Appendix 12b

REPORT

of dissertation for the acquisition of:

educational and scientific degree "**doctor** "	X
scientific degree **"Doctor of Science"**	
	the true is indicated by the sign "X"

Author of the dissertation:

		Asya	Konstantinova	Manoylova	UCTM
academic position	scientific degree	name	middle name	last name	workplace

Topic of the dissertation:

Sustainable Soil Management with Carbon Farming

Scientific area:

5	Engineering sciences
code	name

Professional area:

5.13	General Engineering
code	name

Scientific specialty:

Systems and Devices for Environmental Protection

The report was written by:

Assoc. Professor	Doctor	Nadia	Lubomirova	Petrova	IMC-BAS
academic position	scientific degree	name	middle name	last name	workplace

1. Meeting the minimum requirements under the Regulations:

A) The candidate meets the minimum requirements	20 points	X
B) The candidate doesn't meet the minimum requirements	0 points	
		one of the answers given is marked with the sign "X"

It is mandatory to fill in if answer B is marked. The publication activity of the candidate is analyzed. The response of the results achieved (quoted) is analyzed.

In accordance with the requirements of the Development of Academic Staff in the Republic of Bulgaria Act, the Rules for its Implementation, and the Regulations of the University of Chemical Technology and Metallurgy (UCTM), Asya Konstantinova Manoylova fully satisfies the minimum requirements for acquiring the educational and scientific degree of 'Doctor' (PhD) in professional field 5.13. General Engineering. As evident from the submitted reference in Appendix 1z to the Rules for the Implementation of the Development of Academic Staff in the Republic of Bulgaria Act (RIRDASRBA), the candidate accumulates a total of 61.66 points, which exceeds the required minimum. Regarding the topic of the dissertation thesis, 4 scientific publications have been presented, two of which are in journals referenced and indexed in world-renowned scientific information databases (by SJR metric: rank Q3 and Q2), while two of the publications, in which the candidate is first author, have been published in edited collective volumes of scientific conferences. One citation of a publication related to the dissertation thesis and participation in a project under the National Recovery and Resilience Plan have also been presented. The results of the dissertation thesis are represented by 8 participations in 6 national and/or international scientific forums.

2. The relevance of the topic of the dissertation:

A) The topic is relevant and new (there are no known results on the topic by other authors)	8 points	X
B) The topic is relevant and results from other authors are known	6 points	
C) The topic is not relevant, but results from other authors are known	2 points	
D) The topic is not relevant and no results from other authors are known	1 point	
E) The topic does not correspond to the level of dissertation	0 points	
		one of the answers given is marked with the sign "X"

The evaluation of the relevance of the dissertation must be substantiated
The topic of the dissertation is timely and scientifically significant, demonstrating high potential for practical application in sustainable soil management and carbon farming. An integrated approach combining sewage sludge from wastewater treatment plants with biomass ash fractions, potash ash, natural zeolite, and organic additives leads to the formation of stable organo-mineral systems with enhanced physicochemical properties. These multicomponent systems are of particular interest as they combine a source of organic carbon with mineral components capable of participating in its retention and transformation. Additional treatment with sulfuric acid promotes phase transformations and improves the agrochemical characteristics of the resulting mixtures. Comprehensive studies on the formation of such systems are currently lacking in the scientific literature, as are detailed investigations establishing the interrelationships between chemical composition, phase transformations, and spectroscopic, microstructural, and morphological characteristics. Such a comprehensive investigation would be of key importance for assessing the applicability of industrial and agricultural waste materials in sustainable soil management and carbon farming.

3. Type of research:

A) Theoretical	4 points	
B) Applied	4 points	

C) Theoretical with application elements	4 points	X
D) It does not correspond to the level of dissertation	0 points	
		one of the answers given is marked with the sign "X"

The level of research must be substantiated if answer D is marked.
The dissertation combines an experimental setup with a physicochemical interpretation of the results regarding their applicability in carbon farming. The experimental approach is logically structured, involving the development of waste product mixtures with varying organo-mineral compositions: biomass ash and bottom ash, industrial sludges, zeolite, and poultry manure. Initially, the reference state of the mixtures was determined, followed by tracking the changes occurring upon acid activation and the incorporation of additional functional components. The chemical, mineralogical, and morphological characteristics of the resulting systems were determined using elemental chemical analysis (ICP-OES and CHNS data), powder X-ray diffraction (PXRD), infrared spectroscopy (IR), and scanning electron microscopy (SEM). Based on this comprehensive physicochemical approach for determining nutrient elements, organic carbon, potentially toxic element content, phase transformations, and the presence of organic functional groups, as well as carbonate, sulfate, and aluminosilicate structural units, a subsequent assessment of the developed organo-mineral systems for soil ecological applicability was conducted.

4. Objectives of the research:

A) Realistic and of scientific and / or applied interest	8 points	X
B) Realistic, but not of scientific and / or applied interest	3 points	
C) Unattainable (unrealistic)	0 points	
		one of the answers given is marked with the sign "X"

Objectives must be specified. The type of the set objectives must be justified.
The dissertation formulates a primary objective: the development and characterization of organo-mineral mixtures based on industrial and agricultural wastes with potential for application in sustainable soil management and carbon farming. To achieve this objective, the following sequential tasks were set: selection and characterization of suitable waste materials and mineral components; development of experimental mixtures with varying organo-mineral ratios; physicochemical, mineralogical, and morphological characterization of the obtained systems; assessment of the influence of individual components on the stabilization of organic matter and the mineral matrix; and evaluation of the potential of the developed mixtures for application as soil amendments. The set objective is scientifically sound, fully achievable within the framework of the listed tasks, and was subsequently successfully accomplished in the dissertation.

5. Contributions of the dissertation:

A) With lasting scientific and / or applied response, they form the basis for new research and applications	20 points	X
B) They are of significant scientific and / or applied interest, complete and / or summarize previous research	16 points	
C) They are of scientific and / or applied interest	12 points	

D) Lack of significant contributions	8 points	
E) Lack of contributions	0 points	
		one of the answers given is marked with the sign "X"

Contributions must be specified. The type of results achieved must be justified.
The presented dissertation proposes an innovative and scientifically significant solution with direct application in sustainable soil management and carbon farming. **The scientific contributions** and novelty of the work are manifested in the development of a comprehensive, multi-stage process – from the sequential mixing of organic waste with ashes, through acid activation, to final modification with potassium and aluminosilicates. The ratios in the individual series are precisely selected to ensure an optimal balance between nutrient potential, alkalinity, and environmental safety. The process is optimized through acid activation with sulfuric acid, which stabilizes the mineral matrix and promotes the formation and transformation of mineral phases, functional groups, and reactive structural components, while simultaneously limiting the mobility of toxic elements. The study builds upon existing literature data by focusing on the chemical, mineralogical, and microstructural evolution of waste and mineral materials during their combined utilization, thereby expanding scientific knowledge regarding the behavior, transformation, and stabilization of carbon-containing and nutrient components. Thus, the dissertation makes a valuable fundamental contribution to the scientific understanding of the interactions between the organic and mineral fractions in the development of multi-component soil amendments. **The applied scientific contributions** lie in the development of a scientifically grounded approach for the valorization of waste streams from biomass, industrial sludges, and organic residues by incorporating them into multi-component formulations to produce soil amendments, thereby creating prerequisites for their resource recovery in accordance with the principles of the circular economy. This approach possesses high replication potential and can be applied in the investigation and preliminary assessment of analogous products derived from secondary raw materials. Furthermore, the dissertation formulates a clear applied scientific concept for implementing the developed mixtures into sustainable soil management and carbon farming practices, aimed at improving soil properties, ensuring the efficient utilization of nutrients, and reducing the environmental footprint

6. Conclusion

A) The evaluation of the dissertation is **POSITIVE**	This evaluation is assigned to a total number of at least 40 points	X
B) The evaluation of the dissertation is **NEGATIVE**	This evaluation is assigned to a total number below 40 points	
		one of the answers given is marked with the sign "X"

To be filled in at the request of the member of the scientific jury
The submitted dissertation meets the requirements of the ADASRB, the Regulations for its Implementation, and the Regulations of the UCTM for the acquisition of the educational and scientific degree "Doctor" . The thesis is distinguished by its topicality, scientific novelty, and significant applied potential, as well as by an in-depth analysis of the scientific literature and knowledge regarding EU strategies and initiatives for the implementation of carbon farming. I evaluate the dissertation with the maximum number of points according to the evaluation form

indicators – a total of 60 points. I propose to the honorable Scientific Jury to award Asya Konstantinova Manoylova the educational and scientific degree "Doctor" in Professional Field 5.13. General Engineering (Environmental Protection Systems and Devices).

11.11.2026	The report was written by:	Signature:
date	Assoc. Prof. Dr. Nadia Petrova	