MICROWAVE ASSISTED PROCESSING OF PHENOL WASTEWATER ON ACTIVATED CHARCOAL

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The catalytic wet air oxidation (CWAO) is a liquid-phase reaction between organic material in water and oxygen. Generally an air stream is mixed with the effluent and passed over a catalyst at moderated temperatures between 120°C and 310°C and at pressures from 2 to 15 MPa. If the efficiency of aqueous phase oxidation is improved by the use of catalysts, the main key points to be solved are stability of heterogeneous catalysts and recycling of homogeneous catalysts. It should be stressed that compared to conventional wet air oxidation, the catalytic process offers lower energy requirements and much higher oxidation efficiencies. Further developments should include high durability and low cost catalysts. Several studies have recently been devoted to the catalytic oxidation of aqueous phenolic effluents over a stationary bed of activated carbon [1-3]. These works demonstrate the environmentally attractive potentiality of this catalyst for treating highly concentrated effluents. However, for long runs a possible catalyst deactivation will be suspected via polymer formation and lay down on the active catalyst site.

In this study, a phenol wastewater treatment by a two-step adsorption-oxidation process has been investigated. In the first step, polluted water is continuously fed to a fixed bed reactor filled with activated carbon at room temperature. When saturation of the carbon is reached the reactor is heated up by dielectric hysteresis heating. As a result of interfacial polarization, under definite conditions a highly localized cold plasma is sparkling at the surface of the carbon. This phenomena has already been described by Shorrock et al. [4] and used by the authors for oxidatively decompose Tributyl Phosphate in aqueous solution. A free radical chain mechanism involving the formation of hydroperoxides and oxyradicals is often admitted for wet oxidation reaction mechanism (see [5] for a more refined discussion). With microwave assisted processing, the expected effect is a radical enhancement and an oxidation activation under moderate conditions.

Our first investigations concern the following points:

Experiments were performed to control the cold plasma formation in order to avoid thermal runaway.

Phenol adsorption was studied thanks to adsorption isotherms and Freundlich isotherm parameters evaluation.

The experimental results obtained are presented and discussed. Further researches are needed to optimize this process in order to propose a new cost-effective solution for the treatment of organic sludge and refractory industrial wastewater.

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