I. Adsorption mechanism of chlorophenols on iron oxides, titanium oxide and aluminum oxide as detected by infrared spectroscopy

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Abstract

The adsorption of 2-chlorophenol, 2,3- and 2,4-dichlorophenols and 2,4,6-trichlorophenol in liquid and gas phase on iron, titanium and aluminum oxides seem to proceed in a similar way. Higher adsorption of chlorophenols either from gas phase or from aqueous solution was observed on α-Fe_2O_3 than on α-FeOOH. The low adsorption of chlorophenols from aqueous solution on oxide surfaces suggests that hydrophobic chlorophenols cannot effectively compete with water for the absorption on hydrophilic oxide surface sites. The adsorption of chlorophenols on iron, titanium and aluminum oxides was followed by the adsorption isotherm, HPLC and diffuse reflectance FT-IR (DRIFT) spectroscopy. The adsorption of the chlorophenols on the oxides under study is related to the amount of interfacial water content on the iron oxide. The alumina–chlorophenolate surface complex was found to be weak when compared with either the iron or titanium analogs as seen by the C–O stretching vibrations, leading to a lower adsorption on alumina than on iron and titanium oxides.

Keywords: Chlorophenols; Iron oxides; FT-IR (DRIFT) spectroscopy