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:

	MSc	Nikoleta	Dragomirova	Philipova	Integra Plastics AD
academic position	scientific degree	name	middle name	last name	workplace

Topic of the dissertation:

OBTAINING OF ANTIBACTERIAL PHOTOACTIVE POLYMER COATINGS

Scientific area:

4	Natural Sciences, Mathematics and Informatics
code	name

Professional area:

4.2.	Chemical sciences
code	name

Scientific specialty:

Chemistry of High Molecular Weight Compounds

The report was written by:

Assoc. Prof.	Ph.D.	Natalia	Valentinova	Toncheva-Moncheva	Institute of Polymers, Bulgarian Academy of Sciences
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.

According to the rules for acquiring scientific degrees and occupying academic positions at the UCTM, the candidate Nikoleta Filipova exceeds the minimum requirements. The scientific publications included in the current Tthesis (5 items, two publications in Q3, two publications in Q2, one publication with SJR without IF), are referenced and indexed in world-famous databases with scientific information (Web of Science and Scopus), and correspond to 70 points with a minimum number of required points of 50 (indicator 7 in Appendix 5a). Four citations were noted for the scientific publications included in the current thesis. The scientific publications outside the thesis are 3 (one publication in Q1 and two publications in Q2).

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
All the research presented is modern and relevant, special attention being paid to the studies related to the preparation of photoactive polymer coatings based on: - polymer nanogel and amino modified photosensitizer based on 9-aminoacridine; - polymer nanogel (type "in") with incorporated silver nanoparticles (Pox(mDOPA)-Ag0/PAH) and photosensitizer – amino modified protoporphyrin IX, as well as those using a complex of amino modified protoporphyrin IX with incorporated silver nanoparticles as the final layer; on stainless steel substrates. As a result of these studies, it was found that - the obtained photoactive polymer coatings based on polymer nanogel and amino modified photosensitizer based on 9-aminoacridine possess good adhesion and mechanical properties as well as strong antibacterial activity against gram-negative E. Coli. - the obtained photoactive polymer coatings based on polymer nanogel (type "in") with incorporated silver nanoparticles (Pox(mDOPA)-Ag0/PAH) and photosensitizer - amino modified protoporphyrin IX, as well as those using a complex of amino modified protoporphyrin IX with incorporated silver nanoparticles as the final layer, possess good adhesion, scratch resistance, good mechanical properties and strong antibacterial activity towards Gram-negative E. Coli and Gram-positive B. Subtilis strains, which is more clearly pronounced towards Gram-negative bacteria. The results obtained of nanogels usare as suitable coatings for different types of surfaces and the possibility of incorporating different photoactive compounds in them is a new and interesting approach for the preparation of effective antibacterial coatings with potential application in the field of chemical, pharmaceutical and other industries.

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.

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 goals set of the research studies under consideration are realistic and definitely have scientific and applied interest.

The goals related to theoretical studies are:
1. Synthesis of a nanogel based on poly(N-methacryloyl 3,4-dihydroxy-L-phenylalanine methyl ester) (P(mDOPA)) and poly(allylamine hydrochloride) (PAH) using amine/quinone interactions;
2. Modification of the photosensitizer protoporphin IX to obtain a suitable functional amino group in the structure, which will easily participate in covalent bonding to the corresponding functional nanogels via amine/quinone interactions and the preparation of photoactive polymer coatings on a stainless steel substrate;
3. Synthesis of silver nanoparticles, which will be incorporated into a polymer nanogel based on polymethacrylamide containing 3,4-dihydroxy-L-phenylalanine (DOPA) groups (P(mDOPA)) and polyallylamine (PAH) containing primary amino groups (Pox(mDOPA)-Ag0/PAH).

The objectives related to applied studies are:
1. Preparation of two-layer coatings based on Pox(mDOPA)/PAH nanogel on a stainless steel substrate by a “dip coating” procedure, as a first layer it was deposited a synthesized polycationic P(mDOPA)-co-P(DMAEMA+) copolymer, and the next layer were made of a nanogel based on Pox(mDOPA)/PAH;
2. Preparation of a polymer nanogel and an amino modified photosensitizer based on 9-aminoacridine;
3. Preparation of photoactive polymer coatings on a stainless steel substrate by sequential deposition of three layers, the polycationic P(mDOPA)-co-P(DMAEMA+) copolymer, the nanogel based on Pox(mDOPA)/PAH and the modified 9-aminoacridine.
4. Preparation of photoactive polymer coatings with incorporated silver nanoparticles by functionalizing the polymer coating with a photosensitizer based on protoporphyrin.
5. Study of antibacterial activity of the obtained coatings and the possibility тo utilize them as a platform for preparing antibacterial polymer coatings for various applications in the field of pharmaceutics and medicine.

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.
I. Fundamental contributions: 1. An anogel based on poly(N-methacryloyl 3,4-dihydroxy-L-phenylalanine methyl ester) (P(mDOPA)) and poly(allylamine hydrochloride) (PAH) was prepared using amine/quinone interactions. 2. The photosensitizer 9-aminoacridine was modified to create a suitable functional amino group. 3. The photosensitizer protoporphin IX was modified to create a suitable functional amino group in the structure suitable to participate in covalent bonding to the appropriate functional nanogels via amine/quinone interactions and the preparation of photoactive polymer coatings (PPIX-ED). 4. It was found that the obtained PPIX-ED showed pronounced antibacterial activity against Gram-negative E. Coli and Gram-positive B. Subtilis strains. 5. Silver nanoparticles were synthesized and successfully incorporated into a polymer nanogel based on polymethacrylamide containing 3,4-dihydroxy-L-phenylalanine (DOPA) groups (P(mDOPA)) and polyallylamine (PAH) containing primary amino groups (Pox(mDOPA)-Ag0/PAH). The obtained results of a fundamental nature will contribute to the accumulation of new knowledge in the relevant scientific field. II. Contributions of an applied nature: 1. Coatings based on Pox(mDOPA)/PAH nanogel were obtained on a stainless steel substrate by a “dip coating” procedure, using as the first layer a polycationic P(mDOPA)-co-P(DMAEMA+) copolymer, and the second layer of nanogel based on Pox(mDOPA)/PAH was deposited. 2. Photoactive polymer coatings were prepared on a stainless steel substrate by sequentially depositing three layers, a polycationic P(mDOPA)-co-P(DMAEMA+) copolymer, a nanogel based on Pox(mDOPA)/PAH, and modified 9-aminoacridine. The obtained photoactive polymer coatings were found to possess strong antibacterial activity against Gram-negative E. coli. 3. Modified amino protoporphyrin (PPIX-ED) was used to prepare three-layer photoactive polymer coatings on a stainless steel substrate by sequentially depositing the polycationic P(mDOPA)-co-P(DMAEMA+) copolymer as the first layer, Pox(mDOPA)/PAH nanogel as the second layer, and a third layer based on PPIX-ED. 4.The obtained Pox(mDOPA)-Ag0/PAH) nanoge, showed pronounced antibacterial activity against Gram-negative E. Coli and Gram-positive B. Subtilis strains. 5. Two-layer polymer coatings on SS were obtained by dip coating procedure using the polycationic (P(mDOPA)-co-P(DMAEMA+) copolymer and Pox(mDOPA)-Ag0/PAH nanogel. It was found that the obtained coatings have good adhesion, scratch resistance and mechanical properties. 6. Photoactive polymer coatings with incorporated silver nanoparticles were obtained by functionalization of the polymer coating with a photosensitizer based on protoporphyrin. It was found that they have the best adhesive and mechanical properties compared to the other studied coatings, as well as pronounced antibacterial properties against Gram-positive and Gram-negative bacteria. The obtained results of an applied nature represent an excellent base for new directions of research and applications.

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
Based on the overall evaluation, my assessment of Nikoleta Filipova's work is **POSITIVE** with a maximum total score of 60 points. The documents presented by the candidate fully comply and meets the requirement of the Law on the **ACQUISITION OF SCIENTIFIC DEGREES AND DEVELOPMENT OF THE ACADEMIC STAFF IN THE REPUBLIC OF BULGARIA** for acquiring the academic position of „doctor" in the scientific specialty 4.2 Chemistry of High Molecular Weight Compounds at University of Chemical Technology and Metallurgy. Moreover, the candidate exceeds the minimum requirements for acquiring the educational and scientific degree" doctor". The presented research is up-to-date, the literature review of Nikoleta Filipova thesis describes in detail what has been achieved by other authors on the same researched topics and applications. The obtained results of a fundamental nature will contribute to the accumulation of new knowledge in the relevant scientific field, and those of an applied nature represent the basis for new research directions and applications. This gives me reason to recommend to the Scientific Jury to render a positive decision on Nikoleta Dragomirova Filipovana filling the the educational and scientific degree of "doctor", in scientific specialty 4.2. Chemical Sciences (Chemistry of High Molecular Compounds).

22.12.24	The report was written by:	
date		signature