

SCIENTIFIC OPINION

НАЦИОНАЛЕН ЦЕНТЪР ПО ОБЩЕСТВЕНО ЗДРАВЕ И АНАЛИЗИ	
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By: Assoc. Prof. Silvia Tsanova-Savova, PhD
Regarding: Dissertation Thesis for the award of scientific degree "Doctor"
On the subject: Study of the content of total mercury in various media of importance for human health and the environment.
Doctoral student: Daniela Dimitrova Stankova-Kostadinova, independent doctoral student in the scientific specialty "Hygiene", National Center of Public Health and Analyses.
Scientific Research Supervisor: Assoc. Prof. Rositsa Georgieva, PhD

On the basis of order No. RD-21/15.01.2024 of the Director of the National Center of Public Health and Analyses, I am included in a scientific jury for the defense of a Doctoral thesis "Study of the content of total mercury in various media of importance for human health and for the environment" for the award of the educational and scientific degree "Doctor", in the scientific specialty "Hygiene" in professional direction 7.1 Medicine from the field of Higher Education 7. Health care and sports, to doctoral student Daniela Dimitrova Stankova-Kostadinova.

The scientific opinion on the present dissertation work will be presented successively in three aspects: actuality of the problem, educational and scientific aspect.

ACTUALITY

The dissertation work is dedicated to a very relevant problem, dealing with both optimization and validation of analytical methods for the determination of mercury in various environments, as well as a large-scale study of mercury content in different media of importance to public health and the environment, with and important scientific and practical application. Mercury is classified as a priority hazardous substance in the European Union and beyond and is therefore included in almost all legislative documents relating to environments of importance to human health and the environment. There is no theoretical safe level for this highly toxic element and any concentration above the limit of quantification is considered unsafe. The World Health Organization designates mercury as one of 10 chemicals of major public health concern that require action by member states to protect public health. In the literature review, the physicochemical properties of mercury, professional and non-professional exposure, the toxic effect of elemental, inorganic and organic mercury are examined in detail. The available data on mercury content, the regulatory documents on its content in various environments, as well as the analytical methods for its determination are referenced. Up-to-date data from international organizations such as UNEP are provided for the assessment of Hg emissions by sector in kg, both at the global level and for Bulgaria.

In this regard, the aim of the doctoral work, to optimize and validate methods for the determination of total mercury by direct analyzer of solid and liquid samples and to apply them to the safety assessment of various media of importance for human health and the environment, is particularly topical and of wide social significance. Thus, the combination of importance of the topic and the wide scope of the results (a total of 2,583 samples from different environments were analyzed) determine the significant contribution of the current dissertation to the protection of human health and the environment.

EDUCATIONAL ASPECT

- The doctoral student has mastered in detail and depth one of the most modern methods for mercury determination - EPA 7473 "Method for direct determination of mercury in solid and liquid samples" using DMA-80, Milestone, as well as approaches for optimizing analytical conditions for its determination in different environments (including through the use of CRM), which is a key element in the conduct of any trial. The optimized method has been validated in accordance with BDS EN ISO/IEC 17025.
- Both the analytical method for mercury determination and the statistical methods for processing the results are known in depth and correctly applied. A very high level of knowledge of the European and national regulatory framework has been demonstrated, regarding the maximum values for mercury in cosmetic products, food, water, soil, sludge from waste water treatment, products made of polymeric materials.
- An in-depth level of knowledge on modern scientific achievements on the problem is shown, which is clearly highlighted by the detailed analysis of the literature (214 sources, of which 45 in Bulgarian and 42 from the last 5 years), as well as in the discussion of the results, in which a correct comparative evaluation with data of other authors has been made.
- The structure and layout of the dissertation clearly demonstrate an excellent mastery of the methodology for the implementation and presentation of research work.

SCIENTIFIC ASPECT

The appropriate design of the study, the selection of the studied environments, the applied optimized and validated methods for the analysis of mercury enable the doctoral student to achieve correct results, which are presented precisely, with the relevant statistical parameters and a clear numerical and graphical layout. The influence of the matrix is an essential factor for the analytical result, and in this regard, the PhD student presents a precise optimization of the standard EPA 7473 method for the determination of mercury in various media with a direct mercury analyzer DMA-80 in terms of drying temperature and time, temperature and time of decomposition, evaporation time, amalgam heating time, recording time. The optimization of the method leads to the achievement of very good validation parameters and demonstrates a detailed knowledge of the methodology used and of the specific conditions in the determination of total mercury in each investigated environment. The scale of the study - 2583 samples from different media were studied: cosmetic products - 1051 samples; foods, food additives and food additives - 227 samples; waters - 998 samples; soils - 104 samples; sediments - 109 samples; products made of polymer materials - 94 samples; the use of state-of-the-art analytical statistical methods determines the large number of results obtained, which are accompanied by an in-depth discussion, including a comparison with the current European and national regulatory framework in the field, as well as a comparison with various modern literature data.

Among the variety of results and conclusions of an original and confirmatory nature, I would like to emphasize in a summary as follows:

- Methods for the determination of mercury in cosmetic products, food, water, soils and sediments and polymeric materials have been optimized and validated, with very good analytical characteristics, which makes them suitable for application in researching the mercury content in components of the living environment.

- A survey of the mercury content in various media of importance to human health and the environment was conducted and their safety was assessed. In most of the samples analyzed, Hg concentrations were below the LOQ of the analytical procedures. Presence of mercury above the LOQ was found in 493 pcs. of the analyzed 2583 samples (19% of all products examined).
- The results of the large-scale study carried out in our country on the content of total mercury in various media of importance to human health and the environment show that the analyzed environments are safe in terms of the presence of mercury and when used do not pose a risk of increased intake of this toxic element.

Contributions are clearly formulated and correspond to the results obtained. It should be emphasized that, for the first time in Bulgaria, comprehensive studies have been carried out on the content of mercury in various environments of importance for human health and the environment: cosmetic products, water, food, soils, sediments for use in agriculture, polymer products materials, by applying an optimized and validated EPA 7473 "Method for Direct Determination of Mercury in Solid and Liquid Samples. Based on the results of the conducted large-scale research, the summarized and systematized information on the presence of mercury in the studied environments can be used in fulfilling Bulgaria's commitments in implementing Regulation (EU) 2017/852 and the Minamata Convention on mercury.

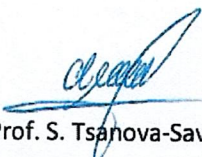
CONCLUSION

Based on the following assessments:

1. The topic of the dissertation is of current concern.
2. State-of-the-art analytical methods for mercury determination are applied, which are optimized for different environments and validated, according to modern requirements.
3. The obtained results are precisely presented, with an original and confirmatory character.
4. Contributions are correctly formulated, with scientific and applied significance.
5. Five scientific publications and 9 participations with scientific reports in scientific forums are attached to the dissertation work, which meet the requirements for the scientific degree "Doctor".

With deep conviction, I give my positive assessment of the dissertation work and propose to members of the scientific jury to award the educational and scientific degree "Doctor" to Daniela Dimitrova Stankova-Kostadinova in the scientific specialty "Hygiene".

07.02.2024


Assoc. Prof. S. Tshanova-Savova, PhD