

## REVIEW

**by Prof. Dr. Evgenia Petrova Valcheva**  
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of the materials submitted for participation in the competition for the academic position "professor" at Paisiy Hilendarski University of Plovdiv, field of higher education 4. Natural sciences, mathematics and informatics, professional direction 4.1 Physical sciences (Physics of condensed matter).

In the competition for "professor", announced in the State Gazette, no. 92 of 18.11.2022 and on the website of Plovdiv University "Paisiy Hilendarski" for the needs of the Department of Physics at the Faculty of Physics and Technology, as a candidate participates Associate Professor Maria Georgieva Marudova-Zsivanovits from the Department of Physics, Faculty Physics and Technology, Plovdiv University "Paisiy Hilendarski".

### **1. General presentation of the received materials**

By order No. P33-4125 / 24.08.2020 of the Rector of Plovdiv University "Paisiy Hilendarski" (PU), I have been appointed as a member of the scientific jury of a competition for the academic position of "**professor**" in the PU in the field of higher education 4. Natural sciences, mathematics and informatics, professional direction 4.1 Physical sciences (Physics of condensed matter), announced for the needs of the Department of Physics at the Faculty of Physics and Technology.

To participate in the announced competition, only one candidate, Associate Professor Maria Georgieva Marudova-Zsivanovits, from the Department of Physics, Faculty of Physics and Technology, University of Plovdiv "Paisiy Hilendarski", submitted documents.

The set of paper materials presented by Associate Professor Dr. Maria Georgieva Marudova-Zsivanovits is in accordance with the Regulations for the Development of the Academic Staff of the PU, and includes the following documents:

- application form to the rector for admission to participate in the competition;
- CV in European format;
- diploma for higher education with acquired educational and qualification degree "master" - original with appendix or notarized copy;
- diploma for educational and scientific degree "doctor" - original or notarized copy;
- diploma (certificate) for the academic position "associate professor" - original or notarized copy;
- list of scientific works;
- scientific works (copies of publications);
- certificate of compliance with the minimum national and additional faculty requirements (if any);
- declaration of originality and authenticity of the attached documents;
- annotations of the materials under Art. 76. from PRASPU (in Bulgarian and a foreign language);
- extended habilitation certificate
- self-assessment of contributions;
- list of citations;
- document (certificate) for work experience;
- documents for academic work;
- documents for scientific research activity;

- other documents.
- a set of paper documents from item 1 to item 17 - 4 pieces
- a set of documents from item 1 to item 17 on electronic media - 8 pieces.

The candidate Assoc. Dr. Maria Marudova-Zsivanovits has submitted a total of 40 publications, 1 book chapter, 1 patent, 1 textbook, 1 teaching aid and 7 electronic courses. Accepted for review are 41 scientific works that are not the dissertation and are counted in the final evaluation, 1 textbook, 1 teaching aid, 7 electronic courses, participation and management of 9 research projects. Assoc. Dr. Maria Marudova-Zsivanovits is also a co-author of works that are not presented and are not peer-reviewed - 2 scientific works on the dissertation and 17 scientific works from the doctorate. The distribution of the scientific works participating in the competition under relevant headings, in the country and abroad, is as follows: all publications are in publications, referenced and indexed in world-famous databases (Web of Science and/or Scopus), 20 of the publications participating in the competition are in journals with an impact factor, 20 with an impact rank, 7 are published in the country, the h-index is 10 according to Scopus. A document for Patent for invention Peg is presented. No. 67404 B1, with Title: Preparation of water-insoluble glucan by means of a transferase enzyme reaction.

I have no notes on the documents. The candidate has submitted all the documents for the competition required by the Law on the Development of the Academic Staff in the Republic of Bulgaria.

## **2. Brief biographical data of the candidate**

Prof. Dr. Maria Marudova-Zsivanovits graduated as a Master in Physics, qualification - engineer-physicist, specialization "Physics of Polymers" at Plovdiv University "Paisiy Hilendarski", Faculty of Physics in 1998. She continued her education as a doctoral student and In 2007, he defended his thesis for the degree of Doctor of Chemistry of High Molecular Weight Compounds. She actively worked to increase her professional qualification by successively specializing in various universities to master modern experimental techniques for research in the field of condensed matter - "Marie Curie" specialization in the "Science of food materials" division at the Institute for Food Research, Norwich, England, for various periods; University of Leeds, Leeds, England; Cor-Vinus University, Budapest, Hungary.

From 1999 TO 2009, he was successively an assistant and head of the Department of Experimental Physics of the Faculty of Physics, Paisiy Hilendarski University of Plovdiv. Since 2009, he has been an associate professor at the "Physics" department at the Faculty of Physics and Technology. The candidate's professional, teaching and scientific experience fully correspond to the field of higher education, professional direction and scientific specialty for which the competition is announced.

## *3. General characteristics of the applicant's activity*

*3.1. Assessment of educational and pedagogical activity and preparation of the candidate (study materials, lecture courses, work with students, graduates and doctoral students)*

The teaching activity of Assoc. Dr. Maria Marudova-Zsivanovits is extremely active and diverse. Educational and pedagogical activity is evaluated in several directions. As teaching aids (Textbooks, teaching aids and electronic courses), the candidate has developed 1 textbook, one manual for laboratory exercises and 7 interactive courses.

I highly appreciate the participation of Prof. Dr. Maria Marudova-Zsivanovits in the development of study plans and curricula. In this area, documents are presented for developed curricula, a total of eight - two for doctoral programs, 2 for a master's program for the specialty "Food Physics",

full-time studies (r.o.), specialists and non-specialists (plus 2 part-time (h .o.) of the same plans), 2 curriculum for the specialty "Engineering Physics", bachelor's degree, r.o. and z.o.

A total of 19 study programs have been developed. This number includes 9 lecture courses for OCS "Bachelor; 3 for OCS "Master", some of which are also developed in English, some for distance learning. The range of topics developed is impressive - traditional such as Mechanics, Molecular Physics and Thermodynamics, Fundamentals of Electronics, as well as modern and interdisciplinary ones such as Application of polymers in medicine and biotechnology, Polymer photovoltaics.

I would like to point out that the administrative-organizational activity is extremely important in training, although it is an additional burden to the official duties of teaching and conducting scientific research. In this Assoc. Dr. Maria Marudova-Zsivanovits is the coordinator of the doctoral program "Physics of Condensed Matter", the program "Structure, Mechanical and Thermal Properties of Condensed Matter" is responsible. For the specialty "Engineering Physics" full-time education and qualification degree "Bachelor", Assoc. Dr. Maria Marudova-Zsivanovits is responsible for the profiling module "Polymers and Polymer Technologies".

The candidate demonstrates active work with students, graduates and doctoral students. She carried out scientific guidance in all degrees of study: doctoral students - one defended, one expelled with the right to defend and two newly enrolled; scientific guidance of graduates - a total of 16 theses are protected in the Bachelor's and Master's OCs.

In addition, as an administrative-organizational activity, the candidate is a faculty manager under the Erasmus program, Head of the Polymer Physics Laboratory and New Materials Laboratory.

### *3.2. Evaluation of the candidate's scientific and scientific-applied activity*

I accept all submitted materials for review. There are no data necessitating reduction due to coincidence or overlap (with participation in other procedures). The complete list of scientific works with which Associate Professor Maria Marudova-Zsivanovits applied includes a total of 40 publications after habilitation, 90 citations, 1 patent. The candidate co-authored 1 book chapter as first author. A list of 18 participations in national and international conferences, numerous participations in organizing committees and editorial boards is presented. In the summarized data according to various criteria in tabular form according to the requirements for occupying the academic position of "professor" laid down in the ŽRASRB, the candidate has presented: criterion A - dissertation for the scientific degree "doctor" (50 points); criterion B - 13 publications with indexes Q1-Q4 (total 214 items with required 100 items); criterion G7 - 27 articles; D8 - 1 chapter of a book; D9 – 1 patent (420 items in total, with 200 items required according to the Regulations for the Implementation of the ZRAS); criterion D - 180 points out of 90 specified citations (with a required 100 points); criterion E - 226 (with required 150 points).

The reference provided to meet the minimum requirements is according to Web of Science/Scopus. The Hirsch index for the citation of publications is h:10 (Scopus). Publications can be classified by type as follows: out of all B4 and D7 articles, 15 are in AIP Conference Proceedings and Journal of Physics: Conference Series, so I assume they are conference report publications. Both editions are authoritative and have an SJR and IF impact rank; 8 were published in the Bulgarian publication Bulg. Chem. Commun., also with impact rank. 20 of the publications participating in the competition are in journals with an impact factor, with a total IF of 50.9. All publications are co-authored with three or more co-authors.

### 3.2. Contributions (scientific, scientific-applied, applied) and citations

The scientific and scientific-applied activity of Assoc. Dr. Maria Marudova-Zsivanovits is in the field of materials science and is more specifically related to the development of multi-layered nanoscale structures from natural polymers. Research on these materials aims to establish their potential for application as drug delivery systems. Polyelectrolyte nanostructures were investigated because they are extremely suitable for the immobilization of materials with biological activity. In the presented studies, multilayered structures of polysaccharides and proteins with good mucoadhesive properties were developed. The buccal mucosa is chosen for introduction into the body. More specifically, research and scientific contributions can be summarized in two groups of thematically related publications:

1. Development of polyelectrolyte multilayer structures (PMS) and characterization of their physical and physico-chemical properties;
2. Investigation of the ability of multilayer structures to include and controllably release three types of model medicinal substances – benzydamine, betahistine and tolfenamic acid. Medicinal substances are selected with regard to their physical state (crystalline) and their solubility in organic or aqueous media.

The first group includes studies of electrostatic interaction as the main mechanism for irreversible and stable adsorption of polyelectrolytes on the substrate and for the construction of the layers. Therefore, provision and control of the electric charge both on the surface of the polymer film and on the solutions of polyelectrolytes has been developed. Biodegradable polyesters - polylactic acid (PMK), poly- $\epsilon$ -caprolactone (PEK), as well as their mixtures were chosen as polymers forming the support. A corona discharge was used to modify the surface of the pads and provide additional surface charge. This is an innovative approach, which was applied for the first time in the construction of PMS at the Faculty of Physics and Technology of Plovdiv University. The influence of the type of support and its polarity on the formation of the polyelectrolyte layers for a pair of chitosan/xanthan polyelectrolytes and for a pair of chitosan/casein polyelectrolytes was investigated. The influence of the method of deposition of the polyelectrolyte layers on a previously treated PMC or PEK substrate on the thickness and structure of the layers was established.

The multilayer structures were investigated comprehensively with precise methods, such as FT-IR, UV-VIS-NIR spectroscopy, X-ray photoelectron spectroscopy (XPS), laser refractometry, scanning electron microscopy (SEM), atomic force microscopy (AFM), differential scanning calorimetry (DSC). The influence of pH and ionic strength on the structure and morphology of chitosan/xanthan and chitosan/casein polyelectrolyte layers was investigated. For the chitosan/casein system, optimal pH and ionic strength values were derived for maximum benzydamine hydrochloride loading efficiency.

The conducted in-depth studies and their results are of a scientific and scientific-applied nature.

The second group includes research on the inclusion of model medicinal substances (ML) in PMS and establishing the biopharmaceutical behavior of the medicinal substances. Multifaceted characterization was carried out in terms of physical, physicochemical, mucoadhesive properties and sustained release, on the basis of which it was concluded that PMS with 8 polyelectrolyte layers of chitosan and xanthan, containing the drug substance benzydamine hydrochloride and obtained by double crosslinking of chitosan with glutaraldehyde and trisodium polyphosphate emerges as promising and can be used as a promising drug-delivery system for buccal mucosal application. The

developed PMS proved to be an optimal delivery system for moderately soluble drugs due to the achieved high loading efficiency.

An essential applied contribution of the research is the preparation of the successfully loaded multi-layer polyelectrolyte structure chitosan/casein with three model medicinal substances (benzidamine hydrochloride, betahistine dihydrochloride and tolfenamic acid). The performance indicators of the system and the kinetics of the release of medicinal substances have been established. These studies are of high significance for science and practice in a new and modern field of research.

Additional directions of research, which are no less significant as contributions of a scientific-applied and applied nature, are:

1. Study of physical and physico-chemical properties of food products. A complex of physical methods for establishing the authenticity of food products is proposed.

2. Development of sensors for ammonia registration. An electrical and optical sensor for recording ammonia based on composite films with high sensitivity has been developed.
3. Development of edible packaging based on biopolymers. They are in this area developed two methods for obtaining multicomponent films suitable for use as active food packaging with proven barrier properties and stability.

4. A technology has been developed for packaging minimally processed fruit with single-layer (chitosan) and double-layer (chitosan/alginate) edible coatings.

Analytical assessment of the contributions formulated in this way characterizes them as enrichment of existing knowledge and theories, creation of new methods, constructions, technologies for obtaining materials and multi-layered structures for application in practice. The significance of the contributions is reflected in the significant citation count of 90 citations for the publications participating in the competition (excluding self-citations and co-authors). Assoc. Dr. Maria Marudova-Zsivanovits has received recognition among the scientific circles at home and abroad. And here I want to note the development and protection of a Patent for an invention, which shows the importance of the selected research topic for practice. Data on the obtained economic effect of attracted funds for projects managed by the applicant in the amount of BGN 192,500 are presented.

The main scientific and applied contributions are related to developments, with the potential for innovative transfer in industry. Having familiarized myself with the documents, materials and scientific works presented at the competition, and after analyzing their significance and the scientific, scientific-applied and applied contributions contained in them, I can conclude that scientometric indicators exceed in all indicators the specific requirements of ZRASRB. The quantitative indicators of the criteria for occupying the academic position of "professor" specified in the reference for minimum requirements, presented by the candidate, exceed in all indicators the specific requirements of ZRASRB.

### **3. Assessment of the candidate's personal contribution**

Although the publications with which Prof. Dr. Marudova-Zsivanovits participated in the competition are co-authored, I would like to point out that in a modern and interdisciplinary field of research this is inevitable. In the attached reference, a correct assessment of the candidate's personal contribution to the various developments is given, covering the entire spectrum of activities from developing the research concept, obtaining the structures, selecting the research methods, experiment and analysis of research results. This is an indication that to a large extent the contributions are the candidate's personal work and shows her leading role in the research. Assoc. Prof. Marudova-Zsivanovits's contribution to collective publications is significant.

#### **4. Critical remarks and recommendations**

Critical remarks and recommendations to the candidate's scientific works and activities are not available. The submitted materials for the competition are precisely designed. The candidate's scientific and scientific-applied contributions show promising potential for future use in the pharmaceutical, food industry, etc.

#### **5. Personal impressions**

I have no personal impressions of the candidate's performances outside the competition.

#### **CONCLUSION**

In conclusion and after a thorough analysis, I would like to confirm that the documents and materials presented by Assoc. Dr. Maria Marudova-Zsivanovits meet all the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria (ZRASRB), the Regulations for the Implementation of ZRASRB and the relevant Regulations of PU "Paisiy Hilendarski".

The candidate in the competition has submitted a sufficient number of scientific works published after the materials used in the defense of the ONS "doctor" and habilitation. The candidate's works contain original scientific and applied contributions that have received international recognition, a representative part of which has been published in journals and scientific collections issued by international academic publishing houses. Research results have practical applicability. Assoc. Prof. Dr. Maria Marudova-Zsivanovits's contributions directly oriented to the academic work are significant. Her scientific and teaching qualifications are unquestionable. The results achieved by Assoc. Dr. Maria Marudova-Zsivanovits in the academic and research activities fully correspond to the minimum national requirements.

After getting acquainted with the materials and scientific works presented in the competition, analyzing their significance and the scientific, scientific-applied and applied contributions contained in them, I find it reasonable to give my positive assessment and to recommend the Scientific Jury to prepare a report-proposal to the Faculty council of the Faculty of Physics and Technology for the election of Assoc. Dr. Maria Marudova-Zsivanovits to the academic position of "Professor" at PU "Paisiy Hilendarski" in: field of higher education 4. Natural sciences, mathematics and informatics, professional direction 4.1 Physical sciences (Physics of condensed matter).

4.04. 2023

Reviewer: .....

(prof. Evgenia Valcheva)