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The influence of raw materials (composition of the charge, petrographic characteristics, indicators of technical, plastometric analysis, granulometric composition) and technological factors (coking period, process temperature) on the sorption properties of the carbonized product - coke was studied.

Keywords: *carbon adsorbents, coke sorbent, sorption capacity, adsorption activity, activation.*

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CORROSION AND CAVITATION IN TUBE FURNACES DURING THE HEATING OF WATER-CONTAMINATED OIL

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Tube furnaces in coking plants heat tar and oils, playing a crucial role in steam conservation. However, heating water-contaminated oil in these furnaces leads to severe corrosion, marked by hemispherical cavities. Light microscopy reveals no intergranular corrosion, but cavitation-induced damage is evident. Water contamination increases vapor phase, especially at low flow pressure and high temperature, promoting cavitation and erosion. Hydraulic calculations show that under 1 bar pressure, 20% water content, and 160°C, cavitation is inevitable, accelerating corrosion, particularly with ammonium chloride. Electrochemical and gravimetric analyses confirm high corrosion rates, emphasizing the importance of controlling water contamination to prevent equipment degradation.

***Keywords**: tube furnace, coal tar oil, corrosion, metallographic method, cavitation.*

Modernization of coke plant equipment involves the introduction of compact, metal-efficient units, requiring the use of corrosion-resistant materials in various critical systems, such as benzene recovery, hydrogen sulfide removal, and coal tar processing. Tube furnaces, essential for distilling coal wash oil and heating tar, are prone to corrosion, which significantly affects equipment reliability and service life. Corrosion can be exacerbated by factors like manufacturing defects, improper material selection, and the presence of aggressive compounds. Solid deposits and coke accumulation inside furnace tubes contribute to accelerated corrosion and overheating of heat transfer surfaces, leading to premature failure.

Impurities in crude oil, particularly metals and chlorides, increase the risk of high-temperature corrosion, prompting the need for high-grade alloys resistant to such aggressive environments. Soda treatment is employed to reduce chloride content in tar.

Sulfide corrosion, a common failure mechanism in tar and oil refineries, occurs due to the chemical interaction of sulfur compounds with pipe materials, leading to wall thinning and reduced strength. Chromium content in steel is increased to enhance resistance to sulfide corrosion.

Cavitation and erosion in tubular furnaces occur when flue gas-heated water flows under high pressure and temperature, further exacerbating corrosion and surface degradation, particularly when emulsified water is present in coal wash oil.

A gap exists in understanding the impact of operating parameters, such as temperature, pressure, and flow rate, on tube bundle durability when processing coal tar. Research into these factors could lead to more effective corrosion prevention strategies and extended equipment life.

Experimental research was conducted on a tubular furnace in the benzene department, where oil contamination with water led to the evaluation of corrosion rates using industrial conditions. Electrochemical methods and polarization curves were used to assess the corrosion aggressiveness of oils, providing valuable data for improving material selection and operational strategies.

RESULTS AND DISCUSSION

The tube furnace of the benzene department was frequently stopped for repairs to replace sections of the tube bundle with a diameter of 127×10 mm and a length of 10 metres. The inner surface of the pipe is covered with oxide deposits exhibiting an uneven, rough structure with spots of varying intensity. The surface also features localized depressions, including through - penetrating ones, as well as notches, cracks, and irregularities in the metal, likely resulting from localized mechanical effects.

From a fragment of the pipe that had undergone severe corrosion damage, Sample 1 and Sample 2 were extracted and prepared for microstructure examination. Visual inspection of the provided sample segment revealed a defect originating at the metal surface and extending deep into the sample. This defect fully penetrates the sample, emerging on the opposite side, and resembles an irregular crater. Such a defect is identified as pitting corrosion, the most destructive form of localized attack, characterized by the formation of holes in the metal. This type of corrosion is typical of stainless steels in chloride - containing environments.

The studied samples consist of 15Kh5M cracking steel. Examination of the unetched surface of the microsections revealed non - metallic inclusions of the following types: pitted oxides, stringer oxides, non - deformable silicates, and lamellar silicates. Corrosion damage exhibits a hemispherical shape, with no evidence of intergranular corrosion. Additionally, signs of cavitation-induced metal degradation were observed.

When the oil flow moves and heats up, a vapor phase containing benzene hydrocarbons forms, which is a normal condition for the distillation of wash oil. An increase in the vapor phase fraction is observed during process disturbances and oil watering. The calculation of vapor phase fraction values is based on the chromatographic composition of the absorbing oil across the range of its operating heating temperatures.

CONCLUSIONS

Heating watered oil in a tube furnace causes severe corrosion damage to the metal, manifesting as hemispherical caverns. No intergranular corrosion is observed, but evidence of cavitation damage is noted.

Oil watering significantly increases the vapor phase fraction, particularly under conditions of decreasing flow pressure and rising temperature, which enhances cavitation and erosion of the tube bundle. The high polydispersity of water droplets (P_D = 4.8), their large size (up to 229 µm), and low specific interfacial surface area (0.16 μm^{-1}) heighten the oil's susceptibility to cavitation.

Hydraulic calculations reveal that, in a turbulent flow regime with a pressure of 1 bar, a water content of 20 %, and a temperature of 160°C, cavitation becomes inevitable. Cavitation accelerates corrosion, particularly in the presence of aggressive compounds such as ammonium chloride. Electrochemical analyses confirm the elevated corrosion rate of watered oil, while gravimetric measurements demonstrate the high corrosiveness of oil vapors toward carbon steel, driven by the release of aggressive coke oven gas components.

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NOVEL BIODEGRADABLE POLYMERS MODIFIED BY HUMIC ACIDS

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