REVIEW

from Panteley Petrov Denev, DSc
Professor at the University of Food Technologies – Plovdiv

on the materials, presented in competition for acquisition of academic degree "**professor**"
at the Institute of Organic Chemistry with Centre of phytochemistry (IOCCP), BAS

in area of higher education 4. Natural sciences, mathematics and informatics
professional field 4.2. "Chemical Sciences".
scientific specialty 01.05.10 "Organic chemistry, chemistry of natural and physiologically active substances"
for the needs of the Laboratory for Biologically Active Substances - Plovdiv

In the competition for "professor" announced in the State Gazette, issue 43 from May 31, 2019 and on the website of IOCCP, there is one candidate - assoc. prof. Petko Nedyalkov Denev, PhD from the Laboratory for Biologically Active Substances - Plovdiv

1. General presentation of the received materials

Only Dr. Petko Nedyalkov Denev from the Laboratory for Biologically Active Substances - Plovdiv submitted documents for participation in the announced competition.

The set of paper materials presented by assoc. Prof. Petko Denev is in accordance with the Rules for the law for development of the academic staff in IOCCP and meets the criteria of IOCCP-BAS for occupying the academic position "Professor".

Indicator	Minimal requirements of IOCCP, BAS	Points declared by the candidate
А	50	50
Б	100	159
Г	250	337
Д	200	1062
Е	150	331

The applicant has provided all required documents and supporting evidence

2. Short biographic data

Petko Denev was born in Sliven in 1981. He graduated with a Bachelor degree from the University of Chemical Technologies and Metallurgy, Sofia in 2003, majoring in Biotechnology. In 2005, at the University of Food Technologies - Plovdiv he graduated the Master's Degree in the same specialty. In 2011, at the University of Food Technologies - Plovdiv, he defended his PhD in 5.12. "Food Technology" and specialty 02.11.11 "Technology of Bioactive Substances" in Independent Form of Training. The topic of his dissertation was "Investigation of the antioxidant activity of anthocyanin-containing fruits and functional foods obtained from them". The scientific adviser of the doctoral student was assoc. prof. Maria Krachanova, PhD. He occupied the academic positions of assistant professor in 2007, chief assistant professor in 2011, and in October 2014 was elected by the scientific council of IOCCP for the academic position "associate professor" in professional field 4.2. "Chemical Sciences" by the proposal of a scientific

jury chaired by: Prof. Vasya Bankova DSc and members: Prof. Fanny Ribarova PhD, Prof. Milka Krasteva DSc, prof. Albena Stoyanova Dsc, prof. Atanas Pavlov DSc, assoc. prof. Antoaneta Trendafilova PhD and assoc. prof. Maria Krachanova PhD.

Reference to NACID on the minimum scientometric requirements for acquiring the academic position "associate professor"

Group	Scientific indicator	Ресой точки
А	Dissertation thesis for educational and scientific degree "Doctor"	50.00
В	Scientific publications in journals referenced and indexed in world-renowned scientific information databases (Web of Science and Scopus)	130.00
Г	Scientific publications in journals referenced and indexed in world renowned scientific information databases (Web of Science and Scopus), other than those specified in Group B	217.00
Д	Citations in scientific publications, monographs, collective volumes and patents, referenced and indexed in world renowned scientific information databases (Web of Science and Scopus)	80.00
	Total	477

At the same time, Petko Denev was appointed as a Head of the Laboratory for Biologically Active Substances - Plovdiv. In this position, assoc. prof. P. Denev implements scientific guidance of the conducted research in the laboratory. He is responsible for the human resources policy of the laboratory, the scientific and career advancement of the scientific staff, as well as the responsibility for the implementation and compliance with the rules for safe and healthy working conditions and fire protection.

In 2013, Prof. Petko Denev was awarded with the Pythagoras prize for Young Scientist, which was awarded by the Ministry of Education and Science, as well as the Young Scientist Award "Prof. Marin Drinov" in field "Biomedicine and quality of life", awarded by the Bulgarian Academy of Sciences.

He is a member of the following scientific organizations: Regional Union of STC in Plovdiv, Bulgarian Phytochemical Society; Union of Chemists in Bulgaria;
He had implemented and several specializations abroad:

1. Belgium, Ghent, Technical university KaHo Sint Lieven, 3 months – 2005 in the frames of Socrates-Erasmus programme.
2. Romania, Bucharest - Center for biosensing and biodynamics: Advanced course in biosensors, 2006
3. Czech Republic, Academy of the sciences of the Czech Republic, Institute of Biophysics, Laboratory of free radical pathophysiology, 3 months – 2006, 2 months – 2007.
4. Slovenia, Maribor, University of Maribor, Laboratory for Separation Processes and Product Design, 1 month – 2012. In the frames of project BG051PO001/3.3-05-0001 „Science and business" from Operational Programme „Development of Human Resources" - „Selection of postdocs and young scientist for one-month trainings in high-tech scientific complexes and infrastructures"

He has participated in a total of 19 scientific projects funded by national sources, of which:

- Manager of 2 projects funded by the NSF at the Ministry of Education and Science;
- Coordinator of IOCCP in 2 projects funded by the NSF at the Ministry of Education and Science;
- Participant in 6 projects funded by the NSF at the Ministry of Education and Science;
- Participant in 1 project funded by NIF to MEET;
- Participant in 3 projects funded by Bulgarian universities;
- Scientific consultant in 2 projects, from the program for supporting young scientists of BAS;
- Participant in 3 projects funded by Bulgarian private companies;
- Participates in projects funded by EU Operational Programs - 3, incl. 1 as a leader, as well as in projects developed in international cooperation within the framework of inter-academic agreements (EBR) - 3. as a leader.

3. General characteristics of the applicant's activities

The applicant has a total of 88 scientific publications, of which 47 are in journals with impact factors (IF) and 20 in non-IF journals. The total IF is greater than 100. Published papers in conference proceedings - 21 pcs. In addition, Petko Denev also participated in the writing of 3 monograph chapters, patent and utility model applications – 2 pcs., as well as oral presentation and poster reports in scientific forums without full publications – 75 pcs.. Citations found in the Scopus database are 762 items, with auto-citations removed. According to Scopus, the h-factor is 12, again with auto-citations excluded.

Assoc. Prof. Denev's educational activity consists in joint management of successfully defended diploma students - 8 pcs. and in the guidance of 10 students in the frames of the project students' practices.

Information about the distribution of the scientific works of assoc. prof. Petko Denev, PhD, with whom he applied in this competition.

Total count - 31 pcs, distributed as follows:

1. With impact factor - 22 pcs. (Total IF - 52.39)

Distribution on quartiles according to (www.scimagojr.com):

Q1 - 10 pcs.

Q2 - 4 pcs.

Q4 - pcs.

2. Without impact factor - 5 pcs.

3. Utility model - 1 pc.

4. Collective monographs chapters - 3 pcs.

First and/or corresponding author in 10 publications.

Group A indicators; Petko Denev presents a dissertation for the educational and scientific degree "Doctor" – Investigation of antioxidant activity of anthocyanin-containing fruits and functional foods obtained from them, successfully defended on 05.04.2011. This is in line with the scientific requirements under the low for development of academic stuff and the rules of IOCCP.

Group B indicators, the candidate presents 8 scientific publications, which are equivalent to a habilitation work and are referenced and indexed in world-renowned scientific data bases - Web of Science and Scopus. In all, Petko Denev is the first or correspondent author. The articles are on the antioxidant and antimicrobial properties of plant and herb extracts used as ingredients or supplements in foods and beverages. There is also an independent review on the ability of fruits, vegetables, herbs and mushrooms from the territory of Bulgaria to capture and deactivate free oxygen radicals. These articles are published are in the period 2014-2019 and are thematically focused on the chemistry of natural compounds, food chemistry and toxicology. **The eight articles were published in journals with a total IF – 19.352. The quartile distribution is Q1 - 3, Q2 – 3 and Q4 - 2 pcs. The sum of points is 159, with a minimum of 100 required**.

This gives me reason to believe that the articles presented here are completely equivalent to a habilitation work

Group G indicators

Scientific publication in publications referenced and indexed in world-renowned databases of scientific information outside the habilitation	Q1 - 7 pcs - 175 p. Q2 - 1 pcs - 20 p. Q4 - 6 pcs. – 72 p.	267
A book or a collective monograph chapter	3 x 15	45
An invention, patent or utility model for which a copywright document has been duly issued	25	25
	Total	337

Group D indicators

The total number of citations of Petko Denev's scientific works in scientific publications, monographs and collective volumes, referenced and indexed in world-renowned databases of scientific information (Web of Science and Scopus) for the period 2010-2019 is 762. The candidate participates in the competition for the professor only with those 531, which are listed in Scopus after taking the academic position "associate professor" (2015 – 2019) and from whom the self-citations were removed. **The points obtained - 1062, as well as the h-index -12 - cover the minimum requirements of IOCCP.**

Group E indicators

14. Participation in a national scientific or educational project participant in 6 projects funded by the NSF at the Ministry of Education and Science; Coordinator for IOOCP of 2 projects funded by the NSF at the Ministry of Education and Science;	8x10	80
15. Participation in an international scientific or educational project Participant in 1 project funded by NIF at MEET;	1x20	20
16. Guide to a national scientific or educational project Leader of 2 projects funded by the NSF at the Ministry of Education and Science	2x20	40
17. Leadership of the Bulgarian team in an international scientific or educational project	3x50	150
18. Attracted funds for projects managed by the applicant	105 757/ 5 000 lv.	21
	Total	311

From the documents submitted by Assoc. Petko Denev a list of 25 projects, I accept that his participation: in 3 projects funded by Bulgarian universities;

in 2 projects, from the Program for Supporting Young Scientists at BAS as a scientific consultant;

in 3 projects funded by Bulgarian private companies,

do not meet the conditions required of the law, so I do not take them into account when forming the score. **However, the 311 points received fully meet the minimum requirements of the law for development of academic stuff and its rules, as well as the rules of IOCCP**.

Petko Denev's entire scientific contribution is aimed at investigating some medicinal and / or economically important plants that are ingredients in functional foods or may be added to them as additives. His works are mainly of applied nature and focus on three main areas:

1. A more in-depth study of the chemical composition and biological activity of *Aronia melanocarpa* fruits and functional foods;
2. Utilization of the wastes from the essential oil industry to obtain new products;
3. The relationship between the chemical composition and structure of plant polysaccharides with their biological activity.

Central to the research activity of Petko Denev and the Laboratory for Biologically Active Substances (LBAS), at IOCCP, leaded by him in the last 5 years, are the fruits of chokeberry and the juice produced from them (Publication № 4, 6, 19, 21, 24, 27). The product is among the richest sources of polyphenols and anthocyanins in the plant kingdom and is well suited for the preparation of functional foods. The popularity of these fruits is due not only to their nutritional value, but also to the ever-increasing evidence of their health effects. As a contribution of scientifically applied character, I refer to the volume study conducted on the composition of organic acids, sugars and phenolic compounds in the fruits of chokeberry with the aim of improving the quality, organoleptic properties and biological activity of functional chokeberry foods. In these studies, the optimum temperature of juice compression and nectar extraction was determined because it had a pronounced effect on the composition of the polyphenolic components in these products. This is very important as differences in the chemical composition of the fruit and those in the processing parameters of the processing can lead to functional foods with different chemical composition, which in turn is a prerequisite for different biological activity.

The use of co-pigmentation as one of the main mechanisms for the natural stabilization of anthocyanins (anthocyanins) is an integral part of this area. Aronia fruits are especially rich in anthocyanins, which are unstable during processing and storage of products derived from aronia fruits. The use of herbal extracts as co-pigments opens the possibility for the development of functional chokeberry foods with improved sensory properties and biological effects, due to the increased color stability and anthocyanins in them. Technological experiments have also been carried out to synergistically increase the antioxidant activity of chokeberry drinks by adding an extract obtained by the homogenization of rosehips. Petko Denev's contribution to this study is evidenced by his inclusion in a protected utility model (№28).

Assoc. prof. Petko Denev has also made a significant contribution to the technology for functional foods. Evidence for their biological activity, both in vitro and in vivo, is required to meet the requirements for functional foods. The functionality of chokeberry juice was tested in healthy adult rats by examining its effect on various somatometric, lipid, and histopathological parameters in experimental animals (№ 4). Aronia juice has been shown to significantly reduce the proatherogenic fraction of low-density lipoproteins in the animals tested and to a decrease in

their total cholesterol. Animals have also been reported to have reduced atherosclerotic lesions and lower aortic wall restructuring. In addition, chokeberry juice slows down age-related changes in the aortic wall and can be recommended as a prophylactic agent for aging in good health (№ 6). The activity cage test shows that aronia-treated rats increase the number of vertical movements compared to adult controls, increase their acetylcholinesterase activity in the hippocampus, which is a marker of improved functional activity of cholinergic neurons and an indicator of neuroprotective effect (№ 27). These results demonstrate the effectiveness of the technology developed for the production of aronia-based functional foods, which retains its biological activity after technological processing.

Another contribution of Petko Denev, which enriches the knowledge about the phytochemical composition and biological activity of Bulgarian medicinal plants, is a review article, summarizing own results for ORAC antioxidant activity of nearly 80 Bulgarian fruits, vegetables and herbs, including unpublished results for 11 Bulgarian mushrooms, 4 vegetable and 2 herbs. To this may be added a chapter from the Handbook of food bioengineering by Elsevier (№ 30), which summarizes the available information on the health effects of flavonoids and their role in healthy nutrition and results for flavonoid content (flavan-3-ols, flavonols and flavones) of selected fruits and vegetables and its correlation with their ORAC antioxidant activity.

Due to the large accumulated volume of results for the antioxidant activity of aronia products, Petko Denev has applied his knowledge in characterizing and determining the functional properties of blackberry leaves (Rubus fruticosus), aronia leaves (Aronia melanocarpa), raspberry leaves (Rubus idaeus) hawthorn leaves (Crataegus monogyna), valeriana (Valeriana officinalis), Lemon balm (Mellisa officinalis), St. John's wort flower (Hypericum perforatum), as well as aerial parts of lady’s mantle (Alchemilla glabra), meadowsweet (Filipendula ulmaria), dwarf elder (Sambucus ebulus), Japanese quince (Chaenomeles maulei), which were distinguished for their very high in vitro antioxidant activity measured by different assays methods - ORAC, TRAP, HORAC and inhibition of lipid peroxidation (№ 1, 2, 5, 11, 18, 23).

2. Utilization of the waste from the essential oil industry to obtain new products;

The research of Assoc. Prof. Petko Denev in this area is mainly within the project DN 17/22 "Recovery and application of waste materials from the essential oil industry for green synthesis of metal nanoparticles", coordinated by him for IOCCP-BAS . His contribution are mainly to characterize the extracts obtained from the biomass waste from the essential oil industry. For example, in a series of studies (№ 8, 12, 17, 22), various polyphenolic and polysaccharide extracts of rose (Rosa damascena), calendula (Calendula officinallis), lavender (Lavandula angustifolia) and lemon balm (Melissa officinalis) were obtained and characterized. Particularly interesting is the study on the synthesis of nanoparticles using Rosa damascena waste extracts and their application for the electrochemical sensing of hydrogen peroxide and vanillin (№ 25). Silver nanoparticles (AgNPs) were synthesized by reducing Ag+ with four different rose extracts. Biosynthesized AgNPs were deposited on a graphite electrode and stabilized using chitosan. The electrodes developed show high sensitivity and reproducibility in the quantification of H_2O_2 and vanillin.

3. Study of the chemical composition and biological activity of pectic polysaccharides.

I can refer these works by Petko Denev's as part of a team to the basic scientific research that for the first time characterized the polysaccharide composition of 11 Bulgarian and European medicinal plants (№ 14, 15, 16, 20, 29). The hot water extraction process is optimized as a reliable way to obtain pectin-rich polysaccharide complexes having high in vitro complement fixation activity and high ex vivo intestinal immunomodulatory effect. It is isolated for the first time from the flowers of the linden a unique pectic polysaccharide with an anti-inflammatory potential,

representing unusually acetylated rhamnose and highly glucuronidated galacturonic acid. The structure and immunomodulatory activity of lavender and nettle pectin polysaccharides, showing ex vivo immunostimulatory action on phagocytic leukocytes and intestinal immunomodulating activity, were studied for the first time, as well. These pectins has been shown to activate the innate and acquired immune response through the blood and contained in it payer's patches, neutrophils, macrophages and immunocompetent cells of the gut payer's patches. The large-scale study shows that acidic pectin-type heteropolysaccharides in Bulgarian medicinal plants exhibit a pronounced immunomodulatory activity with immunostimulatory and anti-inflammatory potential. The results obtained are of practical application and can be taken as a contribution of confirmatory and applied character.

I have not found a form of plagiarism in the materials submitted by Assoc. Prof. Petko Denev for the contest.

4. Critical remarks and recommendations

1. To intensify teaching.
2. Begin the supervision of PhD students.
3. Continue the tendency for laboratory research to move to semi-industrial and applied developments.

CONCLUSION

The documents and materials presented by assoc. prof. Petko Nedyalkov Denev meet all the requirements of the Law for the Development of the Academic Staff in the Republic of Bulgaria (LDASRB), the Rules for its implementation and the Rules for the Implementation of the LDASRB of BAS and IOCCP-BAS.

The candidate has submitted a sufficient number of scientific papers, published after the materials used in the defense of the Doctoral degree and for the acquisition of the academic position of "associate professor". The applicant's works have original scientific and applied contributions that have received international recognition as a representative part of them have been published in journals by international academic publishers. Its theoretical developments have practical applicability. The scientific qualification of assoc. prof. Petko Nedyalkov Denev, PhD is beyond doubt.

The results achieved by assoc. prof. Petko Nedyalkov Denev in the research activity, fully comply with the specific requirements of the IOCCP-BAS for the application of LDASRB.

After being acquainted with the materials and scientific works presented in the competition, analysis of their importance and the scientific and applied contributions contained therein, I give my **positive** assessment and recommend the elaboration and submission of a report to the scientific council of IOCCP-BAS for the election of assoc. prof. Petko Nedyalkov Denev, PhD for the academic position of "Professor" at IOCCP – BAS in the field of higher education 4. Natural sciences, mathematics and informatics, professional field 4.2. Chemical Sciences, specialty 01.05.10. Bioorganic chemistry, chemistry of natural and physiologically active substances for the needs of the Laboratory of biologically active substances – Plovdiv.

29.08.2019 Rewiewer: .....

Prof. Panteley Denev, DSc