamiaceae family representatives – mint and thyme due to their chemical composition. Based on the main components in peppermint and thyme oils, the thermodynamic phase diagrams for the vapour-liquid balance of the essential oil-water system were constructed. Crops widespread and grown in Bulgaria, such as three types of mint (hot, curly, and marsh) and thyme (garden and wild), were used. The theoretical number of plates was determined according to the graph-analytical method of McCabe and Thiele. The actual number of plates and height of a cohobation column processing primary distillation waters from peppermint and thyme oils were also calculated. The calculations were made for two concentrations of primary distillation waters – average and maximum.

Γ 7.6. Ivanova D., Y. Tasheva, E. Sotirova, **A. Dimitrov**, S. Sotirov, **2023**. *Prediction of the Granulometric Composition of the Silt Loading on Transport Arteries in the City of Burgas Based on Artificial Neural Networks.* Recent Contributions to Bioinformatics and Biomedical Sciences and Engineering, Lecture Notes in Networks and Systems, vol. 658, Springer 2023, pp. 21-31.

This study integrates data from laboratory road silt analyses and predicts these values using artificial neural networks. It's knownthat the emissions from vehicular traffic are a significant contributor to total particulatematter (PM) concentrations in urban areas and have detrimental effects on human health. The characteristics of these emissions, from different traffic-related sources, are essential to study their impact on human health. The deposition of particulate matter (road silt) on road surfaces and its suspension from roadways is the main mechanism by which road transport causes secondary PM pollution. The analysis of road siltwas performed by sieve and laser diffraction analyses. The obtained data were used to predict the grain size composition of the fractions below 75 μm from the road silt samples, by neural networks, after sampling along the main and secondary traffic arteries of the city of Burgas, and analyzing the fractions up to 75 μm.

Γ 7.7. Mollova E., E. Ivanova, S. Turmanova, **A.N. Dimitrov**, 2023-**2024.** *Microplastics – Ecosystem pollutants (Review).* Journal of the Serbian Chemical Society, 89 (7–8), pp. 939-980.

The presence of microplastics in different ecosystems has been intensively studied since the beginning of the 21st century. They have since been found in all components of the environment as well as in a number of organisms. Microplastics (MPs) is a term for particles whose size is 1 μm–5 mm that are formed during the breakdown of larger plastic products or are produced in microsizes for various industrial and cosmetic products. The distribution of these particles is due to their rapid transportation over large distances which is facilitated mainly by their small size and low density. There are still no uniform methods and standardised procedures for sampling and analysis. Therefore, the facts about the occurrence, distribution and threats to ecosystems and human health from MPs are not yet fully understood. This literature review is a broad presentation of the state of knowledge on the distribution of MPs in the atmosphere, water, soil and organisms. In addition, this document describes the most widely used methods for separation, identification and characterisation of MPs.

Γ 7.8. Prokopov Ts., M. Nikolova, **A. Dimitrov**, D. Taneva, S. Tasheva, **2023**. *Investigation of kinetic parameters of total flavonoids obtained at onion extraction*. Journal of Environmental Protection and Ecology, 24 (6), pp. 1987-1999.

It was studied extraction process of obtaining of total flavonoids from onion with different solvents and extraction duration (up to 1 h). The kinetic parameters: partition coefficient, extraction rate, process reaction constant, activation energy, reaction order and process rate constant, half-life and reaction rate were calculated. The molecular internal diffusion coefficients were determined according to the Minosian formula and also according to the Willie-Chang, Stokes-Einstein equations, and the effective diffusion coefficient was determined for total flavanoids extracted from the total amount of raw material studied.

Г 7.9. Semerdzhieva A., P. Merdjanov, **A. Dimitrov**, S. Tasheva, **2023**. *Investigation of hydrodynamic of a cohobation column processing distillation waters from fennel fruits.* Journal of Environmental Protection and Ecology, 24 (7), pp. 2333-2340.

In this paper, a full factorial experiment with a second-order compositional design is conducted to study the hydrodynamics of a cohobation column. The experiments were carried out with three-fold repeatability. The factors influencing the hydrodynamics of the column were: temperature, flow rate of the distillation feedwater (expressed by the feed rate) and recirculation of the primary distillation feedwater. Following the experiment, the pressure drop in the cohobation column operating with horizontal sheet packing was determined during the processing of primary distillation waters from fennel fruit. A regression equation describing the pressure drop in the cohobation column as a function of the influencing independent factors was derived, the homogeneity of the variances studied was determined, and the significant coefficients and adequacy of the model were determined.

Г 7.10. Mollova E., E. Ivanova, S. Turmanova, **A.N. Dimitrov**, **2023**. *Contamination of the coastline of Burgas bay with microplastics.* Journal of Environmental Protection and Ecology, 24 (8), pp. 2614-2621.

Black Sea coastal areas are poorly studied for microplastic MP pollution. The current work focuses on the analysis of microplastic pollution in the coastal strip of the Burgas Bay. Monitoring has been carried out in two seasons at six pilot sites covering the beachfront of Burgas. Contamination was determined based on microplastic type and size using a Micro Fourier Transform Infrared (μ-FT-IR) imaging microscope. Seven types of plastic particles of PP, PAN, PS, PVC, PA, PBT and ABS with sizes ranging from 28.03 μm2 to 3503.1 μm2 were identified.

Г 7.11. Semerdzhieva A., P. Merdjanov, T. Atanasova, D. Atanasov, **A. Dimitrov**, S. Tasheva, **2024**. *Analytical determination of thermodynamic and kinetic parameters and thermo physical characteristics of essential oils from the Lamiaceae family.* Oxidation Communications, 47 (2), pp. 272-284.

Essential oils are widely used in perfumery, cosmetics, food and other industries. In the present study, thermodynamic and kinetic parameters as well as thermophysical characteristics of essential oils from the *Lamiaceae* family were calculated. The three types of *Mentha* (*piperita* L., *crispa* L. and *pulegium* L.) and the two types of *Thumys* (*vulgaris* L. and *serpyllum* L.), which are grown in Bulgaria, were examined. The Gibbs free energy (–1255.4–5196.34 J/mol), enthalpy (113.01–391.02 J/mol), entropy (–2.44–19.73 J/mol K), activation energy (–3099.71–103.42 J/mol), internal energy (90.80–376.27J/mol) and Helmholtz energy (–5289.65–1229.89 kJ/mol) of the essential oils were calculated. The specific heat capacity (208.32–1361.99 J/kg K), thermal conductivity (299.42–334.75 W/m K), thermal diffusity (245.59–1169.96 m2/s) and kinematic viscosity (6.94–11.55 m2/s) of essential oils were determined. The calculated thermophysical characteristics: specific heat capacity, coefficient of thermal conductivity, thermal diffusity and kinematic viscosity can be used in the design of various heat exchangers (distillation apparatuses, florentine flask, cobation columns and condensator-cooler used in essential oil industry).

Г 7.12. Semerdzhieva A., P. Merdjanov, D. Atanasov, N. Nenov, **A. Dimitrov**, S. Tasheva, **2024.** *Investigation of a distillation process in the extraction of essential oil from fruits of fenel with superheat steam.* Oxidation Communications, 47 (2), pp. 368-376.

The process of the distillation is widely used in manufacturing of essential oil. In this study is used the process of distillation with aim of obtaining essential oil from fruits of fennel in experimental laboratory distillation installation. The distillation curve for extraction of essential oils from the process of distillation at different temperatures for the supplied steam was presented. A graphical dependence of the distillation rate during the duration of the process was constructed. The values oobtained for the distillation rate during the process ranged from 5.5 to 7.5% (± 0.05) average rate. Equations were derived for calculating the rate of distillation depending on the duration of the process at the temperature of the supplied steam. The percentage of the extracted essential oil from the raw material was calculated under

the same process conditions but at different temperatures of the supplied steam. It was found that the optimal temperature for supplied steam is 150ºC.

Г 7.13. Naydenova St., A. Veli, Z. Mustafa, **A. Dimitrov** , L. Gonslavesh, **2024**. *Seasonal variations in PAHs (BAPeq) content in particulate matter under urban conditions*. Journal of Environmental Protection and Ecology, 25 (6), pp. 1775-1784.

During the last century, anthropogenic factors had the greatest impact on the load of the biosphere with polluting substances. In the current century, measures to reduce emissions have been increasingly successfully and massively implemented, but in urban conditions, air quality, as the most consumed component, remains unsatisfactory. The territory of the researched city of Burgas is included in the area for assessment and management of atmospheric air quality "Southeast" with code BG0006. It is indicated as a territorial unit exceeding the norms for particulate matter (PM). The current study focuses not on their concentration, but on an analysis of the 19 polycyclic aromatic hydrocarbons (PAHs) they contain. Since only one surfactant (benzo[a]pyrene) is regulated under Bulgarian legislation, benzo[a]pyrene coefficients were calculated for the others, then summed up and compared with the norm.

Г 7.14. Mollova E., E. Ivanova, P. Atanasova, S. Turmanova, **A. Dimitrov**, **2024.** *Monitoring the seasonal distribution of microplastics in Burgas bay, Bulgaria.* Journal of Environmental Protection and Ecology, 25 (6), pp. 1795-1802.

The presence of microplastics in coastal areas can serve as an indicator of marine contamination with them. The present work investigates their presence in the coastal strip of Burgas Bay for the summer-autumn seasons (2023) and is a continuation of a previous study in which pollution was analysed during the winter–spring period (2022–2023). MPs with an area of less than 100 μm2 account for 70% of the total number of particles during the period considered, which is 30% more than their proportion during the winter-spring seasons. There is also a 1.5-fold increase in total particle MPs compared to the previous period.

Г 7.15. Semerdzhieva A., S. Valchev, D. Atanasov, **A. Dimitrov**, S. Tasheva, **2024.** *Cohobation as a method for purification of distillation waters in manifacturing of essential oil.* Journal of Environmental Protection and Ecology, 25 (6), pp. 1813-1819.

Cohobation as a method is used in essential oil industry to extract secondary essential oil that has remained emulsified, mechanically entrained or dissolved in primary distilled waters. In a semi-industrial experimental laboratory cohobation column have been reworked primary distilled waters, obtained after steam distillation of ground fruit from a fennel. As a result of the processing of primary distilled waters in cohobation column, a secondary essential oil and secondary distilled waters were obtained. It has been established that waters after cohobation (the secondary distillation waters from fennel fruits) correspond to class A (according to the European Union Regulation No 741/2020) and can be used for irrigation of agricultural crops.

Г 7.16. Ivanova D., **A. Dimitrov**, Y. Tasheva, S. Sotirov, E. Sotirova, M. Atanasova, M.A. Dimitrova, Kr. Vassilev, **2025**. *Predicting the amount of toxic metals and metalloids in silt loading using neural networks*. Environmental monitoring and assessment.

Material deposited on road surfaces, called road dust, is known to contain different toxic elements. According to particle size, there are different fractions. Particles with an aerodynamic size less than or equal to 75 μm are called silt loading. As a result of exhaust and non-exhaust emissions from motor vehicles, silt loading deposited on the road surface contains toxic metals, non-metals and metalloid like Cr, Ni, Zn, Cu, Co, Cd, Pb, As. Through different pathways these toxic elements can easily get into the soil, surface and ground water, plants, animals and the human body. The high risk of contamination and the extent of toxic effects determine the need for their control and health regulation and systematic monitoring. Specific laboratory equipment is used to perform multiple measurements of toxic metal ions.

The procedure is heavy and time consuming due to the difficulties associated with stopping road traffic during sampling in large settlements and the standard elemental analysis technique ICP-MS that is usually applied. The paper proposes a method for predicting the amount of toxic elements in silt loading using artificial intelligence. The paper proposes the use of neural networks, using previously collected experimental data as a training base. The high prediction accuracy that is obtained (As - 95.304%, Cd - 99.616%, Pb - 27 98.832%) shows that the proposed prediction could succesfully replace the standard elemental analysis.

Г 7.17. Ivanova D, Y. Tasheva, **A. Dimitrov**, S. Sotirov, V. Ivanova, **2025**. *Prediction of the Amount of Nickel by Neural Networks in Silt Loading.* Recent Contributions to Bioinformatics and Biomedical Sciences and Engineering, Lecture Notes in Networks and Systems, Springer 2025.

Dust particles have a harmful effect on human health, and therefore a thorough analysis of their composition is needed. Silt loading from roadways in large populated areas is one of the main contributors to particulate matter pollution. Artificial neural networks are an effective tool for predicting nickel concentrations in sedimentary environments. The use of this approach can aid in assessing and mitigating the health risks associated with heavy metal pollution in the environment. This study aims to predict concentrations of heavy metals (Ni) in particles smaller than 75µm based on results from 12 transport arteries for the concentrations of Cr, Zn, Cu, Pb, Co, B, Na, Mg, Al, K, Mn, Fe, Se, Ba, Tl and Bi obtained by mass spectrometer ICP MS using deep neural network.

Г 7.18. Syulekchieva D., S. Popov, B. Midyurova, **A. Dimitrov,** S. Sotirov, **2025**. *Water quality modelling using multilayer neural network and multivariate statistical techniques,* Studies in Computational Intelligence, Springer. In the Book „Intelligent System Design based on Soft Computing Models". Edited by Prof. Oscar Castillo and Prof. Patricia Melin.

The complexity of water governance makes the involvement of multiple institutions, including citizens, as a prerequisite for the preparation of effective, efficient and appropriate research and policies. Co-creation of knowledge and solutions is increasingly seen as a necessity to address the complex dynamics associated with water pollution. As enabling technologies grow, new approaches that anticipate and assess potential impacts are being developed to foster research and innovation as a framework for responsible research and innovation.

Г 7.19. Semerdzhieva A., S. Valchev, D. Atanasov, T. Atanasova, **A. Dimitrov**, S. Tasheva, **2024.** *Chemical composition, thermodynamic and kinetic parameters and thermophysical characteristics of secondary essential oil of fennel fruits.* Journal of Environmental Protection and Ecology, 25 (8), pp. 2632-2642.

Secondary essential oil through a distillation process known as cohobation in essential oil industry is obtained. Chemical composition of obtained secondary essential oil of fruits of the fennel is investigated. The main components in essential oil are determined: transanethole (55.96%), fenchone (25.81%), cis-anethole (6.9%) and estragole (methylhavicol – 3.56%). Based on determined chemical composition, thermodynamic parameters (Gibbs free energy, entropy and enthalpy change) for intermediate and final state of the process were analytically calculated. Analytically kinetic parameters (activating energy, diffusion coefficient molecular internal, as well coefficient effective diffusion) are received. Thermophysical characteristics (density, specific heat capacity, thermal conductivity coefficient, temperature, and conductivity coefficient, dynamic and kinematic viscosity) are calculated. Values of thermophysical characteristics and thermodynamic parameters can be used to characterise process and in calculation of various heat exchangers in essential oil industry.

Г 7.20. Naydenova St., **A. Dimitrov**, **2025**. PM monitoring on the territory of municipality Burgas – devices and concentrations. Journal of Environmental Protection and Ecology, 26 (1), pp. 9-17.

In the global planetary ecosystem, humans are constantly making an impact on the environment they live in, and it in turn has an impact on their existence. Population growth and economic growth,

related to the satisfaction of needs in the past and the present century, have led to increasingly heavy loading of environmental components with pollutants substances. Usually, municipalities and small agglomerations rate fairly well air pollution from municipal, industrial, vehicular traffic, and other specific sources located on their territory of pollution. According to the European Commission, air pollution poses the greatest risk to the environment and human health and is perceived as the second largest problem by Europeans after climate change, because it is the most consumed component of the environment – each minute each person inhales about 38 liters of air. Its quality is paramount, due to its easy and unhindered spread of pollutants. The sources of pollution are different, but emitted in closely spaced areas they can lead to sharp deterioration of air quality.

Г 7.21. Mollova E., E. Ivanova, S. Turmanova, **A. Dimitrov, 2025**. Monitoring of marine organisms for microplastics in the water area of burgas bay. Journal of Environmental Protection and Ecology, 26 (1), pp. 49-55.

Microplastic pollution in the marine environment is emerging as a global problem based on the small size of the microplastics, which facilitates their ingestion by marine organisms, leading to bioaccumulation and transport along the food chain. This process raises concerns about their impact on marine ecosystems and the risks they pose to human health through the consumption of contaminated seafood. The aim of this work is to investigate the presence, variants and total surface area of MPs in two species of marine organisms, Mya arenaria and Mytilus galloprovincialis – from the coastal waters of the Burgas Bay during the months of May to August. The results show contamination in both marine species, PU and PP in Mya arenaria and PE, PP and PS in Mytilus galloprovincialis. PU has the highest cumulative area (34078.56 μm²), followed by PP and PAN, while PE shows the highest presence in samples of Mytilus galloprovincialis. Seasonal variations are observed, with PS and PP dominating in May and June and increased presence of PU and PAN in July and August.

Г 7.22. Semerdzhieva A., D. Atanasov, P. Merdzhanov, S. Valchev, **A. Dimitrov**, S. Tasheva, **2025.** *Chemical composition, thermodynamic and kinetic parameters of primary essential oil from fennel fruits*. Journal of Environmental Protection and Ecology, 26 (2).

The chemical composition of fenel (Foeniculum vulgare Mill.) essential oil has been determined. The major components of essential oil (0.85%) obtained by steam distillation was found to be phenylpropanoids: trans-anethole (63.66%), estragol (4.60%) and cis-anethole (2.43%), oxygenated monoterpene: fenchone (19.68%) and monoterpenes: limonene (2.55%) and α-pinene (2.42%). Based on studied chemical composition, thermodynamic parameters (Gibbs energy, enthalpy, entropy) and activation energy of essential oil were analytically calculated. The values of same thermodynamic parameters and following kinetic parameters (activation energy, molecular internal diffusion coefficient, effective diffusion coefficient, rate constant according to Arrhenius equation) were calculated based on obtained essential oil. The presented data can be used to characterize process by which essential oil has been obtained.

Г 7.23. Angelova N., **A. Dimitrov**, Y. Tasheva, **2025.** *Opportunities for limiting and preventing spills of oil and petroleum products in aquatic ecosystems*. Journal of Environmental Protection and Ecology, 26 (3).

Spills of oil or oil products in water bodies are a prerequisite for major environmental disasters. In tanker accidents, the contaminated areas are huge. Oil spill cleanup and recovery is a complex process and depends on many factors, including the type of oil spilled, the temperature of the water, and the type of shoreline. The low-boiling components evaporate intensively, and the coagulants formed are deposited on the seabed or carried away by the currents. A small part of the released products form an emulsion in the form of a thin layer on the sea surface, which leads to the destruction of entire ecosystems. Environmental pollution caused by oil spills is of increasing concern, making it imperative to develop oil spill remediation strategies.

Г 8.1. S. Sotirov, **A. Dimitrov**, E. Sotirova, **2025.** *Intuitionistic Fuzzy Assessments for Evaluating Air Quality in Burgas for the period 2018-2022.* In Monograph dedicated to Krasimir Atanasov, "Intuitionistic Fuzzy Logic: Horizons of uncertainty and Beyond" to be published by SpringerNature in the Scopus indexed book series "Lecture Notes and Networks and Systems"

This investigation applies intuitionistic fuzzy assessments to evaluate air quality in Burgas, Bulgaria, from 2018 to 2022. Air pollution, particularly fine particulate matter (PM), poses significant health and environmental risks, with PM10 and PM2.5 particles linked to respiratory and cardiovascular diseases due to their ability to penetrate deep into the lungs. During the specified period, field sampling campaigns were conducted to gather data on various atmospheric pollutants, including PM10, ozone (O3), carbon monoxide (CO), and meteorological factors. Samples were collected seasonally and analyzed using standardized methods, ensuring reliable data quality. Using intuitionistic fuzzy sets, this study incorporates degrees of membership, non-membership, and uncertainty, offering a comprehensive evaluation of air quality trends. This approach provides a more nuanced understanding of pollution levels, especially in urban environments with diverse pollution sources. The findings contribute to the ongoing efforts to monitor and manage air pollution, demonstrating the value of advanced fuzzy logic techniques in environmental studies.

24.03.2025 г.   **Подпис:**
гр. Бургас   **(доц. д-р Александър Димитров)**