

REVIEW REPORT
On
A promotion to Professor position
at the Institute of Chemical Engineering, BAS

Related to the concurs about the scientific specialty **4.2. Chemical Sciences**
(Unit operations in chemical and biochemical industries)

Announced in State gazette № 96 from 02/12/2022 г.

Applicant: senior assistant, doctor c Daniela Boyanova Dzhonova-Atanasova

Reviewer : prof. Dr. Jordan Yankov Hristov, Ph.D., D.Sc.

1. Brief on the applicant's biography

Associate professor Dzhonova graduated from the Technical University, Sofia, as a mechanical engineer, with a MS degree and a specialty in Heat transfer. In March 1988 she increased her skills by passing a short course on Applied Mathematics and Informatics. From October 1988 to 1992 she was a Ph.D. student in the department of hydrodynamics at Technical University, Sofia. The thesis entitled “ Heat transfer in two-dimensional free jets” was defended in 1992. From 1994 to the present, doctor Dzhonova works at the Institute of Chemical Engineering, BAS. Doctor Dzhonova is head of the laboratory on “ Transport processes in multiphase media”. From 2018 to 2022 she is the scientific secretary of the institute. Since 2002 doctor Dzonova is a deputy director of the Institute of Chemical Engineering.

2. General characteristics of the scientific and applied activities of the applicant

The main direction in the research of doctor Dzonova are :

- 2.1.** Integrated membrane reactors oriented to various industrial applications
- 2.2.** Enhancement of the efficiencies of industrial packing columns
- 2.3.** Developments of efficient heat energy accumulators

3. Evaluation of the materials applied

There are **44 publications**, independent from the preceding promotion to associate professor.

2.1. Habilitation thesis equivalent: *-8 publications in journals indexed in SCOPUS and Web of Science*

2.2. Section G: *20 publications 4 chapters in contributed books (60 scores) and one utility model (25 scores). In general, for section G-350 scores, with the minimum level required 220 scores.*

2.3. Section D: *172 recorded citations (164 scores) (with the minimum level required 120 scores)*

2.4. Section E: *There is the supervision of one Ph.D. Thesis (25 scores). Participation in 4 national scientific projects (founded by the Ministry of Education and Science), 4 international projects (supported by the EU), and 2 scientific bilateral projects (founded by the Ministry of Education and Science). In general, for section E there are 193 scores.*

4. Main scientific and applied contributions

The main scientific and applied contributions, in according with the applied publications, are outlined as follows :

4.1. Integrated membrane reactors oriented towards industrial applications

4.1.1. Assessment of the hydrodynamic conditions and shear stress distributions in filtration processes by application of computer simulations (CFD)

Several basic configurations of non-integrated membrane modules with a tangential flow regime (cross flow) or a normal flow direction (flow directed to the membrane surface), as well as a submerged module, have been studied.

4.1.2. Submerged membrane module:

Characteristics of the fluid flow (velocity profiles and velocity gradients) in a conventional mixed bioreactor with an integrated tube membrane module have been investigated. The results indicate the possible flow field as a compromise between the minimal membrane fouling and the minimal stresses imposed on the living cells.

4.1.3. Application of CFD for description and prediction of mass transfer in filtration processes

The conditions for stable and efficient working regimes of a separated membrane module, integrated with a bioreactor have been estimated with help of CFD modeling of tangential flow regime.

4.1.4. Assessment of a membrane module efficiency in two cases: Integrated with a mixed bioreactor and submerged module

A demonstration of how the efficiency of an integrated membrane bioreactor should be evaluated in two cases: integrated module and submerged module.

4.2. Investigations on the enhancement of the packed bed columns' efficiencies

4.2.1. Development of new packing materials

A new packing material, based on a ceramic block with a honeycomb structure has been developed for applications in absorption and heat transfer types of equipment. The new packing demonstrates high efficiency and relatively low-pressure drop. In addition, the new packing is stable upon conditions imposed by high temperatures and aggressive media

4.2.2. Measurements and prediction of working characteristics of packing materials with open structures.

These packings are characterized by open mesh structures, thus assuring efficient transfer due to the high contact interface area and turbulent structure of the flow through them with low-pressure drops. Correlations based on experimental data (obtained in the laboratory) on the dynamic holdup and hydraulic resistance of packing INTALOX Metal Tower Packing (IMTP) and metallic packing Raschig Super-Ring (RSR) have been developed. A dispersion model concerning the liquid flow distribution for both packed bed columns assuring high efficiency and packings with open structures has been developed.

4.2.3. Measurements of the inhomogeneity in the liquid phase distribution, wall flow, and temperature field in case of distillation using structured packings.

Experimental data concerning the efficiency of separation in large-scale distillation columns have been collected and treated. The scale of the flow inhomogeneity is of the same order of magnitude as the column diameter.

4.3. Development of efficient thermal energy accumulators

4.3.1. Thermal energy accumulators for solar drying

An overview of methods applied for theoretical assessments and prediction of the design approach applied to thermal energy accumulators is developed. The models allow distinguishing the efficient case of solar drying designs by using suitable materials and efficient constructions

6. References to the applied publications in the literature

7. .

The citations encountered at the moment of application are **172**. On this basis, the Hirsh index is **H-factor=6**.

7. Critical coments and suggestions.

There are no critical comments

8. Personal comments

I know doctor Dzhonova as the scientific secretary of the Institute. I believe that if she will be promoted to the professor position, she will be able to get new results and fruitful contributions to the laboratory where she will be assigned.

CONCLUSION-RECOMMENDATION

Based on the applied and reviewed materials, and applying the conditions imposed by the Law of Academic Development of the Republic of Bulgaria, I may suggest the promotion of doctor Daniela Dzhonova-Atanasova to the position of professor in 4.2. Chemical science (unit operations in chemical and biochemical technologies) at the Institute of Chemical Engineering, BAS

Date: 07.03.2023

Reviewer:

Prof. Dr. Jordan Yankov Hristov, Ph.D., D.Sc.