

TITLE: *Adsorption and degradation process of aromatic organic compounds in wastewater and petroleum industry effluent.*

AUTHOR: Vanessa Pulita Cayres

ABSTRACT

The aromatic compounds degradation in residual water and effluent of petroleum refinery was evaluated in this work under photochemical treatment, using solar light and mercury steam lamp of high pressure with medium intensity 200 W/m², and oxidative process, with hydrogen peroxide (60 % in weight). In the specific case of the effluent treatment, the mercury steam lamp was tested without the external protecting involucre. The adsorption of aromatic compounds in granular activated carbon (CROSSCARBO GAC-LB 12 x 40) was evaluated in laboratory scale and monitored in pilot unit of effluent treatment in the Gabriel Passos Refinery (REGAP/PETROBRAS) situated in Betim, MG. Three effluent types were treated with light and oxidant agent: entrance and in the exit of the carbon filter, and the current (condensed water steam) of recovery or cleaning of the carbon filter. The degradation of aromatics in residual water and effluent was monitored through synchronous fluorescence spectroscopy, which indicated the presence of compounds of the type mono and polyaromatics or polar products. The irradiations or thermal action of the Sun (25 °C) and of the lamp (~33 °C), it did not promote the aromatic compounds degradation of the aqueous mean. The synergic action of the natural or artificial light with the oxidant agent, hydrogen peroxide, decreased or eliminated the fluorescence in the residual water with kinetics of pseudo-first order. In the case of the solar light, the observed speed constant (k_{obs}) to 295 nm (monoaromatics) was $8.17 \times 10^{-2} \text{ min}^{-1}$ and to 350 nm (polar and polyaromatic) was $16.11 \times 10^{-2} \text{ min}^{-1}$. In the case of lamp, the k_{obs} to 295 nm, was $7.25 \times 10^{-2} \text{ min}^{-1}$ and to 350 nm was $2.30 \times 10^{-2} \text{ min}^{-1}$. The solar light degraded the aromatic compounds in the residual water more quickly than the irradiation with lamp, and the degradation reaction under solar light was faster for polyaromatic compounds or polar products (350 nm). During the treatment of the three types of effluents, the thermal action of the mercury steam lamp without external protecting involucre (~30 °C) did not alter the fluorescence. The radiation from this lamp, for 60 minutes, decreased the fluorescence of the effluent one of entrance of the carbon filter, being close of 58 %. However, the synergic action of the artificial light and of the oxidant agent, hydrogen peroxide (2 mL H₂O₂:1 L of effluent), was able of reduce the integrated

area of the fluorescence spectrum to 49 % in only five minutes, promoting total degradation of aromatics after ten minutes of treatment. The combined action of hydrogen peroxide and the irradiation under lamp also eliminated the fluorescence of aromatic traces still presents in effluent after the filtration in the carbon. In the recovery current of the carbon filter, the thermal action of the lamp in synergy to the oxidant agent reduced 55 % of the monoaromatic fluorescence (290 nm). However, the synergic action of hydrogen peroxide and the lamp radiation promoted complete degradation of aromatic ones in only ten minutes of treatment. The adsorption of monoaromatic model compound, toluene, in the granular activated carbon was independent of the initial concentration of this compound in aqueous solution. The naphthalene adsorption process in the carbon, from the aqueous solution, was in function of the time of contact with adsorbent, presenting kinetics of pseudo-first order with $k_{obs} = 9.18 \times 10^{-2} \text{ min}^{-1}$.

Key words: hydrogen peroxide, mercury vapor lamp, fluorescence.