MODIFICATION OF A ZEOLITE CATALYST TO IMPROVE THE QUALITY OF STABLE GAS CONDENSATE PROCESSING PRODUCTS

O. M. Torchakova
Scientific supervisor – PhD, associate professor M. V. Kirgina
Linguistic advisor – assistant I. A. Bogdanov

National Research Tomsk Polytechnic University
634050, Russia, Tomsk, 30 Lenin Avenue, torchakova05@gmail.com

Most processes in oil refining are carried out using catalysts. The development of new catalysts, as well as the improvement of currently available catalysts, is an urgent task, since the demand for high-quality motor fuels with the best physico-chemical, operational and environmental properties is increasing [1].

The aim of this work was to process stable gas condensate (SGC) on a modified zeolite catalyst of the ZSM-5 type. An industrial zeolite catalyst of the KN-30 brand was used as the initial catalyst for the modification. For modification, the original catalyst was crushed and sorted by particle size, a fraction of 0.5–1.0 mm^2 was selected. The modifiers were $Ni(NO_3)_2$ solution and ZnF_2 solution.

A solution of $Ni(NO_3)_2$ salt was prepared with a concentration of 1 % wt. For modification, a crushed fraction of the catalyst weighing 15.0 g was selected, which was impregnated with a solution of $Ni(NO_3)_2$ for 5 hours with constant stirring. Then the catalyst was dried at a temperature of 80 °C for 2 hours and calcined at a temperature of 250 °C for 4 hours.

Modification of the catalyst with ZnF_2 salt was carried out in two stages. At the first stage, the crushed fraction of the catalyst weighing 20.0 g was kept in 100.0 g of $Zn(NO_3)_2$ salt solution with a concentration of 0.1 M at a temperature of 80 °C for 1 hour, after the expiration of time, the catalyst was washed with 100 ml of hot distilled water. After washing, the catalyst fraction was kept in a NH4F salt solution weighing 100.0 g at a temperature of 80 °C for 2 hours. After the expiration of the time, the catalyst was washed with hot distilled water (80 °C) in ratio of 3 ml to 80 ml, followed by drying at a temperature of 120 °C for 6 hours and calcination at a temperature of 600 °C for 6 hours.

The SGC refining process was carried out on a flow-type catalytic unit at a temperature of 400 °C, a pressure of 0.25 MPa and a volumetric feed rate of 0.33 ml/min.

The hydrocarbon composition of the initial SGC and processed products on the different types of catalyst was determined by gas-liquid chromatography.

The results of determining of the hydrocarbon composition are presented in Table.

In the feedstock, the predominant group is n-paraffins, the reduction in the content of which (by 18.468 % vol.) is best achieved by processing the feedstock on a zeolite catalyst modified with a $Ni(NO_3)_2$ solution.

The content of isoparaffins during the processing of feedstock on the initial catalyst increased by 2.083 % vol.; on a catalyst modified with $Ni(NO_3)_2$, there is a decrease in isoparaffins by 6.686 % vol.; on a catalyst modified with ZnF_2 a decrease in isoparaffins by 9.108 % vol.

There is a significant increase in aromatic compounds. During processing on the initial catalyst, an increase in the content of aromatic compounds occurs by 24.343 % vol.; on a catalyst modified with $Ni(NO_3)_2$ an increase in the content of aromatic compounds occurs by 35.490 % vol.; on a catalyst

Table 1. Hydrocarbon composition of feedstock and processed products on a zeolite catalyst

Hydrocarbons group	Feedstock	ZSM-5	$Ni(NO_3)_2$/ZSM-5	ZnF_2/ZSM-5
	% vol.			
N-paraffins	40.960	24.544	22.492	28.883
Isoparaffins	37.736	39.819	31.050	28.628
Naphthenes	19.551	7.964	7.724	5.188
Olefins	0.681	2.258	2.170	7.840
Aromatic hydrocarbons	1.073	25.416	36.563	29.461
including benzene	0.137	2.528	3.263	2.932

modified with ZnF_2 an increase in the content of aromatic compounds occurs by 28.388 % vol. Proportionally, there is an increase in the benzene content.

Decrease of naphthenes content and increase of olefin content during processing on the initial and modified $Ni(NO_3)_2$ solution catalysts are almost the same – a decrease in the content of naphthenes by 11.587 and 11.827 % vol. respectively; an increase in the content of olefins by 1.577 and 1.489 % vol. respectively. When processing feedstock on a catalyst modified with ZnF_2, the content of naphthenes decreases by 14.363 % vol., the content of olefins increases by 7.157 % vol.

References

1. *Modern oil refining catalysts: scientific and technical level and provision of russian catalysts to enterprises of the fuel and energy complex of Russia / L. G. Pinaeva, V. P. Doronin, A. S. Belyi [and others]. // World of oil products, 2020. – V. 2. – P. 6–16.*

PROCESS OF EXTRACTING NANOCELLULOSE FROM AGRICULTURAL WASTE – DURIAN PEEL

Tran Y Doan Trang[1], L. A. Zenitova[2]
Lecturer – Candidate of Engineering Sciences T. Y. D. Trang[1]
Head of Department – Prof., Doctor of Engineering Sciences L. A Zenitova[2]

[1]*Institute of Technology, Hanoi University of Industry*
10000, Vietnam, Hanoi, Bac Tu Liem, Minh Khai, Cau Dien, 298, tydtrang@haui.edu.vn, tydtrang@gmail.com

[2]*Kazan National Research Technological University*
420015, Republic of Tatarstan, Kazan, Karl Marx, 68, liubov_zenitova@mail.ru

Currently, agricultural waste is increasing rapidly, causing a serious environmental problem, and their handling can lead to significant economic losses. The recovery of valuable ingredients from agricultural waste has recently been focused on taking advantage of the available, abundant, and relatively low-cost raw materials. Recycling agricultural waste is considered the most economical and effective solution because it contributes to treating a large amount of agricultural solid waste in the environment.

Durian is considered the "king of fruits" and is especially popular in Southeast Asian countries. The consumption of durian is increasing rapidly and is becoming more and more popular all over the world. According to statistical data from 2012 to 2021, the total durian production ranges from 735 to 1367 metric tons/year [1]. However, the edible part of the durian fruit only accounts for 1/3 of the durian fruit, while the seeds and peel become waste [2–3]. In fact, durian waste is burned or sent to landfills without regard for the surrounding environment [4]. Meanwhile, durian peel has two main components: cellulose (about 80 %) and lignin (20 %). Instead of wasting large amounts of solid waste in the environment, it would be more feasible to recover these valuable components for further applications by suitable chemical and thermal multi-treatment methods. Therefore, the main aim of this study is to collect nanocellulose from agricultural waste - durian peel.

The nanocelluloses from durian peel were extracted by alkaline treatment and acid hydrolysis. The technical parameters of the nanocellulose extraction process were studied to select the most suitable conditions so that the nanocellulose extraction efficiency from durian peel was the highest.

The results showed that the process of obtaining nanocellulose from durian peel was carried out through the following steps:

1) Preparation of raw materials: After purchasing, durian peels were washed to remove impurities before cutting them into smaller sizes. Then, the chopped durian peel was dried in a vacuum oven at 80 °C until completely dry. The dried durian peel was ground by a mill and separated by a 0.25 µm sieve.

2) Preparation of cellulose: To remove wax, lignin, and hemicelluloses, durian peel powder was immersed with sodium hydroxide 15 % (w/v) at 100 °C for 2 hours with a ratio of powder and NaOH of 1 : 20 g /ml. Next, this mixture was filtered through filter paper and washed to neutral pH with distilled water.

3) The bleaching process: After filtration, the obtained solid fraction was bleached with H_2O_2