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PHENOL VAPOUR DEGRADATION WITH THE AID OF CATION-MODIFIED ZEOLITE-Y CATALYSTS IN THE ABSENCE OF OXIDIZING AGENTS

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Air pollution remediation is increasingly important due to the enhancement in the emission of hazardous vapours into the atmosphere due to rapid industrialization. Hazardous vapour can be removed by using various methods, and the common methods are adsorption, photocatalytic oxidation and catalytic oxidation. The main focus of this study is to identify the effect on the degradation of phenol vapour with different metal cation-modified faujasite zeolite catalysts in the absence of oxidizing agents, i.e. under normal air conditions. Faujasite (FAU) zeolite Y was synthesized in the laboratory and subjected to cation modification. For this case, Ferrous(II), Copper(II), Nickel(II) and Silver(I) cations were used for the comparison. Synthesized zeolite catalysts were characterized using Fourier Transform Infrared spectroscopy (FTIR) and powder X-ray diffraction (PXRD). Results obtained from FTIR showed that Zeolite-CuY has successfully loaded into the acid site of zeolite Y. Characteristic peaks in PXRD showed that the FAU type zeolite has successfully synthesized, and metal modification has been completed for Zeolite-CuY, Zeolite-NiY and Zeolite-AgY. The crystallinity of Zeolite-FeY was less when compared to other catalysts, and it may be because of the formation of ferric oxides. According to the particle size analysis, these catalysts were in the 2 - 4 µm size range. To identify phenol degradation products qualitatively and quantitatively, the GCMS headspace method was used, and degradation products were analyzed according to the database library. Benzoquinone degradation product was observed from Zeolite-CuY with a phenol removal percentage of 76.6%. It can be suggested that the mechanism may undergo a Fenton-type reaction and provide OH radicals from the zeolite framework. When phenol was treated with Ni and Ag-modified zeolite catalysts, no apparent degradation products were shown in the chromatogram. However, the concentration of phenol had reduced, implying only adsorption occurred. This study concluded that the Zeolite-CuY partially degrades phenols under normal air conditions.

Keywords: Catalyst, Cation-modified, Degradation, Phenol, Zeolite Y