O p i n i o n

by Prof. Dr. Silvia Todorova, Institute of Catalysis - BAS

regarding the contribution the works of assistant professor Ralitsa Boykova Mladenova, Ph.D., for participation in a competition for " associate professor " in professional field 4.2. Chemical sciences, scientific specialty "Chemical kinetics and catalysis " for the needs of the laboratory "Design and characterization of catalytic materials" in the thematic direction "Application of EPR spectroscopy for the study of radical processes””\ announced in the State Gazette, no. 47/04/06/2024

General presentation of the candidate.

Ch. Dr. Ralitsa Mladenova, assistant professor, is the only candidate in the competition for the academic position "associate professor". The candidate meets all the conditions of the regulations for the terms and conditions for acquiring scientific degrees and for holding academic positions at the Institute of Catalysis - BAS.

To participate in the competition, Dr. Mladenova submitted the necessary documents: a curriculum vitae, a diploma for the educational and scientific degree "doctor", a list of publications for participation in the competition with copies of the same, an author's reference for contributions from scientific publications, a list of participations in national and international conferences and congresses, list of citations noticed in the literature, list of participations in international and national projects. According to Google Scholar for the entire creative period, the candidate is a co-author of 27 publications. 22 participated in the competition, 20 of which were in journals with an impact factor and 2 in other journals. 5 of the publications in fall into the Q1 category; 8 in Q2 and 4- Q3 and 3 in Q4. In 9 of the publications, the candidate is listed as the first author and corresponding author, in 4 She is the second author, in the rest She is the third and following. This indicates a significant contribution of the candidate to the development of scientific research. All the publications of Associate Professor Mladenova are in one of the well-known journals in the field of radiation chemistry and catalysis (*Radiation Physics and Chemistry, Materials Characterization, International Molecules, Applied Sciences, Journal of Radioanalytical and Nuclear Chemistry).* The quality of research is assessed by experts in the field by the number of citations. According to the candidate's data, 64 citations of the works with which She participated in the competition were noticed.

The total number of noticed citations according to Scopus without self-citations of all publications is 121. The total number of points achieved according to indicator B.4 is 134, according to indicator Г.7 – 259, and according to criterion D-128 points, which significantly exceeds the minimum required by the individual indicators. Associate Professor Dr. Ralitsa Mladenova participated in 10 national projects and was the head of one project financed by the World Federation of Scientists. The national projects in which she participated are as follows: 5 with the Scientific Research Fund, 3 within the international collaborations of the BAS and 2 with the Ministry of Education and Science, the "Education with Science" program: the project Chemical experiment-method, a means and condition for the formation of natural science literacy, and INFRAMAT "Distributed infrastructure of centres for the production and research of new materials and their applications, as well as for conservation, access and e-storage of artifacts (archaeological and folklore)" The results of scientific research Associate Professor Mladenova have been presented at 27 scientific events, 14 national and 13 international forums and 1 oral report and 26 poster presentations, respectively. The candidate's Hirsch index (H) without self-citations according to the Scous database is 7.

Scientific contributions.

The habilitation thesis includes 8 scientific publications aimed at researching the influence of gamma radiation treatment on the radical scavenging activity of natural products and foods. High energy radiation treatment is a well-established non-thermal technology for the microbial decontamination of food products, protecting them from damage and extending their life. Irradiation affects the antioxidant activity of natural products, and therefore it is important to determine the effect of different doses of radiation on the antioxidant activity of foods and products containing biologically active substances. The main scientific contributions of Dr. Mladenova, presented in the habilitation work, can be divided into the following directions, with the research mainly using the EPR spectroscopy method: Study of the effect of gamma irradiation on the radical-trapping activity of bee products; Investigation of the effect of gamma radiation treatment on the radical scavenging activity of fruits; Investigation of the effect of gamma radiation treatment on the radical scavenging activity of nuts by the method .

So e.g. it has been found that the antiradical activity of propolis is mainly due to its polyphenol content. Although the amount of some polyphenolic compounds such as caffeic acid, quercetin, rutin, etc. increases after irradiation, others decay. This is the case for catechin, which was not identified in all irradiated propolis samples, while the non-irradiated sample was rich in catechin.

In studies on bee pollen, with different doses, it was found that different doses of gamma radiation had different effects on the radical scavenging ability of the two bee pollen crops studied. For one sample, a decrease in antiradical activity was found in samples irradiated with 2 kGy by approximately 7%, compared to non-irradiated ones , while no change was observed at 5 and 10 kGy . It is assumed that this is due to the significant decrease in the concentration of rutin.

It was concluded that the optimal dose for irradiating bee products for the purpose of microbial decontamination and extending their shelf life is 5 kGy , and it leads to an increase in the antioxidant activity of bee bread and bee pollen, while no effect was found for propolis.

Based on the publications presented in the habilitation work, it can be done concludes that Electron Paramagnetic Resonance is a suitable technique for evaluating the effect of radiation treatment on the radical scavenging activity of natural products and foods. In the publications, for the first time, the generation of free radicals as a result of gamma-irradiation, as well as the influence on the anti-radical capacity of the studied samples, was studied using the EPR spectroscopy method. EPR is an effective method for determining optimal doses of high-energy radiation for microbial decontamination. At the same time, the antioxidant activity may increase or remain unchanged.

Research results included in the habilitation report can help identify non-toxic, bioactive. These substances can be used in functional foods, cosmetics and medicines to improve the quality of life.

Outside of the habilitation reference, the scientific contributions can be summarized in the following directions, referring to the application of the EPR spectroscopy method for:

- Analysis of the effect of gamma irradiation on the antiradical properties of foods and organic compounds;
- Study of free radicals and the effect of external influences such as high energy radiation, etc. in organic substances;
- Characterization of catalytic materials .

So e.g. with the help of ERP spectroscopy, the oxidation and coordination states of the paramagnetic ions in the catalytic materials were determined, which helps to explain the

catalytic activity. Information on the nature of the defects (surface defects, radicals, free and trapped charge carriers or clusters) was also obtained and the influence of the doping agent on the structure of the catalytic material as well as on its photocatalytic properties was determined. So e.g. EPR studies of ZrO_2 confirm the presence of oxygen vacancies along with Zr^{3+} ions, the two crystal defects playing a significant role in exhibiting the photoluminescent properties of the material.

Conclusion

The scientific research of Assistant Professor Ralitsa Mladenova, Ph.D fully correspond to the subject matter of the announced competition for awarding the scientific position of "associate professor". The publication activity and the citations on the published results prove that Dr. Mladenova fully meets all the requirements in the IC - BAS Regulations for awarding academic positions and scientific degrees. Therefore, I strongly recommend to the members of the respected Scientific Jury and the respected Scientific Council of IC-BAS to award assistant professor, Dr. Ralitsa Mladenova, the academic position of "associate professor" in professional direction 4.2 "Chemical sciences" and scientific specialty" Chemical kinetics and catalysis ".

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Sofia

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