AUTOMATION OF THE PROCESS OF BITUMEN PRODUCTION

Abstract. One of the most important directions in the field of oil refining is the rational use of oil residues by involving them in processes such as visbreaking, coking, de-asphaltation, bitumen production. Petroleum bitumen is used in road construction, in the repair of roads, airfields, in industrial and civil construction (for the manufacture of roofing materials, for the insulation of pipelines from ground corrosion, for the preparation of paint and varnish materials). The quality of petroleum bitumen is a determining factor in ensuring the durability of road surfaces. To date, up to 70% of bitumen produced in Kazakhstan and the CIS countries do not meet the assortment and quality requirements of the modern market, and this primarily concerns bitumen for road, construction and special purposes. The decrease in natural oil reserves and the difficulty of obtaining high-quality bitumen from processed raw materials at most bitumen plants necessitates the search for new materials to obtain binders of a given quality. The process of bitumen production, carried out on an industrial scale, is very complex, but by now it has been sufficiently studied. However, the approach to the study of this process from the standpoint of the physico-chemical technology of oil dispersed systems reveals new aspects that allow us to hope for its further intensification. Due to the increasing volumes of consumption and the expansion of the field of application of petroleum bitumen, the issue of searching for new raw materials is acute. One of the most promising deposits of petroleum bitumen rocks are West Kazakhstan, where more than 50 deposits with reserves of 152 million tons have been discovered. However, to date, the extraction of petroleum bitumen rocks and their use in construction have not acquired significant proportions, due to their insufficient knowledge and imperfection of their processing technology. Until now, the main attention in matters of oxidation is paid to the study of the state of the vapor–liquid system, calculations of the partial pressure of volatile components of the oil system depending on its composition and external conditions, which is fundamental for technological calculations. In this case, oil is represented as a multicomponent molecular solution, the vapor-liquid interface is considered flat, and the vapor pressure above the flat surface is equal to the pressure in the liquid phase. In addition, in all thermodynamic and technological calculations, the vapor-liquid system is thermodynamically formed, leaving the process of vapor phase generation without due attention.

Keywords. automated process control systems (automated process control systems), oil refining industry, complex mechanization, bitumen, oil refining.

Introduction. Bitumen was the first product obtained from oil, which was used by man: already 3800 years before our era, it was used as a building material. Bitumen and asphalt extracted in the areas of oil fields were used as binders, antiseptic, anticorrosive and waterproof materials, for the construction of buildings and towers, water and drainage channels, tunnels, grain and reservoirs, roads, in shipbuilding, medicine and for the mummification of corpses. A mixture of bitumen and sulfur protected fruit plants from insects. With the development of the oil industry, the processing of asphalt-resinous oils has increased, production has increased and the quality of bitumen has improved, which has been replaced by natural asphalt, but the extraction of the latter continues to this day. At present, bitumen is widely used in construction, industry, agriculture and reactive technology.
In recent years, the production of petroleum bitumen worldwide has amounted to more than 80 million tons per year, including 32.6 million tons in the USA. Attention is drawn to the tendency to increase the capacity and output of bitumen for refined oil. The yield of bitumen for oil is 2-5%, in the USA 4.5%, which is explained by the greater share of production of residual and compounded bitumen there; in Germany 4.8 – 5%; in England 2.2 – 2.4%; in Romania 3.8%. Over the past 15 years, the capacity of bitumen production processes in foreign countries has increased dramatically, including in the USA by 1.5-2 times, in England by 1.45, in France by 2.1, in Germany by 5.75, in Canada by 1.1 and in Venezuela by 4.85 times.

Such a significant increase in the production and consumption of bitumen, as well as increased requirements for their quality, urgently require a deeper and comprehensive study of the composition and properties of bitumen, the influence of the parameters of the technological regime, the kinetics and hydrodynamics of processes and the nature of raw materials on these indicators. The use of new schemes and automation tools will allow complex automation and intensification of bitumen production processes. Analysis of technical and economic performance of bitumen plants to determine the most rational way of their production.

Bitumens were widely used in industry long before theoretically based methods of analysis and research were developed. This fact explains the use of traditional methods of analysis for the evaluation of so-called technical properties. Such property values are used for labelling purposes as well as in a number of bitumen production and application issues. The prevalence of conditional methods of analysis is explained by their simplicity, the possibility of comparing the quality of the resulting product with previously accumulated information. State and international standards include different conditional characteristics of bitumen and methods of their definition, but in practice are commonly used a few, described below. A mixture of bitumen and sulphur used to protect fruit plants from insects. With the development of the oil industry, the processing of asphalt-resin oils increased, and bitumen production and quality improved, which displaced natural asphalt, but the production of the latter still continues. Bitumen is now widely used in construction, industry, agriculture and jet technology. Increasing loss of hydrogen is accompanied by compaction processes with formation of high-molecular-weight products of high aromaticity (asphaltene) and thickening of raw material to a given consistency (bitumen grade) [1-3].

The quality of petroleum bitumen is a determining factor in ensuring the durability of road surfaces. The decrease in natural oil reserves and the difficulty of producing high-quality bitumen from recycled feedstock at most bitumen plants causes the need to search for new materials to produce a given quality binder.

In connection with increasing volumes of consumption and expanding areas of application of petroleum bitumen, there is a burning issue of finding new raw material resources. One of the most perspective deposits of oil-bitumen rocks are West Kazakhstan, where more than 50 deposits with reserves of 152 million tons are opened. However, until now oil-bitumen rocks mining and their use in construction did not get a significant scale due to their insufficient exploration and imperfection of their processing technology.

The process of producing bitumen, carried out on an industrial scale, is highly relevant. However, the approach to the study of this process from the position of physical and chemical technology of oil dispersed systems reveals new aspects that allow us to hope for its further intensification.

**Methods and materials.**

Consideration of physical and mechanical properties shows that oil wastes are low-viscous liquid with abnormal deviation of such indicators as extensibility, needle penetration depth, softening point which is caused by the significant content of paraffin hydrocarbons.
It is known that paraffinic hydrocarbons have a negative influence on the bitumen homogeneity, plasticity, adhesion of bitumen to rock materials [12]. The content of asphalt-resinous substances does not allow to obtain residual bitumen from oil wastes at WTT. At direct oxidation of oil wastes the amount of paraffin-naphthenic hydrocarbons is still high. Deeper oxidation does not significantly change the percentage of paraffin naphthenic hydrocarbons. In addition, direct oxidation of oil waste is fire-hazardous, flash point +1630 °C. Thus, the known methods of producing bitumen from oil wastes do not allow to obtain products with optimal composition and properties which satisfy the requirements of GOST 22245.

Bitumen chemically binds less oxygen, the higher is the softening temperature of bitumen. The basic amount of oxygen, supplied by air for oxidation, goes to the formation of water 10-20%, to the formation of carbon dioxide and only a small fraction to the formation of organic substances containing oxygen.

Part of the supplied oxygen does not react and is carried away with the waste gases. As the temperature of the process increases, the oxidation rate of tar increases, the oxygen content in the oxidized bitumen decreases, the duration of the oxidation process and the required total air consumption decreases, and the degree of utilization of air oxygen increases.

When the temperature rises above 250 °C, some commercial and technical properties of bitumen changes: bitumen brittleness temperature increases, and penetration, ductility, heat resistance and ductility range of oxidized bitumen decreases.

Depending on the nature of raw material and the required bitumen properties the appropriate oxidation temperature has to be selected [4].

The problem of regulating the performance properties of bitumen is of considerable interest to researchers and producers. Unfortunately, the situation in this area is still not satisfactory. The production of residual bitumen is not possible at most refineries due to the unsuitable quality of the refined oil and the lack of sufficient vacuum depth at operating facilities. In addition, the fuel or petrochemical option refineries lack components for compounded bitumen. Although it is possible to incorporate heavy vacuum residues into a marketable product, experiments have shown that the option of blending the finished bitumen is less advantageous than oxidising the pre-blended feedstock. Therefore, oxidation remains virtually the only option available for the industrial production of most bitumen grades.

In the process of oil refining, as well as in its production, storage and transportation, as well as in the use of petroleum products, by-products and wastes are generated, from which the necessary components can be selected to improve the durability of bitumen and bituminous-mineral compositions. In addition, the use of waste solves the problem of saving raw materials and materials to protect the environment from contamination. At railway washing and steaming stations during tank cleaning, oil wastes are accumulated consisting of heavy residues: fuel oil, bitumen, tar, crude oil.

One of the most common methods of preparation of bituminous-mineral compositions on the basis of kirov is a method which includes mixing at temperatures not exceeding 90-1200 C of bituminous rock with mineral filler (crushed stone, gravel, sand), introducing them in different quantities, observing the condition of optimum granulometric composition of mineral part of the composition. In cases where the organic part of the kirov low viscosity, the composition is introduced bitumen, and if highly viscous - crude oil. The main disadvantages of these processes of oil-based compositions are low strength, low heat and water resistance and low durability of the coatings which is why they are used only for low category roads with low traffic intensity. The chemical composition and properties of remaining organic material after distillation of fractions boiling down to 2000°C from Munajla Mola kirch are close to those of viscous road bitumen. The cakes prepared in this way can be used in the preparation of ciromineral mixtures. Mineral components are added - sand, crushed materials in fractions larger than 0.315mm with particle size distribution, corresponding to D or G type according to GOST 9128-84, followed by
mixing at 2000°C for 10 minutes. This made it possible to obtain ciromineral mixtures that meet the requirements of GOST 9128-84. Fracture resistance of such biomineral mixtures approximately corresponds to asphalt concrete on residual bitumen. Wide possibilities of regulating the structural and phase transformations and durability of bitumen and bituminous-mineral compositions are achieved by the selection of raw materials and methods of its processing.

The quality of bitumen is also evaluated by such indicators as viscosity, cohesion, density, thermal, optical, dielectric properties, and such quality indicators as bitumen weight loss and change of penetration after heating up characterize the bitumen behavior in service, the service life of asphalt concrete surface.

- The viscosity of bitumen most fully characterizes its consistency at different temperatures of application. At the highest possible application temperature, the viscosity should be as high as possible. Conventional viscosity is defined according to GOST 11503-74;
- flash and ignition temperature are determined according to GOST 4333-48;
- mass after heating is determined in accordance with GOST 18180-72. This indicator characterises the stability of bitumen during prolonged storage at elevated temperatures.

Temperature is the most important process parameter, so compliance with the temperature regime has an impact on the quality of the product. The optimum temperature for the production of vacuum residue depends on the quality of the feedstock and the intended grade of bitumen to be produced. Increase of temperature in oxidation column can worsen the quality of bitumen and accelerate coking of gas space of column [5].

To increase the production of oxidized bitumen can be achieved by various methods. One of them can be the modification of the feed for bitumen production. The effect of certain physical and chemical factors, such as surfactants, modifies their structure, and they become more active [12]. Processing of such modified raw materials is more efficient or less energy-consuming. It was found out in the course of the experiment that CPAV influences strongly enough the oxidation of oil residues by air oxygen.

For the bitumen plant to be designed, it is necessary to control the pressure. The pressure value should not exceed 0,25-0,30 MPa. Increasing the pressure produces a product with higher penetration, but increases the oxidation time of tar.

The air flow rate in the oxidation process is changed so that the oxidation temperature is maintained at the required level: when the temperature drops, the air flow rate increases, when the temperature rises, the air flow rate decreases.

Improving economic efficiency is inextricably linked with the introduction of scientific and technological progress into industry, one of the most important elements of which is the automation of technological processes. Creation of highly efficient automation systems for individual units, as well as automated process control systems (PCS) for major productions in various industries has become possible as a result of the successes achieved in the world in the field of instrumentation and computer technology.

In the refining industry, integrated mechanisation and automation is given great importance. This is due to the complexity and high velocity of the processes, as well as their sensitivity to disturbances. In addition, oil refining and petrochemical industry is characterized by hazardous working conditions, explosion and fire hazard of processed products, and so on.

As mechanisation is introduced into production, the amount of hard physical labour is reduced, the number of workers is reduced, and the productivity and safety of the work performed is increased.

Bitumen-based polymer-bitumen compositions (PBC) with various polymer modifiers as well as plasticisers, stabilisers and similar additives are used to improve the performance properties of road surfaces. The incorporation of polymer additives into bitumen makes it possible to regulate the structural and mechanical properties of the material in a targeted manner.
PBC combines the properties of polymers (high elasticity, heat resistance, durability, frost resistance) and bitumen. Properties and structure of polymer-bitumen compositions are mainly determined by the type of polymer and the disperse structure of bitumen. Introduction of plasticizer (different hydrocarbon fractions) into polymer-bitumen composition improves plasticity and frost resistance of PBC as well as compatibility of polymer bitumen.

Among bitumen modifiers the most widely recommended are various grades of rubber, especially butadiene-styrene rubber, and other classes and varieties of plastic and elastic synthetic polymers. The most effective bitumen modifiers are polymeric materials, which contain a crystalline phase. Therefore, in addition to divinyl styrene thermoplastic elastomer, which is recommended for use in Russia, any polymeric material that contains a stereoblock-copolymer can be used as a modifier. Naturally, the use of branded synthetic polymers even in small quantities (in percentage relation to the whole composition) with multi-ton production volumes, expressed in thousands of tons per year, leads to a very serious rise in price of polymer-bitumen composition and the whole construction. In addition, most of the produced polymers (in particular rubbers) have poor compatibility with bitumen and do not create a homogeneous structure with it. Therefore, an intensive search is undertaken to reduce the cost of the polymer component of PBC in the first place. Surfactants, especially nitrogen-containing cationic surfactants, are used for purposeful adjustment of bitumen properties. Alkylamines, dialkyamines, salts of ammonium aliphatic compounds and their mixtures are used as nitrogen-containing additives. Substances with a complex structure containing functional groups of nitrogen and oxygen are used.

**Results.**

Automation leads to improvement of key performance indicators of production efficiency; increase in quantity, improvement in quality, reduction in production cost; increase in labour productivity. The introduction of automatic devices ensures reduction of rejects and waste, reduction of raw material and energy costs, reduction of capital costs for construction. Automation of production contributes to accident-free operation of equipment, eliminates injuries, and prevents air and water pollution by industrial waste.

The purpose of the process discussed in this article is to produce high quality road viscosity and construction bitumen. This process is carried out under optimal conditions, so in order to maintain these conditions, the process must be automated.

Automated control and management of the process is carried out centrally from the control room. Selection and justification of control and regulation parameters.

Basic parameters of control and regulation are shown in Table 1.

Table 1 - Selection of control and regulation parameters

<table>
<thead>
<tr>
<th>№</th>
<th>Apparatus and flow</th>
<th>Machine parameters</th>
<th>Requirement Regulation</th>
<th>It is necessary to ensure that</th>
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<tr>
<td></td>
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<td>value parameter</td>
<td>value deviation parameter</td>
</tr>
<tr>
<td>1</td>
<td>tar after</td>
<td>temperature</td>
<td>150°C</td>
<td>± 0.5%</td>
</tr>
<tr>
<td>2</td>
<td>heat exchangers</td>
<td>temperature</td>
<td>240°C</td>
<td>± 0.5%</td>
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</table>
The following parameters are regulated and monitored in the automation scheme of the bitumen plant:
- pressure in the reaction zone of the oxidation column;
- Temperature of vacuum residue after the heat exchangers and at the outlet of the furnace, temperature in the separation, oxidation and dispersion sections of the oxidation column
- tar flow rate after the heat exchangers and at the inlet to the column; air flow rate at the inlet to the column;
- oxygen content in the oxidation gas at the outlet of the column.

Temperature is the most important parameter of the technological process, so compliance with the temperature regime has an impact on product quality. Selection of optimum temperatures in the production of vacuum residue depends on the quality of feedstock and the expected grade of the produced bitumen. Increase of temperature in oxidation column can worsen the quality of bitumen and accelerate coking of gas space of the column [6].

In connection with the results obtained. There were studied in detail the following scheme of preparation of oil wastes to get from them bitumen feedstock. The oil wastes should be dehydrated, the fraction boiling up to 3600 °C should be removed (which can be used as a component of technological fuel) and the residue boiling above 3600 °C should be directed for bitumen production. In order to ensure an optimum group composition, a component with relatively high aromatics, resins and asphaltenes content should be introduced before oxidation. The weighted tar of Arlansky oil, mixtures of Tuimazinsky and West Siberian oils, asphalt of deasphalting of the West Siberian oil on the composition and physical-mechanical properties satisfy to these requirements.

One of the directions of solving the problem of utilization of worn-out automobile tyres and rubber products is their crushing with the use of the resulting rubber crumb to modify petroleum bitumen. Rubber crumb is widely used as a component of crack filler compositions for road construction, construction roofing and various anticorrosive mastics [16]. The properties of polymer-bitumen compositions (PBC) are determined by the volumetric content and particle size of the dispersed phase - polymer in bitumen matrix. In cases of small particle size, the disperse phase has little effect on the development of irreversible deformations in the material, and when the particle size of the disperse phase increases beyond the critical size the composition tends to delaminate. Due to its low solubility the rubber is introduced in a finely dispersed form, which requires additional energy expenses for its crushing. Preparation of RBCs is carried out with a mixer, as well as with water steam or air with circulation of the mixture by the pump. It is noted that the way of PBK preparation affects the rheological properties of the composition.
The air flow rate in the oxidation process is varied so that the oxidation temperature is maintained at the required level: when the temperature drops the air flow rate increases, when the temperature rises the air flow rate decreases.

**Discussion.**

Based on technological conditions of continuous production of bitumen in oxidation columns, automatic control and regulation of basic parameters is carried out in the following sequence: vacuum residue from the park to columns K-1, K-2 is preheated in heat exchangers T-1, T-2 (the temperature in which regulated by valves, located on the bypass line of bitumen) and a tubular furnace P-1. The consumption of tar in P-1 in each flow is recorded in the operator's room. The temperature of raw material in the furnace is controlled by regulating the steam supply to the furnace. After heating in P-1, tar goes to the columns K-1, K-2, which flow rate is regulated by the regulators. Constancy of the air flow is automatically regulated. Temperature stability in separation zone is provided by valves, which are located on bitumen pipelines after coolers CV-1, CV-2, and bitumen pumping out from the columns by pumps H-2, H-3.

In addition, the pressure in the separation zone, the temperature in the reaction and dispersion zones are measured in the column. The concentration of oxygen in the oxidation gases is recorded at the outlet of the column. After cooling in coolers CHB-1, CHB-2, bitumen is removed to goods tanks [7-11].

Due to high explosion and fire hazard of production, electronic equipment is selected only in intrinsically safe version. Where possible, pneumatic devices and actuators are used [12-15].

At fuel profile plants, it is proposed to change the sequence of vacuum distillation and oxidation processes used in the production of bitumen. In the process of vacuum distillation, non-selective distillation of paraffin-naphthenic and aromatic hydrocarbons from fuel oil in the tar decreases. Further, in the process of tar oxidation, an additional decrease in the content of aromatic hydrocarbons passing into asphaltenes occurs. Thus, during the processing of raw materials, the already insufficient content of compounds with an aromatic structure is reduced. With the processed sequence of these processes, the composition of the final product may be different. Preliminary oxidation of raw materials causes the transition of aromatic hydrocarbons into more highly boiling compounds, which do not boil off during subsequent distillation and remain in the residue.

As a result, bitumen should contain more compounds with an aromatic structure and have greater ductility.

Pre-oxidation carried out at high temperatures contributes to a large selection of distillates at the stage of subsequent vacuum distillation, since the distillation raw materials are heated by the heat of the oxidation reaction, and not by the heat of fuel combustion transmitted through the walls of the furnace pipes, which is associated with the danger of coking. Preliminary partial distillation of light fractions reduces the load on the vacuum-creating equipment.

Thus, concentrated visbreaking residues as residual bitumen do not correspond to the commercial road brands of BND, but bitumen BN 60/90 can be obtained from them, for which low-temperature indicators are not normalized. The evidence of the positive qualities of concentrated visbreaking residues (high extensibility) led to experiments to improve low-temperature properties in order to obtain compounded bitumen.

Experiments were carried out on mixing concentrated visbreaking residues with factory heavy petroleum products: tar, fuel oil, vacuum gas oil, oxidized road bitumen BND 40/60 and BND 60/90. After the work, it was concluded that visbreaking residues from a mixture of West Siberian and Ukhta oil were suitable for the production of road bitumen of BND grades. The most acceptable options for their application are direct oxidation after removal of the salt
fraction, as well as oxidation after mixing with tar. The same residues can be excessively oxidized and then mixed with tar. If necessary, deeply oxidized visbreaking residues can be added to conventional oxidized BND bitumen without violating the requirements of the standard. A reasonable combination of these methods, depending on the production situation, should ensure uninterrupted production of road bitumen of standard grades and year-round operation of visbreaking plants.

**Conclusion.**

We may conclude that the optimum content of rubber crumb in bitumen feedstock is 1% at an oxidation temperature of 2000°C, which agrees well with the results of the analysis. At this temperature two parallel processes are realised: devulcanisation of rubber with subsequent dissolution and oxidation of tar oils into resins, providing the most favourable hydrocarbon composition and effective thickening of the system. The presence of tar in the rubber crumb makes the asphalt concrete more rigid. Considering that the hydrocarbon composition of bitumen obtained by oxidation of bituminous raw material with pure rubber at 2000°C is almost identical to the composition obtained by oxidation of crumb rubber with cord at 2200°C, we can say that the polyamide fibre has almost no influence on the process of bitumen modification.

Having made this literature review, we can conclude that there are at the moment and is under research a huge number of ways to produce bitumen. But obtaining a quality product from low resin high paraffin oils has not been considered by anyone and needs further research. A review of these scientific findings, developed at different times in view of the development of oil residue processing technology, provides direction for the study of oil residues for the production of bitumen.

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Гульсара Мамбеталиева, магистр, Yessenov University, Ақтау, Қазақстан, gulsara.mambetaliyeva@yu.edu.kz
Гульмира Билашова, магистр, Yessenov University, Ақтау, Қазақстан, gulmira.bilashova@yu.edu.kz
Гульмира Булекбаева, PhD, Yessenov University, Ақтау, Қазақстан, gulmira.bulekbayeva@yu.edu.kz
Маржан Чажабаева, т.ғ.к., Yessenov University, Ақтау, Қазақстан, marzhan.chazhabayeva@yu.edu.kz
Амина Букаева, PhD, Yessenov University, Ақтау, Қазақстан, amina.bukayeva@yu.edu.kz

БИТУМ ОНДІРУ ПРОЦЕСІН АВТОМАТТАНДЫРУ

Андатпа. Мұнай оңдеу саластығының маңызды багыттарын бірі мұнай құралының висбрекинг, кокстеу, асфальтсыздандыру, битум өндіру сияқты процестерге тарту арқылы ұтымды пайдалану болып табылады. Мұнай битумы жол құрылысында, жолдарды, аэродромдарды және аеропорттарды ортада, енергетикалық және арнайы мақсаттарға қатысты қолданылады.

Мұнай битумының жол тәсілінің берілген қамтамасыз ететін анықтаушы фактор болып табылады. Бүгінгі таңда Қазақстанда және ТМД елдерінде өндірілетін битумның 70%-ға дейіні ассортименті мен және бұл бірінші кезекте бірнеше мақсаттарға қатысты. Табиғи мұнай қорының әрекеті және битум зауытының қиындығы байланысты шикізаттан жоғары сапалы битум қалқамасын қамтамасыз ететін фактор болып табылады. Бүгінгі таңда Қазақстанда және ТМД елдерінде өндірілетін битум 70%-ға дейіні ассортименті мен қалқамасы қамтамасыз ететін фактор болып табылады. Бүгінгі таңда Қазақстанда және ТМД елдерінде өндірілетін битум 70%-ға дейіні ассортименті мен және бұл бірінші мақсатқа қатысты. Табиғи мұнай қорының әрекеті және битум зауытының қиындығы байланысты шикізаттан жоғары сапалы битум қалқамасын қамтамасыз ететін фактор болып табылады.

Мұнайлы-битутым жылығын жыныстырғыш зарядты алу үшін жаңа мұнай қорының әрекетін қамтамасыз ететін фактор болып табылады. Бүгінгі таңда Қазақстанда және ТМД елдерінде өндірілетін битум 70%-ға дейіні ассортименті мен қалқамасы қамтамасыз ететін фактор болып табылады.
жүйесінің ұшпа компоненттерінің парциалды қысымын оның қурағына және сыртқы жағдайларына байланысты есептеуге аударылды. технологиялық есептеулер үшін негізгі болып табылады. Бұл жағдайға мұнай қопкомпонентті молекула және ерітінді ретінде ұсынылыңыз, бу-суықтық қысымын интерфейсі жағынан құрастырылған. ал жағынан суықтың құрайды. Соньмен катар, барлық технодинамикалық жағдай технологиялық есептеулерде бу-суықтық қысым қалыптастық термодинамикалық түрдегі қалыптастық, бу қысымның генерациялау процессін түсіндірген техникалық журналдық."}

Түйінді сөздер. Технологиялық процестерді басқарудың автоматты түрді аударылған жүйелері (ТП АБЖ), мұнай өңдеу, қаржы пайдаланылуы, битум, мұнай өңдеу.

Гульсара Мамбеталиева, магистр, Yessenov University, Актау, Казахстан, gulmira.bulekbayeva@yu.edu.kz

Гульмира Билашова, магистр, Yessenov University, Актау, Казахстан, gulmira.bilashova@yu.edu.kz

Гульмира Булекбаева, PhD, Yessenov University, Актау, Казахстан, gulmira.bulisbaeva@yu.edu.kz

Гульмира Булекбаева, к.т.н., Yessenov University, Актау, Казахстан, marzhana.chazhabayeva@yu.edu.kz

Амина Букаева, PhD, Yessenov University, Актау, Казахстан, amina.bukayeva@yu.edu.kz

АВТОМАТИЗАЦИЯ ПРОЦЕССА ПРОИЗВОДСТВА БИТУМА

Аннотация. Одним из важнейших направлений в области нефтепереработки является рациональное использование нефтяных остатков путем вовлечения их в такие процессы, как висбрекинг, коксование, деасфальтизация, производство битумов. Нефтяные битумы применяются в дорожном строительстве, при ремонте дорог, аэродромов, в промышленном и гражданском строительстве (для изготовления кровельных материалов, для изоляции трубопроводов от грунтовой коррозии, для приготовления лакокрасочных материалов). Качество нефтяных битумов служит определяющим фактором в обеспечении долговечности дорожных покрытий. На сегодняшний день до 70 % выпускаемых в Казахстане и странах СНГ битумов не соответствуют по ассортименту и качеству требованиям современного рынка, и в первую очередь это касается битумов дорожного, строительного и специального назначений.

Уменьшение природных запасов нефти и сложность получения качественного битума из перерабатываемого сырья на большинстве битумных установок вызывает необходимость поиска новых материалов для получения, ведущих процесса. Процесс по производству битума, осуществляемый в промышленных масштабах, является весьма сложным, но к настоящему времени достаточно изученным. Однако подход к изучению этого процесса с позиции физико-химической технологии нефтяных дисперсных систем раскрывает новые аспекты, позволяющие адаптироваться на его дальнейшую интенсификацию. В связи с возрастающими объемами потребления и расширением области применения нефтяных битумов остро стоит вопрос поиска новых его сырьевых ресурсов. Одним из наиболее перспективных месторождений нефтебитумных пород является западно-казахстанские, где открыто более 50 месторождений с запасами 152 млн т. Однако до настоящего времени добыча

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нефтебитумных пород и использование их в строительстве не приобрели значительных масштабов, что обусловлено недостаточной их изученностью и несовершенством технологии их переработки. До сих пор главное внимание в вопросах окисления уделяют изучению состояния системы пар – жидкость, расчетам парциального давления летучих компонентов нефтяной системы в зависимости от ее состава и внешних условий, что является основополагающим для технологических расчетов. При этом нефть представляют многокомпонентным молекулярным раствором, границу раздела системы пар-жидкость считают плоской, а давление паров над плоской поверхностью равным давлению в жидкой фазе.

Кроме того, во всех термодинамических и технологических расчетах систему пар-жидкость представляют термодинамических сформировавшейся, оставляя процесс зарождения паровой фазы без должного внимания.

Ключевые слова. Автоматизированных систем управления технологическими процессами (АСУ ТП), нефтеперерабатывающей промышленности, комплексной механизации, битум, нефтепереработка.