# EXTRACTION-ADSORPTIVE METHOD OF SEPARATION OF RESINOUS AND AROMATIC HYDROCARBONS FROM OILS

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The scheme of the device was proposed for processes of increasing the quality of engine oils by refining them from aromatic hydrocarbons and resinous substances, which consist of extraction block for preliminary selective pre-refining of oil by solution and adsorptive block for thin pretreatment of oil by using selective adsorbent.

It is known, that poly cyclic aromatic hydrocarbons and resinous compounds in the composition of oil distillates worsen their quality [1,2]. At present time the wide-spread method of selective treatment of engine oils from these hydrocarbons is an extraction method. Polar solvents, which extract them selectively from oils, are used for this purpose. The main industrial solvents are phenol, furfurol, N-methylpyrromidine-2. In oil refining plants of Baku furfurol is widely used, it is less toxic and more selective.

One of the wide-spread apparatus, used for oil refining, is rotor-disc extractor, which was also involved in oil refining plants of Baku.

One of the methods, used for oil refining, is an adsorptive method by using selective adsorbents. Laboratorial scheme of device and principle of the work were given below (fig.1) [3].

Crude material is given from capacity 1 by pump 5 on the line I to absorber, which is provided with adsorbent, electric thermostat heat and thermo steam to control temperature. For further analysis the refined product is selected in calibrated receiver on absorber 3 on the line I. At saturation of adsorbent transmission of crude material is stopped and absorbed aromatic hydrocarbons are desorbed by desorbing agent (isopropyl alcohol). Desorbing agent is passed to absorber from capacity 2 by pump 6 on the line III. To achieve the desorption temperature in absorber 3 the temperature is increased by electric heat. Desorption product in mixture is extracted with desorbing agent out of absorber on the line IV in cooler 4 and selected in calibrated receiver for further chromatographic and spectrophotometric analyses. In the end of desorption transmission of displacer is stopped and at the given temperature its residues are blown away from absorber layer by blow-down gas, which is given by line V. Then absorber is cooled and further cycle of adsorption and desorption is carried out.

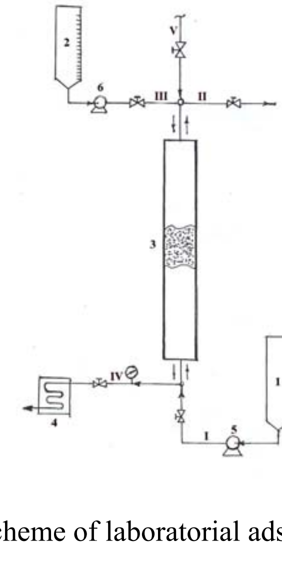


Figure 1. Scheme of laboratorial adsorption device.

Each of the above mentioned refining methods of oils from aromatic hydrocarbons have their own essential disadvantages, which decrease their effectiveness.

Extraction method is effective, that at big concentrations of resinous and aromatic hydrocarbons it is possible to decrease sharply their concentration in raffinate by for example furfurol. During the experiment distillate D-11, which contains the following indicators of hydrocarbon groups: methane-naphthene-62,6 % (mass); aromatic: light-16,7 %, average-7,0 %, heavy-7,9 %, resinous substances-5,8 %, was used as a crude material in the work [4]. As it is seen distillate contains more than 31 % aromatic hydrocarbons. While refining oils by extraction method with furfurol in raffinate 5% aromatic hydrocarbons and resinous substances, which worsen the quality of oils, are remained after 6 stages. Further by this method refining process is ineffective due to big expenses. As to adsorption method of oil refining by adsorbents, it was proved in many research works, that [3] at big concentrations of extracted hydrocarbons this method is not applicable, as it requires great amount of expenses, but at less concentrations it is highly effective. To obtain high-qualitative oil from raffinate it is necessary to extract residues of aromatic hydrocarbons and resinous substances, since fine refining is impossible in extractor. Fine refining of liquids from trace element is successfully carried out by selective adsorption with corresponding sorbents. Researches of recent years [5] showed that the best selective adsorbent for extracting aromatic hydrocarbons from hydrocarbon mixture is alumosilicate adsorbent.

Considering the above mentioned disadvantages of the methods, for obtaining high qualitative oils by more effective method, we have used the device (principle technological scheme was given in (fig. 3).

The device consists of the following basic units: 1- rotor, 2-shaft, 3-right and left bearing units, 4- discharge rings, 5- bed plate, 6- under frame, 7- casing, 8-contact cylinders, 9 and 10-separation cylinders for heavy and light phases, 11- channel for crude inlet, 12-channel for solvent inlet, 13-channel for yield of extraction solvent, 14-channel for yield of raffinate solvent, 15-drain orifice, C-crude material, S-solvent, r s- raffinate solvent, e s –extraction solvent, 1-line for raffinate solvent inlet to capacity C-1, P-1-pump, A-1- absorber, P-1-calibrated receiver, C-2-capacity, P-2- pump, C-1-cooler, RD-1-reductor, "D"-1, "D"-2-driers.

The working principle of the device is the following: Rotor-1 is rotated by electric motor with phase rotor, which is fixed together with extractor in frame 6. Run-up time of rotor is up to 1000 rotation /min., not more than 120 s. After start up previously heated crude oil and solvent-furfurol are given into contact zone through inlet channels 11 and 12 correspondingly. In contact zone, which consists of contact rings 8, separation cylinders the selective refining process of oils begins for heavy and light phases 9 and 10 with further separation of formed fractions-raffinate and extraction solvents.

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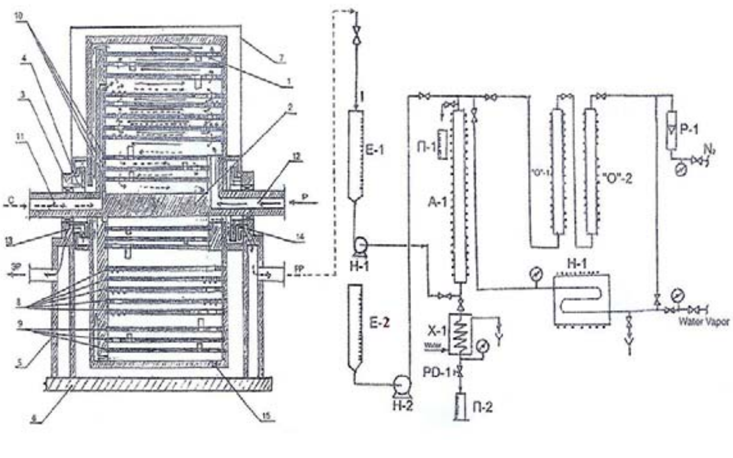


Figure 2. Principle technological scheme of ectractional-adsorption device.

The refined oil (raffinate solvent) is taken out of apparatus through channel for release of raffinate 14 by discharge disc 4, but the extract is taken through channel 13. After dead stop of rotor casing 7 is taken and through drain orifice 15 the rest phase is poured from apparatus and apparatus is pumped through.

Partially refined in extractor from aromatic hydrocarbons and selected in capacity C-1 oil is pumped through by pump P-1 at 35-40$^0$C through absorber A-1, filled by amorphous alumosilicate adsorbent. The refined product moves on top of absorber and gathered in calibrated receiver R-1. By the end of adsorption A-1, crude id transmitted to another absorber (not given in scheme). On absorber A-1 desorbent-water solvent of isopropyl alcohol is passed from capacity C-2 by pump P-2, simultaneously rising temperature in absorber up to 100$^0$ C by electric heat. The product-aromatic hydrocarbon from absorber A-1 enters to receiver R-2 through cooler-1 and redactor RD-1.

Isopropyl alcohol is desorbed from layer of amorphous alumosilicate adsorbent, when the temperature increases in absorber A-1 from 130$^0$ to 200$^0$C, by dilute nitrogen till 50-60 % by volume water steam, which is heated in heater H-1. After processing the layer of adsorbent by water steam, alumosilicate is dried in driers "D"-1 and "D"-2 by nitrogen at 360$^0$C and dehydrated. Further the absorber is cooled till 35-40$^0$C and then the following cycle of oil refining process is carried out.

The process, realized by the proposed scheme, considerably improves the quality of oil. Extraction method of refining can bring the residual amount of aromatic hydrocarbons in raffinate not less 5 % (mass) than total amount of oil, but the proposed device allows bringing residual amount of aromatic hydrocarbons in oil not more than 0,01 % (mass).

All the processes in the system work mutually and continuously. Output of extractor by raffinate solvent is input of absorbers and they are managed by common center with mathematical model, which was elaborated by us.

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