

Appendix 12c

REVIEW

to occupy the academic position:

"Professor"	
"Associate Professor"	X
	one of the academic positions indicated shall be marked with the sign "X"

Candidates to occupy the position:

№	academic position	scientific degree	name	middle name	last name	workplace
1	Senior assistant	Dr	Dimitar	Tsvetkov	Peshev	UCTM
2						
3						

Scientific area:

5	Technical Sciences
code	name

Professional area:

5.10.	Chemical Technologies
code	name

Scientific specialty:

Unit Operations in the Chemical and Biochemical Technology
--

The competition has been announced:

101	27.12.2019	Chemical Engineering	Chemical and System Engineering
in SG issue	date	for the needs of the Department	Faculty

The review was written by:

Prof.	Dr	Iren	Hernani	Tzibranska-Tzvetkova	ICHE- BAS
academic position	scientific degree	name	middle name	last name	workplace

1. Review for the candidate:

Senior assistant	Dr	Dimitar	Tsvetkov	Peshev
academic position	scientific degree	name	middle name	last name

1.1. Completion of the provided documents:

A) The competition documents are in full compliance with the Regulations	3 points	X
B) The documents are complete but do not fully comply with the requirements of the Regulations	2 points	
C) The documents are not completed in accordance with the requirements of the Regulations	0 points	
		one of the answers given is marked with the sign "X"

Missing documents and violated requirements must be described if response C is marked.

Very good layout and appearance of the presented materials. A remark to the submitted list of publications is the lack of data on journals quartiles, which makes it difficult for assessment. However, it should be emphasized that the scientific publications of Dr. Peshev are in journals, widely known in the world, highly reputable and specialized in the field of chemical engineering.

1.2. Meeting the minimum requirements under the Regulations:

A) The candidate meets the minimum requirements	20 points	X
B) The candidate doesn't meet the minimum requirements	0 points	
		one of the answers given is marked with the sign "X"

It must be filled in if answer B is marked. The publication activity of the candidate is analyzed. The response of the results achieved (quoted) is analyzed.

Dr Peshev exceeds considerably the requirements under the regulations. This is evidenced by the reference for the minimum required number of points for the position of Associate Professor in Technical Sciences at the UCTM according to the Law on the Development of the Academic Staff in the Republic of Bulgaria and the Rules for the Implementation of the aforementioned law. He exceeds the required points in all of the scientometric indicators; concerning the number of citations this difference is drastic- 2370 points against 50 required. His scientific activity is diverse, in up-to-date fields of research, realized in 31 scientific publications except those in his dissertation. 15 of them are in journals with impact factors. Moreover, high IF of the published studies is observed - except three of them, the IF ranges from 1.5 to 7 inclusive.

The publications found an excellent response in the world scientific literature, which is indicated by the number of citations – 236, as well as the high h-factor of the candidate (9 according to Scopus).

The applicant's activity is well balanced between publishing, participation in scientific conferences, research at foreign universities (Imperial College, UK) on the one hand, and teaching on the other. A textbook, published in 2017, on Heterogeneous Chemical and Biochemical Reactors with Dr Peshev as only author, is presented. It contains 167 pages - two main parts (Real reactors, Heterogeneous reactors) and three supplementary texts. The author gives lectures on Transfer Processes in Biotechnology for the students in "Biotechnology" and on Chemical Reactors (part II) for the students in "Chemical Engineering". He is active as a teacher in Chemical Engineering with German and English teaching.

1.3. Relevance of scientific and / or applied research:

A) The research is relevant. Part of the research is pioneering (no results are known on the topic by other	7 points	X
---	----------	---

authors)		
B) Research is relevant. Results from other authors are known for each of the topics and / or applications studied.	5 points	
C) Most of the research is relevant, but also some results are presented that have no scientific and / or applied value	3 points	
D) The smaller part of the research is relevant	2 points	
E) Research is not relevant	0 points	
		one of the answers given is marked with the sign "X"

The evaluation of the relevance of the research must be substantiated.
<p>I accept rating A) even though I find the explanation "no known results on the topic by other authors" to be unrealistic. Membrane separation studies are numerous in the world. However, the study of organic solvent-resistant membranes, as well as their behavior in complex multi-component systems such as natural extracts, was really new in the years when Dr. Dimitar Peshev's research began.</p> <p>Started with European project under the 7th Framework Program, with the participation of a multinational team of universities, research institutes and membrane companies, this cooperation continues to this day. I am referring to prof Livingston's group at Imperial College, which is a world leader in membrane separation. Dr. Peshev is an active participant in this group and I believe that besides original and wide-ranging (studies in the theory and practice of the process, transfer mechanisms, characterization of membranes, as well as development of new ones), his research can be characterized as pioneering.</p> <p>I also appreciate the publications in the field of CVD (chemical vapor deposition) processes as well as their application for membrane modification. Dr. Peshev's research has a wide potential for application because it has a very good theoretical basis. In addition, it should be emphasized that the experiments are performed with modern equipment, including a variety of membranes and membrane modules. In the field of mathematical modeling, developments are equivalent in number, content and with a clear focus. Considering the research in the field of CVD processes, where the author has also worked extensively, the investigation regarding the use of plasma-enhanced chemical vapor deposition to modify nano- and ultrafiltration membranes has to be mentioned. Within this topic, successful cooperation with the Institute of Solid State Physics at the Bulgarian Academy of Sciences</p>

has been realized.

The relevance of other two topics in which the author has worked - biosorption of heavy metals with free and immobilized microorganisms and encapsulation of natural extracts is beyond doubt. Of these, the first one is the subject of a vast variety of publications in the world literature, i.e. rating B is appropriate for this topic. The second one - encapsulation of natural extracts in order to extend their stability in storage conditions, but also to optimize the mechanism of their release - is not only of high relevance and in a relatively early stage of development, but also opens a great horizon for future research.

The investigations in rheology, hydrodynamics and mass transfer in film flow on a horizontal rotating disk, also, in my opinion, falls in rating B.

I find that the majority of Dr. Peshev's research deserves rating A) for up-to-date and novelty.

1.4. Knowledge of the problems subject of research:

A) The candidate knows in detail the achievements of other authors on the researched topics and/or applications	6 points	X
B) The candidate is partially familiar with the achieved results on the researched topics and / or applications	4 points	
C) The candidate has no prior knowledge of the status of the researched problems	0 points	
		one of the answers given is marked with the sign "X"

The evaluation must be substantiated if answer C is marked.

The applicant has proved his knowledge in the areas listed in 1.3., including knowledge of the scientific achievements worldwide, in support of which I will list several reasons: high quality of the publications, each of which has a thorough analysis of the state-of-art of the respective problem; they have been published in high IF journals; the number of citations of the published research proves the interest of the world scientific community; these a results of a team work with leading scientists - abroad (the group of prof. Livingston) and at home (prof. Georgi Peev); the candidate has experience with European projects and projects within the Bulgarian Science Fund; the investigations are performed with modern equipment.

1.5. Type of research:

A) Theoretical	4 points	
B) Applied	4 points	
C) Theoretical with application elements	4 points	X
D) It does not correspond to the level specified in the Act for the Development of the Academic Staff in the Republic of Bulgaria and the Regulations	0 points	
		one of the answers given is marked with the sign "X"

The level of research must be substantiated if answer D is marked.

As I noted above, the research of Dr. Peshev has a theoretical basis and great potential for applications. In most of the investigations, there is an attempt to clarify the mechanisms of transfer (momentum and mass) and an analysis using adequate mathematical tools. The applied character of the research is proven in the study of new systems (subject to separation by nanofiltration), in solving specific practical problems using the mathematical model (in CVD research), conclusions with a wide applicability (such as containing antioxidants natural extracts). For example, the study of the ethanolic extract of rosemary - one of the first studies, provides the framework for implementation of nanofiltration with organic solvent-resistant membranes (OSN) in technologies for separating/concentrating bioactive components contained in the products of liquid- solid extraction. In my opinion, the investigations follow the classical approach of chemical engineering (and that is their merit), including a good theoretical base, orientation to the engineering practice, analysis of the computational and experimentally observed results.

1.6. Objectives of the research:

A) Realistic and of scientific and / or applied interest	8 points	X
B) Realistic, but not of scientific and / or applied interest	4 points	
C) Unattainable (unrealistic)	0 points	
		one of the answers given is marked with

Objectives must be specified. The type of the set objectives must be justified.

1. The experimental study of OSN is focused at: selection of efficient membranes, determination of process parameters, optimization of the filtration mode (dead-end or cross-flow) in view of concentration or fractionation (diafiltration) of the initial extract, characterization of the antioxidant activity of the product after nanofiltration.

There is a great interest and publishing activity in this field, due to the diversity of experimental systems on the one hand and the unresolved problems on the other related to the ability to scale-up the process.

2. Concerning the mathematical modeling of membrane separation: Creation of a multi-scale mathematical model capable of being included in commercial simulation software packages for chemical technological processes, sufficiently versatile to select the appropriate model for transfer across the membrane, with access to databases with physical properties and different molecular structures;

The software product has been tested to model the hydrodynamics and mass transfer in spiral-wound membrane modules used in typical industrial OSN processors. In support of the realistic objectives of the research, two of the publications (T3 and T16 in the presented list of publications) have received more than 100 citations within 3 years after they were published.

3. Creation of microcapsules containing natural extracts with antioxidant and antibacterial effect under fluidized bed conditions and low (below 40°C) temperatures.

There are three publications in this field which, in my opinion, have a great future and potential for both new experimental research and mathematical description.

4. A theoretical and experimental study of the mass transfer under absorption/desorption of non-Newtonian fluids on a rotating disk with application to rotating-disk reactors.

This topic has been in the focus of Dr. Peshev's dissertation (scientific supervisor assoc. prof. Agness Nikolova, publications T32 to T36) and has been fruitfully continued thereafter in another three publications. The interest is due to the combination of intensive mixing, short residence times and high rate of deformation, as well as the possibilities for a number of real applications such as medicine (blood oxygenation), formation of a dispersed phase, polymerization processes, conditions of no gravity (in spaceships and stations) etc.

5. Biosorption of heavy metals for bioremediation of wastewater.

The topic has been studied in collaboration with colleagues in the biotechnology department

at UCTM using two immobilization techniques - on the surface of a hybrid material and by incorporating it into the matrix.

6. Modeling of the chemical vapor deposition with a view to providing stationary inlet reactor conditions and homogeneity of the resulting thin layers.
7. Use of plasma-enhanced chemical vapor deposition to modify nano- and ultrafiltration membranes.

The technology allows the application of unconventional organic "monomers" to create highly cross-linked thin films resistant to organic solvents, at lower temperatures than those in the conventional CVD reactors. The results are of interest for organic solvent nanofiltration.

This overview of the objectives proves a wide scope of interests, as well as ability to focus on realistic and up-to-date tasks and to solve them from a chemical engineering point of view.

1.7. Methods of research:

A) Adequate to research and set scientific objectives and /or applications	8 points	X
B) Partially appropriate, enabling part of the scientific objectives and / or applications to be achieved	4 points	
C) Inappropriate methods	0 points	
		one of the answers given is marked with the sign "X"

Methods must be specified. The type of methods used is justified.

As I noted above, modern equipment and methods of analysis have been used, as well as an adequate mathematical description based on fundamental mass and momentum conservation equations. In the field of membrane separation, several nanofiltration modules (at UCTM, at Imperial College-London, at the Institute for Solid State Physics (ISSP) - BAS) have been used, allowing for different filtration modes to be studied as well as optimization of the conditions for separation or concentration of biologically active substances. The latter have been analyzed by group- as well as component- analytical methods (HPLC). Antioxidant activity was determined by free radical test (DPPH and ABTS).

The characterization of membranes (especially those obtained after CVD assisted modification) was performed using scanning electron microscopy (SEM), Attenuated Total Reflection Fourier-Transform Infrared (ATR-FTIR) spectroscopy, energy dispersive X-ray spectroscopy (EDX), X-ray Photoelectron Spectroscopy (XPS), atomic force microscopy (AFM), contact angles determination.

The developed OSN Designer is a software tool including OSN modules (batch concentration, semi-batch diafiltration at constant volume, steady-state filtration) that have been tested in Aspen Plus and COFE. They are based on modern models for predicting mass transfer through the membrane

The models used in the CVD studies are based on the equation of motion and mass transfer in non-Newtonian fluids, whose rheology follows a two-parameter model (Ostwald-de Waele).

The adsorption kinetics of heavy metals biosorption was investigated on the basis of experimental data and an adapted BET isotherm model, used to describe the adsorption equilibrium. The supporting materials for immobilization are synthesized by a sol-gel process.

The encapsulation of rosemary extract in fluidized bed conditions was carried out in collaboration with and equipment of the University of Hamburg.

This brief overview of the methods (experimental and theoretical) used by Dr. Peshev, characterizes his research as meeting the world standards in the investigated fields. He has had access to the modern experimental base at Imperial College (UK), at the ISSP-BAS, at the University of Hamburg, as well as the ability to give the correct setup of the study and to actively participate in it.

In the field of membrane separation, where the highest number of publications is observed, I have also my personal impressions. Moreover, by participating in the European project of ISSP-BAS, Dr. Peshev was actively involved in the choice of the nanofiltration equipment, defining the requirements to be posed to the manufacturing company. In the theoretical developments – mathematical models and analysis of the results - I feel the basis given by the late prof. Georgi Peev and I note this as a positive fact for the scientific growth and development of Dr. Peshev.

1.8. Candidate research contributions:

A) With lasting scientific and / or applied response, they form the basis for new research and applications	20 points	X
B) They are of significant scientific and / or applied interest,	16 points	

complete and / or summarize previous research		
C) They are of scientific and / or applied interest	12 points	
D) Lack of significant contributions	8 points	
E) Lack of contributions	0 points	
		one of the answers given is marked with the sign "X"

Contributions must be specified. The type of results achieved must be justified.
<p>A. In the field of membrane separation, incl. possibilities for modifying nano- and ultrafiltration membranes by CVD-assisted process, mathematical modeling, encapsulation of natural extracts, I find the basis for new research and applications. Various systems (rosemary, lemon balm, hawthorn, spent coffee) have been investigated in view of their separation, concentration, and storage. The main contributions in these areas can be defined as:</p> <ol style="list-style-type: none"> 1. High degree of concentration and antioxidant activity of the retentate is achieved which allows it to be used directly as a preservative or in food supplements. Example: ethanol extract of rosemary; 2. The ability of OSN to be used for partial separation of caffeic and rosmarinic acids from ethanol solution has been demonstrated. 3. The solvent (in the permeate) is recovered and can be reused for extraction, which increases the economic effect of the process. 4. Supercritical extraction in combination with OSN in a three-stage extraction scheme results in a high degree of rosmarinic acid recovery and concentration (membrane rejection 99%). 5. A new technology (extraction and nanofiltration) has been proposed for the efficient and complex utilization of caffeine and phenolic antioxidants contained in spent ground coffee. 6. A software product has been developed to enable OSN to be included in commercial software packages. This is also the first publication examining the integration of Matlab models in an Aspen Plus environment. The product has been adapted to include reverse osmosis (RO) and to be applied to RO seawater desalination processes. 7. The ability to achieve increased storage stability, as well as antioxidant and antibacterial

activity comparable to those of the fresh extract has been demonstrated by encapsulating water-alcohol extracts of rosemary; the encapsulation is realized in a batch spouted bed.

8. Systematic studies have been conducted on Plasma-Enhanced Chemical Vapor Deposition (PECVD) of polymers to modify nano- and ultrafiltration membranes. A positive effect on the hydrophobicity of the membranes, the permeability and rejection was obtained.

B. In the field of biosorption of heavy metals, the *Trichosporon cutaneum* R57 strain was investigated; the order of selectivity for cadmium, copper and chromium ions was determined; immobilization of cells prevents their inhibition by the action of metal ions and increases their potential for wastewater treatment.

C. Based on mathematical modeling of the CVD process, a solution is proposed that allows the full use of precursors (two precursor mixtures evaporated from a flat surface) at constant composition of the reaction mixture. It is suggested to use a two-section boat with the possibility one section to be of regulated length. The solution is illustrated by a numerical example based on organometallic compounds.

D. Modelling the mass transfer in a film flow of non-Newtonian fluid over rotating disk proved the increasing mass transfer rate when both the coefficient of consistency and the rheology index decrease. By increasing the disk rotation speed and decreasing the rheology index of the fluid, a synergetic effect on the mass transfer coefficient is observed..

1.9. Participation of the candidate in the achievement of the presented results:

A) The candidate has at least an equal participation in the submitted papers	8 points	X
B) The candidate has at least an equal participation in most of the submitted papers	7 points	
C) The candidate has a secondary participation in most of the submitted papers	4 points	
D) The candidate participation is unnoticeable	0 points	
		one of the answers given is marked with the sign "X"

Critical notes must be provided if one of the items C or D is marked.

The publications of Dr. Peshev have different number of authors, ranging between two (4 articles) and 8 (1 article), most of them with 3-4 authors. Given the co-authors, some of

whom are leading names in their field, I believe that the candidate was an active and equal participant in the publications. I also base my personal opinion on him as an independent and responsible scientist. In fact, I was a little surprised by the fact that I found him as corresponding author in only 4-5 of the publications, but that does not change my opinion about his participation.

1.10. Pedagogical activity:

A) The candidate has effective and sufficient pedagogical activity at the university. The textbooks issued are modern and useful (they meet the requirements of the Regulations). The work with undergraduate and doctoral students is at a high professional level.	8 points	X
B) The candidate has sufficient pedagogical activity at the university. The textbooks issued satisfy the requirements of the Regulations.	6 points	
C) The pedagogical activity and / or textbooks issued are insufficient (do not meet the requirements of the Regulations)	0 points	
		one of the answers given is marked with the sign "X"

Critical notes must be provided if one of the items B or C is marked.

The textbook presented is correctly written and certainly much needed in the teaching practice. However, I think the content as well as the explanation text could be expanded, especially in the bioreactor's part; I hope this could happen in a second edition. For example, in the supplementary part concerning enzyme kinetics the text about heterogeneous reactions is missing, namely in the presence of solid phase when external mass transfer + reaction is rate limiting, or when diffusion in the biofilm + reaction occurs. There are two appropriate examples on page 71 and 82, but it is worth expanding this section. The example on page 82 excludes both external mass transfer and internal diffusion.

When gas-liquid mass transfer is considered, I also recommend to include the chemostat with aeration when oxygen is rate limiting, or when both oxygen and another substrate are rate limiting.

1.11. Critical notes:

A) Lack of critical notes	8 points	X
B) Critical notes of a technical nature	7 points	
C) Critical notes that would partially improve the results achieved in a small part of the research	5 points	
D) Critical notes that would partially improve the results achieved in most of the research	3 points	
E) Significant critical notes	0 points	
		one of the answers given is marked with the sign "X"

Critical notes must be provided if one of the answers C, D or E is marked.

I have no critical comments on the scientific papers presented.

1.12. Conclusion

A) The evaluation of the candidate's activity is POSITIVE	This evaluation is assigned to a total number of at least 65 points	X
B) The evaluation of the candidate's activity is NEGATIVE	This evaluation is assigned to a total number below 65 points	
		one of the answers given is marked with the sign "X"

The sum of points according to 1.1 to 1.11 is 98.

I strongly recommend the candidature of Dr. Dimitar Peshev for the academic position of Associate Professor in the Department of "Chemical Engineering" at the University of Chemical Technology and Metallurgy, Sofia.

2. Review for the candidate:

academic position	scientific degree	name	middle name	last name

The structure of the review under the previous point 1 shall be respected.

3. Review for the candidate:

academic position	scientific degree	name	middle name	last name

The structure of the review under the previous point 1 shall be respected.

Candidate ranking (in case of more than one candidate who has received a positive evaluation to occupy the academic position):

Based on the assigned points, the candidates who have received a **positive** evaluation are ranked as follows:

1	Senior assistant	Dr	Dimitar	Cvetkov	Peshev	98
place	academic position	scientific degree	name	middle name	last name	points
2						
place	academic position	scientific degree	name	middle name	last name	points
3						
place	academic position	scientific degree	name	middle name	last name	points

05.05.2020	The review was written by:	
date	Iren Tzibranska	signature