

OPINION

by Assoc. Prof. Dr. Stela Ivanova Minkovska, Institute of Catalysis-BAS
on the competition for occupation of the academic position “**Associate professor**”
in professional field **4.2 Chemical Sciences**,
Scientific specialty “**Chemical Kinetics and Catalysis**”.

In the competition for the academic position of “Associate Professor”, announced in the State Gazette, issue 47 of June 4, 2024 and on the website of Institute of Catalysis-BAS only one candidate is participating - Assist. Prof. Dr. Ralitsa Boykova Mladenova, currently employed in the Laboratory of “Design and Characterization of Catalytic Materials” at the Institute of Catalysis, Bulgarian Academy of Sciences.

1. General presentation of the procedure and the candidate.

The presented by Assistant professor, Dr. Ralitsa Mladenova a set of materials on electronic media is in accordance with the requirements of the Act on Development of the Academic Staff in the Republic of Bulgaria and the regulations on the terms and conditions for acquiring scientific degrees and academic positions at the Institute of Catalysis - BAS and meets the criteria of the Institute of Catalysis for holding the academic position of “Associate professor”.

Dr. Ralitsa Mladenova received a master's degree with a specialization in “Applied Chemistry and Management” in 2000 at the Sofia University "St. Kliment Ohridski", Faculty of Chemistry. In 2000 Ralitsa Mladenova was appointed as a chemist at the Institute of Catalysis-BAS in the laboratory of EPR spectroscopy, and in 2003 she enrolled as a Ph.D. student in professional field 4.2. Chemical Sciences, scientific specialty “Chemical Kinetics and Catalysis” in the same laboratory. She defended a PhD thesis on the topic "EPR study of thermally generated free radicals in foods" in 2007, which fulfilled the criteria of indicator group A of the minimum requirements. In the period 2008-2011, Dr. Mladenova held the position of Research Associate II degree, and since 2011 she has been elected as an Assistant professor. To participate in the competition, the candidate has submitted 22 publications, of which 5 are in journals with rank Q1, 8 in journals with rank Q2, 4 in journals with rank Q3, 3 in journals with rank Q4 and 2 publications are in non-indexed journals. All publications correspond to the theme of the competition and do not repeat those from previous procedures for acquiring a scientific degrees and academic position. Eight of the presented scientific publications are equated to a habilitation thesis, which collects 134 points and fulfills the requirements of group B indicators. The remaining 14 scientific works, of which 12 are refereed and indexed, two not indexed, total 259 points out of the required 220, with which the candidate fulfills the minimum requirements for group D indicators. 64 citations without self-citation were observed (reference in Scopus, H-index 7), which corresponds to the points of indicator groups D and J.

2. General characteristics of the candidate's research and applied scientific activity.

Dr. Mladenova is a co-author of a total of 27 scientific publications, 23 of which were published in refereed and indexed journals. Presented habilitation work summarize the results of 8 publications (Q2 – 4, Q3 – 2, Q4-2). It should be noted that Dr. Mladenova made a significant personal contribution to the research conducted and the interpretation of the results. This is confirmed by the fact that Dr. Mladenova is the first author of 5 and second author of 1 of the 8 publications included in indicator B. Proof of the good research work of Dr. Mladenova is the co-authorship in 10 publications in refereed and indexed journals in the world databases for the last

3 years (2022-2024). The high level of the candidate's scientific output is also confirmed by the number of citations: 64 (WoS or Scopus). The results obtained from the scientific research were presented at the 27 scientific forums. Thanks to her good theoretical and experimental preparation, as well as her ability to work in a team, Dr. Mladenova is a member of the teams of 11 projects financed under various programs (FNI - fundamental research - 3 projects, "Multilateral competition for scientific and technological cooperation in Danube Region - 2022"), Bilateral cooperation and exchange programs-BAS, Ministry of Education and Science, "Ministry of Education and Science of Republic of Bulgaria with title of the project: Distributed infrastructure of centers for production and research of new materials and their applications for conservation, access and e-storage of artifacts (archaeological, folklore), contract No. ДО1-155/28.08.2018.

3. Basic scientific and scientific-applied contributions

The scientific research carried out by Dr. Mladenova falls into a significant scientific field directly related to the improvement of the quality of life - food and health, set as Priority 2. of the National Strategy for the Development of Scientific Research in the Republic of Bulgaria 2017-203. EPR spectroscopy has been successfully applied to characterize catalytic materials. The obtained results have both a fundamental and, for the most part, a scientific-applied nature. The main scientific and scientific-applied contributions from the research of Dr. Mladenova can be summarized as follows:

1. The effect of gamma treatment with different doses of ionizing radiation (2, 5 and 10 kGy) on the radical scavenging activity (RPA) of selected natural products (bee products) was successfully studied by the method of electron paramagnetic resonance (EPR spectroscopy). Based on the experimentally determined radical scavenging activities, it was found that for the microbial decontamination and shelf life extension of bee products, the optimal irradiation dose is 5 kGy. Free radicals formed during irradiation can be captured and deactivated by substances with antioxidant properties. Based on the stable 1,1-diphenyl-1-picrylhydrazyl (DPPH) radical, the antiradical activity of the studied bee products was evaluated. The obtained results confirm the antioxidant activity of propolis, bee bread and bee pollen. To optimize the irradiation dose of bee pollen for the purpose of disinfection and shelf-life extension, as well as to increase its antioxidant activity, determinations need to be made for each individual natural product and each batch.
2. The effect of gamma radiation treatment on the radical scavenging activity of fruits (rosehip seeds, Goji berries) was investigated by the EPR method. The dry residue of rosehip seeds was found to possess radical scavenging properties that increased by approximately 19% after 10 and 25 kGy irradiation. The study of the dependence between trapped DPPH radicals (in %) and the amount of extracts of unirradiated and irradiated with 0.05, 2 and 10 kGy Goji berries showed that the antiradical activity increased with increasing radiation dose, and at a dose of 0.05 kGy the increase was by 5%, at 2 kGy by 13%, and at 10 kGy by 15.6%. It was found that there was no proportional increase in the radical scavenging capacity with respect to the irradiation dose.
3. Based on the experimentally determined radical scavenging activities, it was found that for the microbial decontamination and extension of the shelf life of bee products, the optimal irradiation dose is not 5 kGy. Free radicals formed during irradiation are captured and deactivated, which is proof of the antioxidant properties of the studied bee products. The obtained results confirm the antioxidant activity in bee bread and bee pollen, while no such activity was found in propolis. To optimize the irradiation dose of bee pollen for the

purpose of disinfection and shelf life extension, and at the same time to increase the antioxidant activity, the determination should be carried out for each individual natural product and batch.

4. The effect of gamma radiation treatment on the radical-trapping activity of fruits (rosehip seeds, Goji berries) was investigated with the EPR method. The dry residue of rosehip seeds was found to have radical scavenging properties that increased by approximately 19% after 10 and 25 kGy irradiation. The study of the dependence between trapped DPPH radicals (in %) and the amount of extracts of unirradiated and irradiated with 0.05, 2 and 10 kGy Goji berries showed that the antiradical activity increased with increasing radiation dose, and at a dose of 0.05 kGy the increase was by 5%, at 2 kGy by 13%, and at 10 kGy by 15.6%. It was found that there is no proportional increase in the radical scavenging capacity with respect to the radiation dose.
5. The effect of gamma radiation treatment on the radical-trapping activity of nuts (peanuts and hazelnuts) was investigated using the EPR method. It was found that the radical scavenging activity of peanuts decreases with an increase in the radiation dose, as at 10 kGy the decrease is by 21%, and at 25 kGy it is by 31%. The antiradical activity of the sample irradiated with 25 kGy was dependent on the irradiation time, and six months after radiation treatment it was found that it decreased by a further 16% for peanuts and 43% for hazelnuts, compared to the measurements made a few hours after treatment, while for the sample irradiated with 10 kGy no change related to irradiation time was observed.
6. EPR spectroscopy is applied to systematically study the generation of free radicals during gamma irradiation and their influence on the antiradical capacity of the studied samples.
7. All studied samples were found to exhibit antiradical activity that was altered upon radiation treatment. It is also applied to disinfect and extend their shelf life.

As a conclusion, Dr. Ralitsa Mladenova's scientific research for the most part has a scientific-applied nature and is aimed at finding natural bioactive substances as "catchers" of free radicals for the prevention of socially significant diseases, as well as for the use them as a raw material for functional foods and cosmetic products to improve the quality of life. In addition to the research presented in the habilitation work, Dr. Mladenova has worked in three additional areas. The results obtained from the studies of the effect of gamma-irradiation on the antiradical properties of foods and organic compounds and from the characterization of catalytic materials have been published in 14 scientific works.

4. Reflection of the candidate's scientific publications in the literature.

Dr. Mladenova holds 64 citations of her scientific publications. A check in the Scopus database shows that Dr. Mladeva holds an Hirsch Index (H) of 7 (self-citations excluded), which meets the criteria.

5. Critical remarks and recommendations

I have no critical remarks about the candidate. The documents for participation in the competition are designed according to the requirements and contain comprehensive information about the results achieved and the scientific contributions of the candidate.

6. CONCLUSION

The documents and materials presented by Dr. Ralitsa Boykova Mladenova fully meet and significantly exceed the requirements of the Law on the Development of the Academic Staff in

the Republic of Bulgaria, the Rules for the Terms and Conditions for the Acquisition of Scientific Degrees and the Occupancy of Scientific Posts of the Bulgarian Academy of Sciences and the Rules for the Terms and Conditions for the Acquisition of Scientific Degrees and the Occupancy of Scientific Posts of the IC-BAS.

The publications presented by Dr. Ralitsa Mladenova are on the topic of the competition, and the obtained results are a good basis for further research in the field of application of Electron Paramagnetic Resonance to evaluate the effect of radiation treatment on the radical scavenging activity of natural products and foods. Based on the above, I confidently give my positive assessment and strongly recommend to the Scientific Jury and the esteemed members of the Scientific Council of the the Institute of Catalysis, Bulgarian Academy of Sciences, Dr. Ralitsa Mladenova to be elected to the academic position “Associate Professor” in the professional field 4.2. Chemical sciences, scientific specialty “Chemical Kinetics and Catalysis”.

September 27, 2024

Member of Scientific Jury:

/Assoc. Prof. Stela Minkovska,

PhD/