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Вх.№ 3940 | 11.09 2026 г.

REVIEW

by Prof. Dr. Irena Georgieva Markovska

Department of Chemical Technology, BSU "Prof. Dr. Asen Zlatarov"

Position of the reviewer: internal member of the scientific jury formed by order No. UD - 309 of 27.07.2026 of the rector of BSU "Prof. Dr. Asen Zlatarov"

Regarding: dissertation work of doctoral student Svetlin Petrov Vassilev on the topic "MODELIZATION OF THE PROPERTIES OF PETROLEUM FLUIDS AND PROCESSES IN OIL REFINING", submitted for the acquisition of the educational and scientific degree "doctor" in the field of higher education: 5. Technical sciences, professional direction: 5.10 "Chemical Technology", scientific specialty: "Technology of natural and synthetic fuels"
Scientific supervisors of the doctoral student: Prof. Dr. Dobromir Yordanov and Prof. Dr. Dicho Stratiev

Autobiographical notes for the post doctoral student

Post doctoral student Svetlin Petrov Vassilev was born on 02.11.1976. In 1994 he graduated from the English Language School "Geo Milev" - Burgas, after which he was accepted as a student at the University "Prof. Dr. Asen Zlatarov", Burgas. In 1999 he graduated as a Master of Chemical Engineering, with a specialty in "Chemical Engineering" at the University "Prof. Dr. Asen Zlatarov". After graduating in 1999, he started working at Lukoil Neftochim Burgas AD, Institute of Petrochemistry and Oil Refining. During the period 2001-2002 he completed a 3-month training course for the design of technological furnaces in the chemical and oil industries in Milan, Italy.

From 2017 to the present, he has been working in the company "Tersa EOOD" he founded as a freelance designer and is mainly engaged in research, investigation and consultancy work in the field of chemical, petrochemical and oil refining industries, preparing feasibility studies, conceptual (base) designs, detailed design in the Chemical and Technological part, etc.

Content of the dissertation

The dissertation submitted to me for review by Eng. Svetlin Petrov Vassilev contains 275 pages, including 83 figures and 51 tables. The bibliography contains 647 sources. An extensive literature review of the available methods and approaches for performing molecular reconstruction of oil and oil fractions has been carried out, tracking the period from 1989 - 2025 and the beginning of 2026. Progress in optimization algorithms and the applicability of molecular reconstruction in modeling various oil fluids and processes in oil refining has been tracked. An evaluation of the most commonly used group constituent methods for generating properties of individual components in the molecular database for molecular reconstruction has been made. The errors in the prediction of the most important properties have been estimated and recommendations for improving the accuracy of the input data used in the molecular reconstruction process have been presented.

The the theoretical part review analyzes the results achieved so far worldwide on the issues of the dissertation work and points out the existing, still unresolved problems, some of which are the subject of the current dissertation research.

Relevance of the topic of dissertation

The topic of the dissertation is very relevant, since the ability to accurately predict the physicochemical properties of oil fractions is fundamental for the design, optimization and management of technological processes. The development of reliable models for predicting properties is essential for obtaining high-quality commodity products. Effective modeling allows not only to understand the behavior of the raw material, but also to make accurate engineering calculations, preceding and replacing costly experiments. The relevance of the presented problem is related to offering opportunities for a detailed assessment of the correlations available in the literature for predicting the molecular mass of petroleum fluids in the range from 70 to 1685 g/mol; for deriving a new correlation for predicting the molecular mass by using nonlinear regression and an artificial neural network model, which, with its increased prediction range and increased accuracy, surpasses the correlations published in the literature; for finding new correlations for predicting critical temperature and critical pressure using nonlinear regression and an artificial neural network model, which outperform the correlations published in the literature with increased accuracy in predicting critical

properties for individual hydrocarbons; for studying the change in viscosity of mixtures of different vacuum distillation residues with lighter fractions and confirming that their viscosity decreases exponentially with increasing concentration of the lighter fraction, etc.

Contributions

In my opinion, the main contributions of the dissertation work are both scientific and applied. The main contributions of post doctoral student Svetlin Petrov Vassilev are related to research on correlations for predicting the molecular mass, critical temperature and critical pressure of oil fractions and individual hydrocarbons, which can be used in simulation and modeling of petroleum fluids and oil refining processes, improving or supplementing the predictions of existing correlations used so far.

The conducted studies show the superiority of gas chromatographic methods of simulated distillation over physical distillation methods in performing distillation analysis of petroleum fluids. Confirmation of the equivalence of the obtained data with those of a true boiling point curve reinforces the advantage of these methods, due to the elimination of the need to convert the obtained data into a true boiling point curve.

The proposed correlations for calculating the viscosity of mixtures of heavy fractions and thinners of lighter fractions provide an opportunity to model the viscosity of such mixtures in order to improve the transport properties of heavy fractions using an optimal amount of lighter fractions used as a thinner. These lighter fractions have a correspondingly higher cost and reducing their input has direct economic benefits.

The detailed review of the growing popularity and application of the molecular reconstruction approach and the analysis of the criticality in preparing the initial information on the properties of the molecules in the libraries used for molecular reconstruction can serve to further improve the accuracy of the obtained results and the scope of application of molecular reconstruction.

Evaluation of publications

The publication activity of Eng. Svetlin Vassilev exceeds the requirements of the Standard for Accumulation of Credits in the Education of

Doctoral Students at the Bulgarian State University "Prof. Dr. Asen Zlatarov". The doctoral student has presented the following publications on the topic of the dissertation:

1. Stratiev, D.; Shishkova, I.; Ivanov, M.; Dinkov, R.; Argirov, G.; **Vasilev, S.;** Yordanov, D. Validation of Diesel Fraction Content in Heavy Oils Measured by High Temperature Simulated Distillation and Physical Vacuum Distillation by Performance of Commercial Distillation Test and Process Simulation. *Applied Sciences*, 2022, 12, 11824. **https://doi.org/10.3390/app122211824,** Impact Factor: **2.9**

2. Stratiev, D.; Sotirov, S.; Sotirova, E.; Nenov, S.; Dinkov, R.; Shishkova, I.; Kolev, I.V.; Yordanov, D.; **Vasilev, S.**; Atanassov, K.; et al. Prediction of Molecular Weight of Petroleum Fluids by Empirical Correlations and Artificial Neuron Networks. *Processes* 2023, 11, 426. https://doi.org/10.3390/pr11020426, Impact Factor: **3.4.**

3. Sotirova, E.; **Vasilev, S.**; Stratiev, D.; Shishkova, I.; Sotirov, S.; Nikolova, R.; Veli, A.; Bureva, V.; Atanassov, K.; Georgieva, V.; et al. Comparison of the Methods for Predicting the Critical Temperature and Critical Pressure of Petroleum Fractions and Individual Hydrocarbons. *Fuels* 2025, 6, 36. https://doi.org/10.3390/fuels6020036, Impact Factor: **4.0.**

4. Stratiev, D.; Nenov, S.; Shishkova, I.; Sotirov, S.; Sotirova, E.; Dinkov, R.; Yordanov, D.; **Vasilev, S.;** Stratiev, D.D.; Prediction of Viscosity of Blends of Heavy Oils with Diluents by Empirical Correlations and Artificial Neural Network, *Industrial & Engineering Chemistry Research*, 2023, 62, 49, 21449–21463 https://doi.org/10.1021/acs.iecr.3c02472 Impact Factor **3.9.**

5. **Vasilev, S.**; Stratiev, D.; Shishkova, I.; Dinkov, R.; Yordanov, D.; Abdellatief, T.M.M.; Sotirov, S.; Sotirova, E.; Dimitrov, A.; Georgieva, V.; et al. Oil Characterization, Molecular Modeling and Process Simulation in Petroleum Research and Industry, Opportunities, Challenges and Perspectives. *Molecules* 2026, 31, 1645. https://doi.org/10.3390/molecules31101645, Impact Factor: **5.1.**

6. **Vasilev, S.**; Stratiev, D.; Shiskova, I.; Yordanov, D.; Abdellatief, T.M.M.; Nikolova, R.; Sotirov, S.; Sotirova, E.; Dimitrov, A.; Georgieva, V. Input Data for Molecular Reconstruction of Petroleum Fractions—A Reality

Check. *Processes* 2026, 14, 1606. https://doi.org/10.3390/pr14101606, Impact Factor: **3.4**.

It can be seen that the doctoral student has presented the results of his dissertation research in 6 articles, which have been published in prestigious journals, all of which have an impact factor. The doctoral student is the first author in two of the publications, with an impact factor of IF 5.1 and IF 3.4, respectively (publications No. 5 - in the journal Molecules and No. 6 - in the journal Processes), is in second place in one publication - No. 3, in the journal Fuels with an impact factor of 4.0 and is in a lower position in the remaining 3 publications.

The number of citations for the presented publications is impressive - a total of 25, distributed as follows - publication No. 1 in the list has 4 citations (Stratiev, D.; Shishkova, I.; Ivanov, M.; Dinkov, R.; Argirov, G.; Vasilev, S.; Yordanov, D. Validation of Diesel Fraction Content in Heavy Oils Measured by High Temperature Simulated Distillation and Physical Vacuum Distillation by Performance of Commercial Distillation Test and Process Simulation. Appl. Sci. 2022, 12, 11824).

Publication number 2 on the list has a total of 9 citations (**Vasilev, S.**; Stratiev, D.; Shiskova, I.; Yordanov, D.; Abdellatief, T.M.M.; Nikolova, R.; Sotirov, S.; Sotirova, E.; Dimitrov, A.; Georgieva, V. Input Data for Molecular Reconstruction of Petroleum Fractions—A Reality Check. Processes 2026, 14, 1606).

Publication number 3 in the list has a total of 2 citations (Sotirova, E.; Vasilev, S.; Stratiev, D.; Shishkova, I.; Sotirov, S.; Nikolova, R.; Veli, A.; Bureva, V.; Atanassov, K.; Georgieva, V.; Stratiev, D.D.; Nenov, S. Comparison of the Methods for Predicting the Critical Temperature and Critical Pressure of Petroleum Fractions and Individual Hydrocarbons. Fuels 2025, 6, 36)

Publication number 4 in the list has a total of 10 citations (Dicho Stratiev, Svetoslav Nenov, Ivelina Shishkova, Sotir Sotirov, Evdokia Sotirova, Rosen Dinkov, Dobromir Yordanov, Dimitar Pilev, Krassimir Atanassov, Svetlin Vasilev, and Danail Dichev Stratiev. Prediction of Viscosity of Blends of Heavy Oils with Diluents by Empirical Correlations and Artificial Neural Network. Ind. Eng. Chem. Res. 2023, 62, 49, 21449–21463).

This impressive number of citations shows that the scientific team, of which the doctoral student is a part, is doing science at a very high level, which is of interest to specialists from all over the world working in this scientific field.

Autoreferat

The dissertation work is synthesized and summarized in an 82-page abstract, with the content of the abstract correctly reflecting the essence of the dissertation, including conclusions, contributions and publications. The abstract contains the main highlights and results of the dissertation work, and includes 17 figures and 28 tables that illustrate the results obtained.

Critical notes.

Critical notes. The dissertation has an impressive scientific weight and shows that a large amount of work has been done. My overall impression is that the doctoral student is part of a serious scientific team and has the potential to soon defend a doctorate for a Doctor of Science. My main remarks and recommendations to the work of Eng. Svetlin Vassilev are mainly technical:

The volume of the dissertation (275 pages) is too large to receive the educational and scientific degree (ESD) "doctor", respectively. A literature review of almost 100 pages is also quite "heavy" to read. In principle, the literature review is about 1/3 of the volume of the entire work, which is optimally up to 150 pages. The same applies to the cited literature - 647 sources are too many for the ESD "doctor".

My other technical remark is that it is not customary to cite literature in abstracts, and in this case the doctoral student cited 76 sources.

I am left with the impression that the literature review of 647 sources lacks Bulgarian publications from other teams in Bulgaria. My question is, is this scientific niche in Bulgaria occupied only by the team of Prof. Stratiev and Prof. Yordanov?

My recommendation to the post doctoral student and the team he works with is to issue a patent or utility model to protect their newly obtained scientific results before the Patent Office of the Republic of Bulgaria, as they did before the Federal Intellectual Property Service of the Russian Federation.

The remarks and recommendations made do not belittle the significance of the work done and the results achieved.

Conclusion

In conclusion, I give my positive assessment of the dissertation work. The candidate for the educational and scientific degree "Doctor" meets the requirements of the Act on the Development of the Academic Staff in the Republic of Bulgaria and the Regulations for its implementation and is in accordance with the regulatory requirements of the Bulgarian State University "Prof. Dr. Asen Zlatarov". He has acquired the professional qualities of an established researcher in his field, with proven scientific and practical-applied contributions for the award of the educational and scientific degree "Doctor".
In connection with the above mentioned, I strongly recommend that the esteemed scientific jury award Eng. Svetlin Petrov Vassilev the educational and scientific degree "DOCTOR" in the scientific specialty "Technology of Natural and Synthetic Fuels", in the professional field 5.10 "Chemical Technologies", field of higher education 5. Technical Sciences, according to the Law on the Development of Academic Staff in the Republic of Bulgaria.

Burgas
Date: 11.09.2026

reviewer:
(prof. Dr. Irena Markovska)