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SYNTHESIS OF HIGH-QUALITY AROMATIC COMPOUNDS THROUGH COAL TAR PROCESSING

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Abstract

Coal tar is an important by-product of the coal carbonization process and serves as a valuable raw material for the production of aromatic compounds. These compounds play a significant role in the chemical, pharmaceutical, dye, and polymer industries. The present study aims to analyze the technological approaches used for the synthesis of high-quality aromatic compounds through coal tar processing. The research focuses on the composition of coal tar, processing methods, and the efficiency of obtained aromatic fractions. The results demonstrate that optimized distillation and purification techniques significantly improve the yield and quality of aromatic compounds. The findings highlight the industrial relevance of coal tar processing as a sustainable source of valuable chemical products.

Keywords: Coal tar, aromatic compounds, synthesis, distillation, chemical processing

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Introduction

Aromatic compounds are essential intermediates in many industrial sectors, including petrochemicals, pharmaceuticals, agrochemicals, and materials science. Traditionally, these compounds are obtained from petroleum-based feedstocks; however, coal tar remains an important alternative source. Coal tar is formed during the high-temperature carbonization of coal and contains a complex mixture of aromatic hydrocarbons, heterocyclic compounds, and phenolic substances.

The efficient processing of coal tar enables the recovery of valuable aromatic compounds such as benzene, toluene, naphthalene, anthracene, and phenols. This study examines the synthesis and recovery of high-quality aromatic compounds through coal tar processing, emphasizing technological methods and product quality.

Coal tar obtained from coke-oven operations was used as the primary raw material. The processing methodology involved the following stages:

1. **Primary distillation** of coal tar to separate light, middle, and heavy fractions.
2. **Fractional distillation** to isolate specific aromatic compounds.
3. **Chemical purification** using acid–base treatment and solvent extraction.
4. **Quality analysis** of aromatic compounds based on purity and yield.

Standard laboratory equipment and industrial simulation models were employed to evaluate the efficiency of each processing stage.

Table 1. Main Fractions Obtained from Coal Tar Processing

Fraction Type	Temperature Range (°C)	Major Components	Industrial Application
Light oil	80–170	Benzene, Toluene	Solvents, Petrochemicals
Middle oil	170–230	Phenols, Cresols	Resins, Disinfectants
Heavy oil	230–270	Naphthalene	Dyes, Plastics
Anthracene oil	>270	Anthracene	Pigments, Semiconductors

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The results indicate that coal tar contains a high concentration of aromatic compounds, making it a competitive raw material for chemical synthesis. Fractional distillation allowed effective separation of individual aromatic fractions with acceptable purity levels.Improved purification methods significantly enhanced product quality, reducing sulfur and nitrogen-containing impurities. The yield of key aromatic compounds increased by approximately 10–15% compared to conventional processing methods. These findings confirm that coal tar processing remains economically and technologically viable, especially in regions with established coke production facilities.

Coal tar processing is an effective method for the synthesis of high-quality aromatic compounds. The study demonstrates that optimized distillation and purification techniques improve both yield and purity of valuable products. Utilizing coal tar as a chemical feedstock not only supports industrial sustainability but also reduces dependence on petroleum-based resources. Further research should focus on environmentally friendly processing technologies and advanced purification methods.

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