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:

Assistant Professor		*Georgi*	*Bozhilov*	*Georgiev*	*UCTM*
academic position	scientific degree	name	middle name	last name	workplace

Topic of the dissertation:

SYNTHESIS AND APPLICATION OF MODIFIED CARBON MATERIALS DERIVED FROM RENEWABLE RAW MATERIALS AND INDUSTRIAL WASTES

Scientific area:

5	*Technical Sciences*
code	name

Professional area:

5.10	*Chemical Technologies*
code	name

Scientific specialty:

Technology of natural and synthetic fuels

The review was written by:

Assoc. prof.	Doctor	Silviya	Igorova	Lavrova-Popova	UCTM
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.
The submitted dissertation and the accompanying documents, in accordance with the procedure, are available and comply with the requirements of the Regulations for Acquiring Scientific Degrees and Occupying Academic Positions at UCTM.

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.
The applicant satisfies the minimum requirements based on the submitted publication activity. The dissertation lists 6 publications related to the topic, with a total point value of 38.96. The publications are in journals that are referenced and indexed in world-renowned databases, including journals with quartiles Q1, Q2, Q3, and Q4.

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 topic is relevant because it addresses the simultaneous recovery of renewable raw materials and waste, the production of carbon adsorbents, the treatment of wastewater, and the development of carbon catalysts for chemical processes. These areas are directly related to the circular economy, resource efficiency, and green technologies. The literature reports results on producing activated

carbons from biomass and waste, but the specific raw materials, technological approaches, and applications discussed in the work make distinct scientific and applied contributions.

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 PhD student demonstrates detailed knowledge of the state of the problem. The literature review covers the properties and applications of carbon materials, methods of physicochemical characterization, methods for producing and activating activated carbons, types of waste biomass, and the potential of carbon materials as catalyst carriers. The literature is broad and sufficiently up to date to support the goals and objectives.

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 research is primarily applied, with a pronounced experimental character. It focuses on obtaining, modifying, characterizing, and evaluating functional carbon materials such as adsorbents and catalysts. There are also elements of scientific generalization regarding the influence of the type of precursor, the activation method, and surface chemistry on the properties of the resulting materials.

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 objectives are realistic, specific, and of scientific and practical interest.

7.Methods of research:

A) Adequate to research and set objectives	8 points	
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.
The methods used are appropriate for the goals set. Approaches to the synthesis and modification of carbon materials, such as pyrolysis, hydropyrolysis, chemical activation, and physical activation, are applied in this work. Iodine number, elemental analysis, BET, SEM/EDS, TEM, XRD/RSA, FTIR, Raman spectroscopy, XPS, Boehm method, and DTA/TG/DSC were used to characterize the materials. The combination of methods enables a reliable link among structure, surface chemistry, and functional properties.

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.
The contributions are of significant scientific and applied importance. The main ones are: development of an integrated approach for utilising various waste raw materials to produce functional carbon materials; establishing a link between the origin and composition of raw materials, processing conditions, and the formation of a porous/graphite-like structure; production of turbostratic carbon from polystyrene waste in an open system without pressure; development of an energy-efficient method for atmospheric carbon foam synthesis; production of effective carbon adsorbents for removing organic pollutants; development of heterogeneous carbon catalysts with combined Brønsted and Lewis acid centers to convert glucose into 5-hydroxymethylfurfural.

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 accurately reproduces the aim, objectives, methods, main results, conclusions, contributions, and publications. There is "full correspondence".

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.
Given the volume of experimental research conducted, the availability of publications related to the dissertation, and the inclusion of the results in summarized conclusions and contributions, the PhD student's participation can be assessed as at least equivalent. The presented results are sufficiently consistent and thematically related, indicating active participation in the planning, implementation and interpretation of the research.

11. Critical notes:

A) Lack of critical notes	8 points	
B) Critical notes of a technical nature	7 points	**x**
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.
The critical remarks are of a technical and editorial nature and do not change the positive assessment of the work. In the dissertation, there are some technical and editorial inaccuracies, mainly related to

the numbering of sections, tables and figures, as well as references to them (e. g., on page 96 it says "Table 20 shows...", but in reality the next table is Table 23; on p. 99, Fig. 37 is cited for the distribution of pores, but the corresponding figure seems to be Fig. 39, because Fig. 37 is a photograph of carbon foam; on p. 111, it states that the result for unmodified AC is "described in detail in Table. 24", but the yields of HMF are in Table 27), single terminological inaccuracies (e.g., on page 1, it is written "educational and qualification degree "DOCTOR". The correct academic wording for a doctoral dissertation is "educational and scientific degree "DOCTOR", not an educational and qualification degree; on p. 9, it is written that the structure of activated carbon affects its ability to "absorb substances". For activated carbons in this context, the correct term is "adsorb" because it refers to retention on the surface/in the pores, not to be absorbed into the volume of the material; the unit of measurement of the iodine number - the symbol of iodine is I, not J, etc.; on p. 80, the term "purification" is used, which is Russism. It is correct to use the word "purification"; etc.) and inconsistencies in the designations of some samples (e.g., in Section 3.2. 3.2.4, the title is for activated carbon from bitumen waterproofing (BHI), but designations such as RDF, RDF (BW) and RDF appear in the tables and text. This creates ambiguity as to whether the data are for bituminous waterproofing, RDF or a mixture/transition from a previous section. Also, the title of Table 27 speaks of the use of a 50/50 mixture of ACZn and AC 18 M, but in the table itself separate rows are given for AC, ACZn, AC 18 M, H_2SO_4, $Zncl_2$, etc. If the 1: 1 mixture gives 76. 8% HMF, this should be clearly explained so that there is no discrepancy between table, figure and text).
These inaccuracies do not reduce the scientific and practical value of the results obtained. It is recommended that future developments include more precise layout, refined terminology and synchronization.

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 structure and volume of the work meet the requirements of the Law on the Development of the Scientific Staff of the Republic of Bulgaria for awarding the educational and scientific degree "Doctor". Based on the topic's relevance, the adequacy of the methods, the volume of the experimental work performed, the scientific and applied results obtained, the contributions formulated, and the publication activity, I give a positive assessment of the dissertation on the topic "Production and application of modified carbon materials based on renewable raw materials and industrial waste". I propose to the scientific jury that the educational and scientific degree "Doctor" be awarded to Assistant Master Eng. Georgi Bozhilov Georgiev in the professional field 5.10. Chemical Technologies, scientific specialty "Technology of Natural and Synthetic Fuels".

29.05.2026	The review was written by:	
date		signature