Appendix 12a

REVIEW

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	
academic position	scientific degree	name	middle name	last name	workplace

Topic of the dissertation:

Stable Soil Management with Charcoal-Based Agriculture

Scientific area:

5	Technical Sciences
code	name

Professional area:

5.3	General Engineering
code	name

Scientific specialty:

The review was written by:

Associate Professor	phD	Georgi	Vyacheslavovich	Avdeev	IPC-BAS
academic position	scientific degree	name	middle name	last name	workplace

1. Completion of the provided documents:

A) The dissertation and the competition documents are in full compliance with the Regulations.	4 points	**X**
B) The documents are complete but do not fully comply with the requirements of the Regulations.	2 points	
C) The documents are not completed in accordance with the requirements of the Regulations.	0 points	

		one of the answers given is marked with the sign "X"

Missing documents and violated standards must be described if response C is marked.

2. 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 must be filled in if answer B is marked. The publication activity of the candidate is analyzed. The response of the results achieved (quoted) is analyzed.

3. 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	
B) The topic is relevant and results from other authors are known	6 points	X
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 chosen topic is highly relevant and significant in the contemporary context. It fully aligns with the European Union's priority scientific, economic, and political objectives for building a greener future. The study provides a detailed development and analysis of key strategic tasks, including carbon agriculture, the efficient utilization of diverse agricultural by-products, and the comprehensive sustainable management of natural resources. Within the framework of the study, the term "circular resource economy" is introduced and established; it is in direct synergy with the broader European strategy for a smooth green transition and climate neutrality. In terms of their nature and content, the dissertation includes planned and successfully conducted in-depth experimental studies on various innovative mixtures composed of agricultural waste products. The empirical results obtained from laboratory investigations into the physicochemical properties of the modified mixtures unequivocally demonstrate that they possess significant and undeniable potential for practical application as high-quality functional soil amendments. This effective approach

realizes the concept of a fully closed resource cycle, in which generated industrial waste is transformed into useful and valuable functional materials that directly support the sustainable and responsible management of resources in the long term.

4. Knowledge of the problems, subject of research in the dissertation:

A) The doctoral student knows in detail the achievements of other authors on the topic of the dissertation	8 points	X
B) The doctoral student is partially familiar with the achieved results on the topic of the dissertation	4 points	
C) The doctoral student has no prior knowledge of the status of the problems in the dissertation	0 points	
		one of the answers given is marked with the sign "X"

The evaluation must be substantiated if answer C is marked.
The doctoral candidate demonstrates an exceptionally profound and detailed understanding of the scientific achievements and contributions of other established authors who have worked on the specific topic of the dissertation. She has conducted a comprehensive and systematic critical review of the existing literature; on this solid foundation, she has successfully and professionally selected the most appropriate materials for carrying out her practical research. It is precisely thanks to this meticulous preliminary preparation and theoretical foundation that she achieves excellent, high-quality results in conducting experimental analyses, which are supported by compelling and scientifically substantiated conclusions.

5. Type of research:

A) Theoretical	4 points	
B) Applied	4 points	X
C) Theoretical with application elements	4 points	
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 studies conducted have a pronounced applied scientific character and are oriented toward practical application.

6. 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 objective of this study is to develop and investigate various innovative blends composed of waste products generated as a result of agricultural activities; these blends have potential applications in carbon agriculture and could contribute to the realization of a "circular resource economy," while their properties and potential for practical application are evaluated. The objectives set are realistic and well-founded, representing both scientific and applied interest, as they are aimed at the practical utilization of waste resources, the development of sustainable solutions, and the creation of foundations for more efficient resource use in the relevant field.

7.Methods of research:

A) Adequate to research and set objectives	8 points	X
B) Partially appropriate, enabling part of the scientific objectives and / or applications to be achieved	4 points	
C) Inappropriate methods	0 points	
		one of the answers given is marked with the sign "X"

Methods must be specified. The type of methods used is justified.
Extensive and systematic studies have been conducted to achieve the set objectives, covering both the elemental and phase composition and the characterization of the nature of the salts obtained as a result of their modification after blending, activation, and subsequent processing. For this purpose, a wide range of physicochemical methods has been employed, including X-ray diffraction, infrared spectroscopy, scanning electron spectroscopy with energy-dispersive analysis, differential thermal analysis, and optical emission spectroscopy. These methods enable the tracking of both the initial characteristics of the materials under study and the changes that occur in them as a result of the applied stimuli. The methods employed were applied skillfully and appropriately, with each one tailored to the specific objectives of the study. Using X-ray phase analysis, data on the phase composition were obtained for both the raw materials and the individual mixtures; the changes that occurred after activation were then tracked. The elemental composition was monitored by optical emission spectroscopy, while at the micro level it was analyzed by energy-dispersive spectroscopy. The thermal behavior of the raw materials and the resulting products was characterized using differential thermal analysis. A portion of the obtained samples contained an amorphous phase, the characterization of which was carried out using infrared spectroscopy. Changes in the morphology of the obtained samples were observed using scanning electron microscopy. The results obtained are valid, promising, and correctly interpreted, which confirms the appropriateness of the selected set of research methods and provides a basis for reliable conclusions regarding the materials under study and the changes that have occurred in them.

8. Contributions of the dissertation:

A) With lasting scientific and / or applied response, they form the basis for new research and applications	20 points	
B) They are of significant scientific and / or applied interest, complete and / or summarize previous research	16 points	X
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.
Scientific contributions: 1. The studies conducted establish and experimentally validate a scientific framework for the extraction and characterization of soil amendments from waste and mineral materials (biomass ash, co-incineration ash, industrial residues, zeolite, and bird guano). The influence of component type and composition ratio on phase transformations, morphology, and elemental composition was investigated in 40 different compositions distributed across three series. 2. The relationships between the compositions of the mixtures and their morphology, phase and elemental composition were established and elucidated using ICP, SEM/EDS, X-ray phase analysis, infrared spectroscopy, and elemental analysis. The role of the components and acid modification in the formation and transformation of mineral phases and reactive structural components was clarified. 3. Expanded knowledge regarding the behavior, transformation, and stabilization of carbon-containing and nutrient components during the co-use of waste and mineral materials. The established presence of organic functional groups, carbonate, sulfate, and aluminosilicate units, as well as biogenic elements, enriches our understanding of interactions between the organic and mineral fractions and underpins the potential of systems for the sustainable management of soils and carbon. Contributions from applied research 1. A scientifically grounded approach has been developed for the utilization of biomass waste, industrial residues, and organic by-products by incorporating them into multi-component soil improver mixtures. This approach enables the combination of secondary raw materials with mineral additives, thereby ensuring resource utilization in accordance with the principles of a circular economy and the sustainable management of soils. 2. An analytical framework has been developed for analyzing the composition, structure, and agroecological potential of multi-component soil improvers. It can be used in the development and preliminary assessment of similar materials derived from secondary raw materials. 3. Formulated on a scientifically applicable concept and perspective for applying the mixtures to the sustainable management of soils and carbon, with the aim of improving soil properties, enhancing nutrient uptake, and reducing the environmental footprint of waste. This approach integrates the principles of carbon agriculture, regenerative soil practices, and the circular economy, and can serve as a basis for future technological development and agronomic validation.

9. Evaluation of the compliance of the dissertation summary with the dissertation:

A) Full compliance	4 points	X
B) Compliance of the main parts	2 points	
C) Lack of compliance of the main parts	0 points	
		one of the answers given is marked with the sign "X"

The evaluation must be substantiated if answer C is marked.
The abstract and the dissertation are fully consistent with each other both in content and structure, with the abstract accurately reflecting the main arguments of the dissertation.

10. Participation of the doctoral student in the achievement of the results of the dissertation:

A) The doctoral student has at least an equal participation	8 points	X
B) The doctoral student has secondary participation	5 points	
C) The participation of the doctoral student is unnoticeable	0 points	
		one of the answers given is marked with the sign "X"

Critical notes must be provided if one of the items B or C is marked.

11. Critical notes:

A) Lack of critical notes	8 points	X
B) Critical notes of a technical nature	7 points	
C) Critical notes that would partially improve the results achieved	4 points	
D) Significant critical notes	0 points	
		one of the answers given is marked with the sign "X"

Critical notes must be provided if one of the answers C or D is marked.
I have no critical remarks, except that some of the results obtained have not yet been published. This, however, is entirely explainable and is attributable to the collaboration with private companies, which typically delay the presentation of results from joint research to the broader public for a certain period. This is a common practice in partnerships of this kind, and it does not alter my overall assessment, as it neither calls into question the quality of the results obtained nor the value of the studies conducted.

12. Conclusion

A) The evaluation of the dissertation is **POSITIVE**	This evaluation is assigned to a total number of at least 65 points	X
B) The evaluation of the dissertation is **NEGATIVE**	This evaluation is assigned to a total number below 65 points	
		one of the answers given is marked with the sign "X"

To be filled in at the request of the reviewer
The primary contribution of this work lies in shifting the perspective in the development and investigation of innovative blends composed of waste products generated by agricultural activities;

the focus is placed not only on the final outcome of their application but also on the preliminary understanding of their properties and behavior. Based on a review of the literature, the prevailing approach has primarily focused on the random mixing of raw materials and on field observation of their effectiveness in use; consequently, the process has relied more heavily on subsequent evaluation than on prior planning, targeted analysis, and systematic comparison of the available alternatives. This dissertation proposes a change in approach by conducting preliminary physicochemical characterization of the resulting mixtures, thereby enabling a more well-founded and systematic investigation of their properties even before their practical application and providing a more reliable foundation for decision-making during their development. This represents significant scientific and applied interest that could play a key role in developing new blends and improving existing ones composed of waste products generated by agricultural activities.

15.11.2026	The review was written by:	
date		signature