

OPINION

On a competition to occupy academic position of Associate Professor
Professional field: 4.2. Chemical Sciences
Scientific specialty: Chemical Kinetics and Catalysis
Requesting laboratory: Design and Characterization of Catalytic Materials
Thematic area: EPR spectroscopy and quality of life
Announcement: State Gazette No. 77, 1 October 2019,
by request of Institute of Catalysis (IC) of the Bulgarian Academy of Sciences (BAS)
Reviewer: Prof. Dr. Iliana Borisova Nacheva
Institute of Cryobiology and Food Technology, Agricultural Academy, Sofia, Bulgaria
Scientific jury member appointed by Order No. ПД-09-64/22.11.2019
of the Director of IC-BAS based on a decision of the Scientific Council of IC-BAS
(Minutes No. 2/21.11.2019)

Chief Assistant Professor Katerina Ivanova Aleksieva, PhD, an employee of Institute of Catalysis of the Bulgarian Academy of Sciences, is a sole applicant.

General presentation of the procedure and the applicant

The total number of publications is 32 of which 26 are published in impact factor journals. 27 original scientific papers have been submitted for scientific evaluation, 22 of them having impact factor: 6(Q1), 4(Q2), 7(Q3), and 5(Q4). The documentation contains: (i) a list of 87 citations in Scopus and Web of Science indexed editions; (ii) participation in projects – 10; (iii) participation in scientific forums – 29; (iv) an expert report on lectures, exercises, and reviews for scientific impact factor journals – 15; and (v) a reference for meeting minimum national and IC-BAS additional requirements. The applicant's Hirsch (H) index based on all publications included in the ISI database is 8.

It is impressive that the applicant's reference is accurate and well-illustrated as well as that the evaluation materials fully meet and even exceed the requirements of Act for the Development of the Academic Staff in the Republic of Bulgaria and Rules on the Terms and Conditions for Acquisition of Academic Degrees and Occupation of Academic Positions at IC-BAS.

Brief biographical information

Katerina Ivanova Aleksieva holds a Master's Degree from the Faculty of Chemistry at St. Kliment Ohridski University of Sofia. Her appointment as a research chemist at IC in 2002 marked the beginning of her professional development. The candidate's academic development is related to the acquisition of a doctorate degree in 2009 with a dissertation on the subject: EPR spectroscopy capabilities to identify high-energy irradiated food of plant origin (Diploma No 33598/07.12. 2009) as well as by occupying the academic position of Chief Assistant Professor in 2011. He is a secretary of the Bulgarian EPR Society and a member of the Bulgarian Catalysis Society.

Assessment of research activities and contributions

Dr. Aleksieva participates in the competition by presenting 27 publications published in scientific journals and a collection of papers from a scientific conference. Twenty-two of the submitted publications have appeared in impact factor journals referenced and indexed in Web of Science and Scopus. The candidate is the lead author of 11 publications, which shows her personal contribution to the presented works, and demonstrates her active participation in both the generation of ideas and the design of materials. She has co-authored 4 papers as a

second author, 2 works as a third author, and 10 as a following author, which also shows her ability to work collaboratively with other researchers. These data indicate very good publication activity.

In terms of content, the scientific works are fully relevant to the subject of the competition. The submitted publications are up-to-date and the interpretation of the results obtained is correct and implemented at a high scientific level.

A reference is provided for participation in scientific events: 25 poster presentations, 2 oral reports, and 2 seminar reports that have been presented at 17 international and 12 national scientific forums. The applicant's expert activity consists of lecturing students and conducting student EPR exercises in relation to making highly qualified specialists in modern environmental materials from design to innovation, and is supplemented by peer reviewing of scientific articles for international scientific journals.

The overall basic and applied research activity of Dr. Aleksieva is involved in the use of the electron paramagnetic resonance (EPR) spectroscopy method for three main scientific fields:

- i. identification of foods and drugs irradiated with high-energy (gamma) radiation;
- ii. investigation of the adsorption properties of lignocellulosic waste materials relative to metal ions (biosorption);
- iii. determination of the oxidation state of paramagnetic ions in some catalytic materials.

The contributions presented in the author's and habilitation references are original concerned with basic and applied research and summarizing theoretical and significant achievements in practice.

1. For the first time certain types of foods and medicines have been examined to identify radiation treatments, which have extended the scope of European standards EN 1787 and EN 13708 [1–9, 11–13, 16–19, 21, 24, 26, 27]:

- Essential results for science and practice have been achieved by applying different pretreatment procedures to identify irradiation in fleshy part of fresh fruits, fruit juices, nectars, and concentrated fruit syrups. They prove that the presence of satellite lines in the EPR spectra can be used to identify the radiation treatment of fresh fruits, thus extending the validity of European Protocol EN 1787;
- For the first time EPR analysis in food has been expanded from 'dry' to 'fresh' samples;
- In experiments related to the identification of radiation treatment in fresh, air-dehydrated, and lyophilized tomatoes, the intensity of the EPR spectra of air-dehydrated and lyophilized tomatoes has been shown to decrease to about 50% after 50 days while that of fresh irradiated tomatoes stored at 4°C disappears completely in 15 days;
- A significant contribution of scientific and practical importance is the demonstration of radiation treatment in air-dehydrated dates, plums, and figs. The European protocols EN 13708 and EN 1787 have been found to apply respectively to irradiated dried dates and figs, and dried prunes;
- It has been proven that the Mn^{2+} /singlet ratio can be used as an internal standard for the radiation treatment of lyophilized dried berries, goji berries, and tomatoes, and that free radicals obtained during irradiation do not interfere with or do not destroy antiradical capacity, and even upon increasing the radiation dose to 10 kGy their antioxidant activity is improved;

- Experimental results have been obtained of a highly applied nature proving that the presence of characteristic EPR spectra of cereal samples can be used to identify prior radiation treatments. The kinetic behaviour of different foods was found to be similar with the most stable signals being obtained for white and brown rice;
- An important contribution to the practice is the established data that radiation treatment with gamma rays at doses of 10 and 25 kGy does not affect the fat and fatty acid content and oxidative stability of irradiated hazelnut and peanut oils;
- The advantages and disadvantages of EPR spectroscopy for the identification of gamma-irradiated foods are compared with the methods of direct epifluorescence filter technique (DEFT) and DNA electrophoresis;
- For the first time some types of homeopathic remedies have been investigated along with excipients as tableting facilities to identify radiation.

2. Investigation of the adsorption properties of lignocellulosic waste materials relative to metal ions (biosorption) [10, 15, 17, 22, 25].

The adsorption of Cu^{2+} , Mn^{2+} , and Ag^+ ions in hydrolyzed lignin and alkaline-treated hydrolyzed lignin, both obtained from wheat straw, paulownia, maize stalks, white willow, and acacia, has been studied to determine the oxidation and coordination state of the paramagnetic ions regarding their use as biosorbents in practice.

3. Determination of the oxidation and coordination state of paramagnetic ions in some catalysts [14, 20, 23].

Using EPR spectroscopy an important contribution to the practice is the characterization of the oxidation state of palladium and cobalt in mixed Pd-Co/ Al_2O_3 catalysts, before and after catalytic reaction, as well as the determination of the catalytic activity of lanthana and ceria supported on γ -alumina with respect to nitric oxide decomposition to nitrogen and oxygen. Addressing this contemporary challenge is important to environmental protection.

The significance of the results obtained from the experimental activity of Dr. Aleksieva has been proven by quoting her scientific publications. They represent an indisputable certificate for the quality and recognition of her scientific production. The author's report presents 87 citations to the entries in the competition that have been peer reviewed and indexed in Web of Science and Scopus. This number is many times the minimum required.

The applicant's professional image is complemented by her participation in 10 scientific projects funded by Bulgarian National Science Fund, World Federation of Scientists, Human Resources Development operational programme, equivalent non-currency exchange based projects, and Bulgarian Academy of Sciences, of which she is the coordinator of three. Her involvement in a significant number of projects is a testament to the high value of her research work and her ability to work as a team to achieve scientific and applied goals.

Conclusion

The publishing and research activities of Chief Assistant Professor Katerina Aleksieva, PhD, expressed in 32 scientific publications, 87 citations, participation in 10 research projects, and active expert activity, characterize her high scientific potential. The analysis of the competition materials proves that the applicant has a wide range of scientific interests and steady knowledge in specific fields of science. The presented scientific production by content of scientific achievements and science-metric indicators fully meets the criteria of Act for the Development of the Academic Staff in the Republic of Bulgaria and Rules on the Terms and Conditions for Acquisition of Academic Degrees and Occupation of Academic Positions at

IC-BAS for occupation of the academic position of Associate Professor. This gives me reason to express my positive assessment and recommend to the Honorable Scientific Jury and Scientific Council of IC-BAS to award to Chief Assistant Professor Katerina Ivanova Alexieva the academic position of Associate Professor in professional field 4.2. Chemical Sciences and scientific specialty Chemical Kinetics and Catalysis.

13.01.2020
Sofia

Signature:
(Iliana Nacheva)