REVIEW

by Prof. DSc. Panteley Petrov Denev

Department "Organic Chemistry and Inorganic Chemistry" - UHT Plovdiv

on dissertation for the award of the educational and scientific degree "PhD"

in the field of higher education: Natural Science, Mathematics and Informatics

Professional field: Chemical Sciences

Doctoral program: Ecology and Environmental Protection

Author: Master, eng. Dimitrinka Slavova Ivanova

Form of the doctoral studies: Independent training

Department: Ecology and Environmental Protection

Subject: Investigation of silt loading pollution on main and secondary transport arteries in the city of Burgas

Scientific supervisors: Assoc. Prof. Aleksandar Dimitrov, PhD and Assoc. Prof. Yordanka Tasheva, PhD

Relevance of the topic and expedience of the set goals and tasks

In the dissertation presented by Dimitrinka Ivanova, taking into account the influence of various factors, an actual study is made and the actual content of silt loading by the vehicles using the transport scheme of the city of Burgas is shown.

It is known that the modern way of life is characterized by rapid development of road transport. Exceptional dynamics are defined by the specific qualities of the car:

- saving time, through fast and efficient transport;

- increasing labour productivity;

- extending people's economic and personal ties;

- offering new opportunities for recreation and communication with nature.

The topicality of the subject can also be underlined by the fact that the accelerated development of road transport is having some negative consequences for people's health and the quality of the human

environment. Therefore, addressing the problem of air quality management through the development and implementation of appropriate measures to reduce emissions of air pollutants and achieve the set standards is of strategic importance.

In Bulgaria, there is a lack of systematic studies and experimental investigations on the state of surface deposition, therefore, the present dissertation is extremely relevant and timely for Burgas and for all major settlements in the country.

Knowledge of the problem

The PhD student Dimitrinka Ivanova has made a critical review of 121 normative documents, scientific research articles and communications, most of them published in the last 10 years. The dissertation review provides a concise and clear presentation of the current state of the scientific literature on the impact of motor vehicles on ambient air quality, sources of vehicular pollution and product composition, pavement wear and roadway dust suspension.

As a contribution to the educational part of the doctoral studies is the correct evaluation, discussion and synthesis of correctly cited scientific facts and the identification of problems that justify the clearly formulated main objective. The literature review has enabled the PhD student to correctly navigate the subject matter and highlight the significant issues, both in scientific and applied aspects. The set research tasks are specific, feasible and properly arranged and their solution builds the experimental part of the dissertation.

Methodology of the study

In accordance with the analysis of the literature data and the generalized conclusions, the main objective of the dissertation is formulated: the study and evaluation of the silt loading of the transport scheme of the city of Burgas, taking into account the influence of various factors

To achieve this goal, specific tasks were set: collecting a representative volume of data to characterize the transport scheme in the city of Burgas; collecting a representative volume of data on the intensity of motor vehicles on the territory of the city of Burgas; putting into practice the methodology for sampling and analysis of silt loading on asphalt road surfaces of the U.S. Environmental Protection Agency; sampling of silt loading along major and minor transport arteries of the city of Burgas; determining the granulometric composition of silt loading samples; study of the content of heavy metals in silt loading.

A large set of typical sampling and sampling methods, mathematical modeling, physical and spectrophotometric methods for determining the specific indicators were used for the implementation of the identified tasks.

The experimental studies were carried out in accredited laboratories and at the University "Prof. Dr. Asen Zlatarov" - Burgas with modern equipment, documented with photographs in the dissertation.

The presented results and the scientific analysis of these results are original, performed with the necessary repeatability and are at a good scientific level.

Characteristics and evaluation of the dissertation

The dissertation is presented in 127 standard typewritten pages and contains 32 figures, 17 tables and 5 photographs. 121 sources are cited. The construction of the dissertation meets the requirements, containing the necessary main parts: title page, table of contents, introduction, literature review (39 pages), aim and objectives, materials and methods (10 pages), results and discussion (62 pages), conclusions, contributions and references, which follow a logical sequence allowing the PhD candidate to investigate and analyses with the chosen scientific methods the problems posed.

The dissertation is written in very good professional-scientific language, with good style, conciseness and clarity. The material is easy to read and comprehend. The individual parts are well balanced in volume.

In the "Experimental part" section, the main methods that have been applied to the tasks set out in the dissertation are described in detail: methods for the determination of pollution from motor vehicles using continuous monitoring; emission factors and mathematical modelling; methods for sampling silt loading; sieve analysis, granulometric laser diffraction analysis, laboratory elemental analysis with ISP-MS spectrometer.

The locations of the monitoring stations, the regulatory documents, the sampling method, the parameters of the apparatus used for the analyses are illustrated with diagrams. The PhD student has skillfully selected and mastered a large number of modern methods, applicable and in full accordance with the stated aim and objectives of the dissertation. Dimitrinka Ivanova has acquired the necessary methodological experience in conducting the learned experiment, generalizing the reliability of the obtained results and inferring the manifested regularities.

In the „Results and Discussion" section, the experiments conducted to analyze the study area using an electronic transport map of the city of Burgas are clearly and accurately described. The intensity of the motor traffic flow on main and secondary transport arteries in the city of Burgas is characterized, and the traffic intensity during the base period in 2018 is determined. The analysis of the condition of main and secondary transport arteries in the city of Burgas, depending on the road surface, sidewalks and other factors shows that, despite the high motor vehicle traffic and the passage of heavy motor vehicles, or unsatisfactory road condition, in combination with low traffic, the average value of silt loading averaged 37.81 g/m2.

This leads to the conclusion that, for all roads in the transport scheme of the city of Burgas, as well as the places and areas where the main parking of motor vehicles takes place, are not subject to cleaning and washing.

From the results obtained by laser diffraction analysis, it was found that particles with sizes from 30 to 15 μm averaged 25.52%, with sizes from 15 to 10 μm averaged 6.18%, with sizes from 10 to 2.5

μm averaged 9.31%, and with sizes smaller than 2.5 μm averaged 4.35%. That is, 45.36% of the silt loading is particles smaller than 30 μm and 54.64% is particles from 30 to 75 μm. Almost 50% of the silt loading is the most harmful particles to human health.

As a result of vehicle exhaust fumes, pavement wear, tires and brakes, compounds containing heavy metals are released into the air and deposited in the composition of silt loading. The examination of heavy metals in silt loading samples shows that the average concentration for a given pollutant of all samples was higher in the fraction with particle size below 40 μm, with the highest concentration in streets with more intense traffic. Samples from low traffic streets did not exceed the concentration limits for Ni, Cu, Zn and Pb, despite the higher amount of silt loading recorded at these sites. These are samples from inter-block areas where we have low motor vehicle traffic - less than 500 vehicles/24h.

Contributions and Significance of the Development for Science and Practice

The results of the dissertation have above all scientific and applied value and are directly aimed at solving specific problems in the assessment and monitoring of pollution from motor vehicles in urban environments. The present work provides basic data on silt loading and heavy metals on a part of real road infrastructure of the city of Burgas through representative sampling and analysis. Such results are presented for the first time in Bulgaria.

Contributions of scientific and applied value:

- A methodology for calculating the absolute value of traffic for any hour of the year has been developed and applied. The coefficients of hourly, daily and seasonal load are determined;

- a correlation has been proven between the relative average monthly concentration of nitrogen oxides and the variation in the intensity of motor vehicle traffic;

- the experimental results for silt loading and heavy metals have an applied nature in the methods for assessing atmospheric air pollution with fine dust particles;

- the data obtained can be applied to the calculation of emission factors from fine dust particles, emissions from PMF and modeling of transport pollution in cities, as well as environmental impact assessment.

The established and proven results provide guidance on the real and actual state of silt loading and heavy metal pollution, not only in the city of Burgas, but also in the country.

Assessment of the dissertation publications

There are 4 scientific papers on the dissertation, which have been published in refereed and indexed in world-known databases of scientific information. Two of them are in quartile Q3 and two in Q4, which meets the minimum scientific requirements for the professional field 4.2. Chemical sciences. For one of the publications a document has been submitted that it has been accepted for publication.

Materials from the publications are included in the dissertation. The PhD student has submitted a list of three participations in international and national scientific conferences with international participation. In the scientific publications. The PhD student Dimitrinka Ivanova is the lead author, which shows that she is the main performer of the scientific experiment. The PhD student is also involved in three projects funded by the SRAWA Fund at the National Research Institute, the topics of which are related to the dissertation development.

These data give me grounds to claim that the presented scientific works meet the scientific-metric requirements for obtaining the educational and scientific degree "Doctor" of the University "Prof. Dr. Asen Zlatarov" - Burgas.

Author Abstract

The abstract is 57 pages long and contains 10 tables and 29 figures, which correctly reflect the main results and contributions of the dissertation and meet the specific requirements of the University "Prof. Dr. Asen Zlatarov" - Burgas.

Conclusion

During the development of her dissertation, Dimitrinka Slavova Ivanova has acquired the knowledge and skills to interpret and analyze what is known in the literature. She has shown a thorough knowledge of ecology and environmental protection. She knows, applies and interprets modern methods of analysis, independently sets scientific tasks and solves them correctly. The results obtained in the course of the development are interpreted correctly and represent a certain interest and contribution in scientific and applied aspects. My overall assessment of the dissertation, based on its relevance, structure, content and theoretical generalizations, gives me grounds to assume that the dissertation contains scientific, scientific-applied and applied results that represent an original contribution to science and meet all the requirements of the Law on the Development of Academic Staff in the Republic of Bulgaria (LADAB), the Regulations for the Implementation of the LADAB. The submitted materials and dissertation results comply with the Regulations on the Conditions and Procedure for the Acquisition of Scientific Degrees and Academic Positions at Prof. Dr. Asen Zlatarov University - Burgas.

On the basis of the analysis, I give a positive evaluation of the developed dissertation and propose that Dimitrinka Slavova Ivanova to be awarded with the educational and scientific degree "Doctor" in the scientific field "Natural Sciences, Mathematics and Informatics", Professional direction "Chemical Sciences" in the doctoral program „Ecology and environmental protection".

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Prof. DSc. Panteley Denev