



INSTITUTE OF CATALYSIS  
BULGARIAN ACADEMY OF SCIENCES  
1113 Sofia, Bulgaria  
Tel/fax: (+359 2) 9712967  
E-mail: icatalys@ic.bas.bg

ИНСТИТУТ ПО КАТАЛИЗ  
БЪЛГАРСКА АКАДЕМИЯ НА НАУКИТЕ  
1113 София  
Тел/факс: (02) 9712967  
Ел. поща: icatalys@ic.bas.bg

## STANDPOINT

by **Assoc. Prof. Dimitrinka Aleksieva Nikolova, PhD**  
Institute of Catalysis, Bulgarian Academy of Sciences  
member of a scientific jury of the University "Prof. Dr. Asen Zlatarov" - Burgas,  
regarding the dissertation of **Eng. Vasil Kotsev Yankov**  
head of the "Quality" group at "LUKOIL NEFTOHIM BURGAS" JSCo

**Topic: Dependence of the performance of the H-Oil tar hydrocracking and vacuum-diesel catalytic cracking processes on the properties of the raw material and the hardness of the regime in H-Oil**

Supervisors:

1. Associate Professor Dr. Dobromir Yordanov - Asen Zlatarov University
2. Prof. DSc. Dicho Stratiev - "LUKOIL NEFTOHIM BURGAS" JSCo

for the acquisition of an educational and scientific degree " doctor " in a professional field  
*5.10. Chemical technologies, scientific research specialty 02.10.23 "Technology of natural and synthetic fuels"*

The dissertation work of Eng. Vasil Yankov is in the field of development of the H-Oil hydrocracking technology of tar in a pseudo-fluidized bed as an approach for the utilization of heavy, residual oil fractions in oil refining and part of the approaches to environmental protection in accordance with the growing requirements in modern oil refining.

The fact that heavy oils contain high amounts of undesirable constituents such as sulfur, nitrogen, metals, and asphaltenes has prompted research to improve the activity and stability of catalysts used for hydroprocessing. At the same time, the rate of conversion of the tar in the hydrocracking plant is a determinant of the economics of oil refining, as is the control of the rate of sedimentation.

The significance of the present dissertation is also determined by the fact that it is part of intensive work on the optimization of the operating H-Oil tar hydrocracking complex at LUKOIL Neftohim Burgas JSC, as well as the synchronization of the tar hydrocracking installation with the other process for conversion of heavy oil fractions - the catalytic cracking fluid type, basic processes for improving the economic indicators of modern oil refining.

The present PhD thesis deals with the optimization problems of reaction temperature and reaction time (residence time) on sedimentation rate; evaluation of the joint action of a standard alumina supported catalyst and a nano molybdenum containing catalyst; clarification of the influence of the hardness of the regime in the process "Hydrocracking of tar H-Oil" on the quality of the obtained vacuum gas oil.

The dissertation is structured according to the standard requirements and has a volume of 165 printed pages, is illustrated with 52 figures, 28 tables are presented and 8 equations are included. 286 literary sources are cited. Some of the figures represent technological schemes of different types of reactors and processes illustrating the information. The approach of the doctoral student to organize the abbreviations used in the dissertation in a separate part of the dissertation facilitates their reading. The dissertation is written in very good professional language and is technically very carefully designed. A detailed analysis of the results has been made.

The literature review successfully introduces the problems of the "H-Oil tar hydrocracking" process: history of the process, chemistry and mechanism, varieties of the process, used catalysts, industrial technological schemes - in a stationary, in a moving, in a boiling, ebulating, suspended bed; information on hydrocracking and hydrotreating feedstocks and the influence of the hardness of the tar hydrocracking regime on various parameters. An overview of the "Fluid" type catalytic cracking process was also made. All this shows a very high level of scientific knowledge and ability of Eng. Yankov to handle scientific literature successfully.

The conclusions drawn from the literature review summarize the main problems and the lack of information about the influence of the hardness of the regime (increasing the temperature and prolonging the contact time) on the sediment formation in the hydrocracking of tar in a pseudo-fluidized bed of the H-Oil catalyst, the addition of the nano-catalyst HCAT to the standard catalyst, the physicochemical properties of the raw material. They point to the specific and clearly formulated tasks to achieve the set goal - to study the dependences of the action of the processes "Hydrocracking of tar H-Oil" and "Catalytic cracking of vacuum gas oil" on the properties of the raw material and the hardness of the regime in H-Oil .

Based on detailed and in-depth research done by Eng. Vasil Yankov, the dissertation has significant contributions with completely industrial application for for the successful operation of the modern refinery of "LUKOIL NEFTOHIM BURGAS" JSCo:

- assessment of the economic efficiency of processing new alternative types of oil and their mixtures in the "Lukoil Neftohim Burgas" refinery using the founded regression equation describing the dependence between the reactivity and the properties of the raw material for hydrocracking H-Oil.
- daily monitoring and evaluation of the reactivity of the hydrocracking feedstock, allowing prediction and timely optimization of the technological regime of the H-Oil tar hydrocracking plant through the found dependence between the reactivity and the properties of the H-Oil hydrocracking feedstock.
- to properly manage the sediment content as the main and most difficult to control quality indicator of the commodity boiler fuel through the established influence of the quality of the raw material and its reactivity, as well as the stiffness of the regime, expressed by the reaction time (volumetric velocity) and temperature, on hydrocracking hydrocracking of H-Oil tar.
- to predict the behavior of the catalytic cracking plant and to optimize the joint action of the two most economically efficient processes for deep processing Hydrocracking and Catalytic Cracking in the refinery "Lukoil Neftohim Burgas" by using the established influence of the stiffness of the regime in the tar hydrocracking plant H-Oil on the yield and quality of gas oil fractions-raw materials for catalytic cracking.

The achieved results show the professional growth of engineer Vasil Yankov.

The results obtained during the preparation of the dissertation are reflected in 8 scientific papers published in the journals: *Oxidation Communications* (2019-JCR Q3, 2020-JCR Q3),

*Petroleum and Coal (2019-JCR Q3, 2021-JCR Q4), Petroleum Science and Technology (2020-JCR Q2).* All articles were out of print within only 3 years, which is an indicator of high publication activity

The abstract is very well designed and fully and correctly reflects the results of the research. After a short introduction, the goal and main tasks are formulated. The main results are discussed and the scientific contributions are presented.

### CONCLUSION

I can conclude that topicality, volume of investigations, achieved results and scientific contributions of this PhD thesis fully corresponds to the requirements of the Regulations on the terms and conditions for acquiring scientific degrees and holding academic positions at the University "Prof. Dr. Asen Zlatarov" - Burgas. I give my positive assessment and I suggest with conviction of the members of the Jury and to the Scientific Council of at the University "Prof. Dr. Asen Zlatarov" - Burgas to vote positively for awarding the educational and scientific degree "doctor" to Eng. Vasil Kotsev Yankov.

Date 16. 12. 2022

Member of a scientific jury:

/Assoc. Prof. Dimitrinka Nikolova, PhD/

Подпис заличен  
Чл.2 от ЗЗЛД