Spectroscopic evaluation of humic acid adsorption onto TiO\textsubscript{2} in the presence of clay minerals

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ABSTRACT

Adsorption of humic acid (HA) onto TiO\textsubscript{2} in the presence of clay minerals should be investigated to provide information for understanding of photocatalytic behavior of HA. In accordance with previous studies, adsorption of HA onto TiO\textsubscript{2} in the presence of clay minerals, i.e. kaolinite (Kt) or montmorillonite (Mt) was further elucidated by using UV–vis and fluorescence spectroscopic parameters. Moreover, in the presence of clay particles, effect of Ca\textsuperscript{2+} ions was also assessed in comparison with the conditions attained in the presence of sole TiO\textsubscript{2}. Adsorption of HA onto TiO\textsubscript{2} could well be explained by the changes in the UV–vis spectral features in relation to the successful elimination of the dissolved organic carbon. Specific UV–vis parameters (m\textsuperscript{-1} mg\textsuperscript{-1}L) as SCoA, SUVA\textsubscript{365}, SUVA\textsubscript{280}, and SUVA\textsubscript{254} displayed variations depending on TiO\textsubscript{2}. Although no definite discrimination was attained with respect to the individual effect of each clay type, a distinct influence was observed in the presence of sole TiO\textsubscript{2}. Adsorption of HA onto TiO\textsubscript{2} could well be explained by the changes in the UV–vis spectral features in relation to the successful elimination of the dissolved organic carbon. Specific UV–vis parameters (m\textsuperscript{-1} mg\textsuperscript{-1}L) as SCoA, SUVA\textsubscript{365}, SUVA\textsubscript{280}, and SUVA\textsubscript{254} displayed variations depending on TiO\textsubscript{2}. Although no definite discrimination was attained with respect to the individual effect of each clay type, a distinct influence was observed in the presence of Ca\textsuperscript{2+} ions. Fractional UV–vis parameters (E\textsubscript{254}/E\textsubscript{365}, E\textsubscript{254}/E\textsubscript{436}, E\textsubscript{280}/E\textsubscript{365}, and E\textsubscript{365}/E\textsubscript{436}) indicating the removal of color-forming groups in relation to the removal of UV-absorbing centers showed variations with respect to the TiO\textsubscript{2} dose. Regarding the changes in the specific UV–vis parameters, it could be indicated that the HA adsorption mechanism was significantly different in the presence of either Kt or Mt. Furthermore, as a correlative approach, fluorescence-derived index defined as fluorescence intensity (FI) was successfully employed. FI values were correlated to the specified UV–vis parameters revealing an inverse relationship.

Keywords: Adsorption; Humic acid; Kaolinite; Montmorillonite; UV–vis and fluorescence spectroscopic properties

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