

REVIEW

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**REGARDING: DISSERTATION FOR THE AWARD OF THE EDUCATIONAL AND
SCIENTIFIC DEGREE "DOCTOR " IN THE DOCTORAL PROGRAM "HYGIENE
(INCL. OCCUPATIONAL, COMMUNAL, SCHOOL, RADIATION, ETC.),
PROFESSIONAL FIELD 7.1 MEDICINE, HIGHER FIELD EDUCATION
7. HEALTHCARE AND SPORTS**

ON THE SUBJECT:

**POLLUTION OF VARNA REGION OF THE BLACK SEA WITH PLASTIC WASTE
AND POSSIBLE HUMAN HEALTH RISKS**

from

**Dr. YAVOR HRISTOV CHENKOV
(PhD student in full-time study)**

SUPERVISOR:

PROF. TEODORA TODOROVA DIMITROVA, MD, PhD

Reason for writing the review:

Based on Order No. R-109-651/28.12.2023. of Prof. Todorka Kostadinova, Vice Rector of Medical University "Prof. Dr. Paraskev Stoyanov" - Varna, for the Rector, according to Order No. R-100-823/27.11.2023, considering the report with entry No. 102-2 895/22.11.2023 by Prof. Darina Naydenova Hristova, MD, PhD - Head of the "Hygiene and Epidemiology" department, with a decision according to protocol No. 215/14.12.2023 of the Faculty Council and report with In.No.104-1479/19.12.2023 by

Prof. Antonia Slavcheva Dimova - Yordanova, MD, PhD - Dean of the Faculty of Public Health at the Medical University "Prof. Dr. Paraskev Stoyanov" - Varna, I have been selected as a member of a scientific jury in the procedure for the defense of the dissertation work of Dr. Yavor Hristov Chenkov for the acquisition of the educational and scientific degree "Doctor".

General evaluation of the documents submitted for the defense:

The set of documents (presented on an electronic medium) for the disclosure of the procedure and admission to the public defense of the dissertation work of the Ph.D. Yavor Hristov Chenkov has been prepared and completed by the Law on the Development of the Academic Staff in the Republic of Bulgaria, the Rules for its Application, the Rules for the Development of the Academic Staff at the MU-Varna and contains all the required documents, thoroughly described and arranged.

Doctoral candidate career profile:

Dr. Yavor Hristov Chenkov graduated from secondary education in profiled high school with teaching of Western languages "Zachariy Stoyanov", Sliven in 2008. He received his higher education in medicine in 2016. in Medical University "Dr. Paraskev Stoyanov", Varna. After successfully passing the competition in 2016. Dr. Chenkov is already part of the academic staff of the University of Varna, as an assistant professor in the Department of Hygiene and Epidemiology at the Faculty of Public Health. During one year, in the period 2016-2017 works as well as medical a paramedic at First Psychiatric Clinic MBAL "St Marina" EAD - Varna. He was enrolled in 2017 as a regular specialist at the Second psychiatric clinic in the same hospital. From 2019 is a full-time PhD student at the Department of Hygiene and Epidemiology. The working experience of the PhD student is dedicated to scientific and teaching activities related to interests in the fields of space sciences, zoology, and the arts. He has participated in numerous national and international scientific forums. From 2015 until 2017 he was the regional coordinator of Greenpeace International for the city of Varna, and since 2019 until now he has been an expert at the "Green Sea Yard of Varna" - a center for early socialization, diagnosis, and prevention of children from 0 to 3 years old. Dr. Chenkov has been a certified clinical hypnotherapist since 2021. The same year participated in the Mars 25 project, which reached to semi-final in the traditional yearly contest of NASA.

Relevance and relevance of the dissertation topic:

The dissertation is serious scientific research on a current and extremely important problem for society - the anthropogenic pollution of the environment, in particular of a water basin from plastic waste and the risk to human health. The rapid development of modern technologies, the emergence of new sources of pollution whose long-term effects on nature are not yet sufficiently well studied and evaluated, and the insufficient information and awareness of the public about the various aspects of the pollution of the planet raise several questions.

One of the most significant environmental challenges of our time, leading to disruption of the well-being of ecosystems in nature and carrying potential risks to human health, is the plastic pollution of water bodies. Plastic waste can enter the environment as a result of a large number of terrestrial and aquatic human activities. Due to the cycle of substances in nature, almost all pollutants from land, including plastics, at some point in time enter freshwater basins and from there into the seas and oceans. Plastic debris is found throughout the ocean, including coastal regions, the sea surface, deep-sea areas, and polar sea ice. Regarding plastic pollution in the marine environment, land-based sources have been shown to account for 60-80% of marine litter, while the remaining 20-40% originates primarily from marine/ocean sources. The main sources of plastic in water bodies are shipping activities (fishing, military, research, and tourist cruises); tourism (sea and land); household activities (microplastics from various household products and materials migrating to the marine environment through urban and rural sewage systems); production activities (improper disposal, incineration and recycling of a huge number of plastic products and their waste products entering the environment immediately after their production); agriculture and other sectors of the economy.

The physicochemical characteristics of different types of plastics determine their difficult degradation in the natural environment and their potentially long lifespans. The proven slow natural degradation is the reason for their existence for tens to hundreds of years in an almost unchanged form or varying degrees of fragmentation. The rate of natural polymer degradation can be affected by the complex action of various meteorological and environmental parameters of the environment. The majority of large

plastic debris is almost unchanged from its release into nature or has undergone a low degree of fragmentation.

The plastic problem pollution is globalized because it poses a potential risk of influencing natural ecosystems in mechanical, toxic, or other ways. These processes probably occur at many levels of the food web, of which humans are an integral part. Thus, he is also exposed to various health risks. All this determines the research problem not only as extremely topical but also as extremely socially significant.

The lack of in-depth, wide-ranging, scientific studies on the specific sources of plastic pollution in the Bulgarian water area of the Black Sea is a sufficient argument to evaluate the dissertation as a timely work that fully meets the public interest and the current needs of the public health.

General data for the dissertation:

The scientific work submitted for review is structured according to the modern standards adopted in our country and the requirements of the Medical University "Prof. Dr. Paraskev Stoyanov" - Varna regarding a dissertation for awarding the scientific degree "Doctor" in medicine. The dissertation was written on 168 pages, including 21 figures, 2 tables, 2 diagrams, and a bibliographical reference of 337 titles. It is properly structured with appropriate proportions between the literature review and the other parts – aim and objectives, methods, results and discussion, recommendations, conclusions, and contributions. An archive of photographic evidence is placed in the appendices, as well as the survey card used.

The title is worded precisely and clearly, and fully corresponds to the content.

In the presented Introduction, Dr. Chenkov emphasizes the importance of the problem.

The literature review is extensive, purposeful, and logically constructed. As a theoretical justification and a survey of the available literary sources on the subject of the dissertation, it is well structured in seven sections. The dissertation thoroughly and comprehensively defines the nature of plastics, their life cycle including three phases (production, use, and disposal), and the terminology he uses. Literature data on plastic pollution in seas and oceans, the Black Sea, rivers and lakes, and coastal zones are successively presented in separate subsections.

Despite the lack of biomonitoring studies in the current scientific work, the section "Risks to living organisms and humans" analyzes concepts of the impact (mechanical, toxicological, and epidemiological) that plastic materials can have on environmental ecosystems, as well as the potential risks for living organisms and human health. Special emphasis is placed on the best-studied plasticizers, from the group of phthalates and bisphenol A derivatives, the so-called endocrine disruptors, which harm the endocrine system, reproductive and other organs.

The author's style shows that he is familiar with modern scientific literature and this allows him to justify very well the aims and objectives of his research.

The aim of the dissertation is clearly defined - to outline a simplified conceptual framework for a step-by-step and segmental study of plastic pollution in the Bulgarian waters of the Black Sea and the adjacent coastal areas, in the Varna Region, by optimizing and implementing the various aspects of ecological and biological monitoring. This will help to carry out a comprehensive risk assessment and effectively protect marine ecosystems and the human population from potential environmental and health catastrophes. Achieving the goal is tied to 5 specific tasks. They are formulated clearly, precisely, in a logical sequence, and specifically outline the parameters of the study.

The design of the present research paper applied several different methodologies, including documentary, sociological, field methods, microscopic analysis, and statistical and graphical methods. A survey was conducted and applied to a sample of the population of the city of Varna, including questions related to the population's awareness of plastic pollution and its impact on the environment and the human body. The questionnaire (attached to the dissertation) was correctly developed by the PhD student, and the selection of questions followed the literature data. Based on part of the responses from the survey, a plan was drawn up to visit certain geographical locations to identify "hot spots/zones" with a concentration of plastic waste pollution.

The results cover the main part of the dissertation work. They are well-documented, detailed, and well-illustrated. The survey card sent on social networks was filled out by a total of 262 residents of the city of Varna and adjacent municipalities. Its one open-ended question has the greatest research value in determining the locations for pre-crawling and post-sampling. The selection of locations and sampling, as well as all site survey logistics, is consistent with some established marine and coastal

monitoring guidelines, with some additions and modifications. Debris collected during the two crawls of the central city beach and the northern shore of Lake Varna, other than "plastic" and belonging to the categories "metals", "paper" and "organic waste" were disposed of separately in the respective containers. The most common sherds fall into the "Other" category, of which 15 visibly worn (scratched, flaked, micro-cracked) were singled out for microscopic analysis. The results show that a part of them has undergone different degrees of fragmentation. Based on the assumed polymer composition, according to the observed category belonging to the debris, one part of them can be expected to pose risks of a toxic and epidemiological nature to aquatic ecosystems, and indirectly to the human population. The total weight of the collected plastic waste in the first crawl was approximately 1040 grams and in the second - 960 grams. Percentage distribution of the different categories of plastic waste was calculated, as well as the Clean-Coast Index (CCI), which is an objective method developed to assess the level of cleanliness of coastal areas. Figures show the percentage distribution of colored debris, as well as a distribution depending on the size of the detected waste: micro-, meso--- and macro-plastic.

The most common primary potential microplastic components of unconfirmed origin contained in some commercially available personal care products are identified. The majority of them are hair (shampoos, conditioners) and body (shower gel) products. For this purpose, using the "Beat the Microbead" smartphone application, a total of 65 products available for sale in a single store of the commercial network, located in an outer district of the city of Varna, were scanned.

The discussion of the results is highly appreciated. The discussion reflects the probable reasons for the particular results and the opinions of different researchers on the problem under consideration. In general, it can be said that the data are correctly interpreted in the light of the literature data on the existing scientific evidence.

The dissertation contains certain design limitations and weaknesses due to multiple geographic and resource factors. Additional unexplored locations should be surveyed in the future. It is necessary to investigate plastic waste not only on the surface of coastal areas but also on those located in depth. A disadvantage of the study is the non-representative sample of respondents in the survey, the small number of participants in the sampling, the lack of seasonal tracking of pollution dynamics,

scanning of packages of a small number of products from the commercial network for the presence of potential plastic additives in their contents. When applying microscopic methods, even more powerful professional equipment should be used.

Conclusions:

The 11 conclusions drawn are correctly formulated. They meet the set goals and objectives. The author states that studies of plastic pollution in the freshwater basins of Bulgaria, the Black Sea water area, and the adjacent coasts, are still at a very early stage and urgent measures are needed to protect ecosystems and human health. Regardless of the awareness of the residents of the city of Varna about the existence of an ecological problem with plastic pollution, a worrying fact is the lack of knowledge about the most common categories of plastic waste on the beaches.

Recommendations:

As a result of the analyses, conclusions, and conclusions, a model of a conceptual framework for a step-by-step and segmental study of this problem in the Varna region is proposed. It includes 4 different groups of methodologies, applied in a certain sequence, to thoroughly study the different aspects of plastic pollution in the environment, as well as the aspects of its harmful impact on ecosystems and the human population.

Conducting information campaigns related to plastic pollution could provide the necessary knowledge to citizens, including changing preferences and consumption behavior, which in turn is a good first step towards tackling this environmental problem.

Good consumer practice when choosing personal care products is to check the label and manufacturer's information to ensure that the product does not contain plastic particles and is recognized as "plastic-free".

My recommendation to Dr. Chenkov is to continue working on the topic and to promote his scientific results in an appropriate way (round table, monograph, etc.) among colleagues and the public.

Contributions:

The contributions from the conducted research are presented in two groups - those of an original nature (5 pieces) and contributions of a confirmatory and applied nature (4 pieces). I believe that they are very correctly described, without unnecessary repetition of facts, and I accept them in full. Contributions are undeniably original to

make an initial assessment of some of the most common types of microparticles with a potential plastic character added to personal hygiene products available in the commercial network and for the first time the microscopic analysis of waste from plastic pollution in the Varna region, to tentatively determine the degree of fragmentation and degradation.

Evaluation of the abstract:

An invariable part of the materials provided in this way is the abstract, in which the main part of the dissertation is presented on a total of 83 pages. The abstract fully corresponds to the content of the dissertation, it is very well designed both textually and graphically.

An objective criterion for the significance of Dr. Chenkov's dissertation work is the 3 scientific publications published on the subject and participation in 3 scientific forums. They contribute to the promotion of the PhD student's achievements in the scientific community. This publication activity fully satisfies the quantitative indicators of the Regulations of MU- Varna for the acquisition of the **educational and science degree "Doctor"**.

In summary:

The material presented to me for evaluation is a completed scientific work that confirms the fulfillment of the educational goals in the doctoral program. I congratulate the scientific supervisor Prof. Dr. Teodora Dimitrova and the PhD student Dr. Yavor Chenkov for choosing such a challenging, complex, multifaceted topic that creates opportunities for discussion and opens up subsequent research fields. It is no accident that there are few scientific studies on this problem in our country. The topic is significant, both for protecting a person's health and for preserving the ecological balance in nature.

The dissertation work shows that Dr. Chenkov can independently analyze and summarize data, discuss results, draw relevant conclusions, and make recommendations. Given this, I accept that the dissertation work is his work, with actual contributions and great practical significance.

Conclusion:

I give **an overall positive assessment** to the presentation by **Dr. Yavor Hristov Chenkov** - a PhD student in full-time study in the PhD student program **"Hygiene (incl.**

labor, communal, school, radiation, etc."), professional direction **7.1 Medicine**, field of higher education **7. Healthcare and sports** to Department of Hygiene and Epidemiology, Faculty of Public Health, Medical University "Prof. Dr. Paraskev Stoyanov" - Varna dissertation labor on the topic: **"Pollution of Varna region of the Black Sea with plastic waste and possible risks to human health"**.

The dissertation labor contains scientific-theoretical, methodological, and applied results that represent an original contribution to science and **is responsible for all requirements** on The law for development on the academic composition in the Republic Bulgaria, Regulations for application of ZRASRB and the Regulations for development on the academic composition at Medical University - Varna.

I give my positive vote **"YES"** and with pleasure and conviction I propose to the honorable Scientific Jury to award the educational and scientific degree "Doctor" to **Dr. Yavor Hristov Chenkov** in the scientific specialty "Hygiene".

08.02.2024

Review prepared by:

/prof. Magdalena Platikanova - Ivanova, MD, PhD/

Заличено на основание чл. 5,
§1, б. „В“ от Регламент (ЕС)
2016/679