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Research Article

Adsorption of Fuchsine Dye on TiZnPbO Nanocomposites: Analytical Modeling and Interpretation

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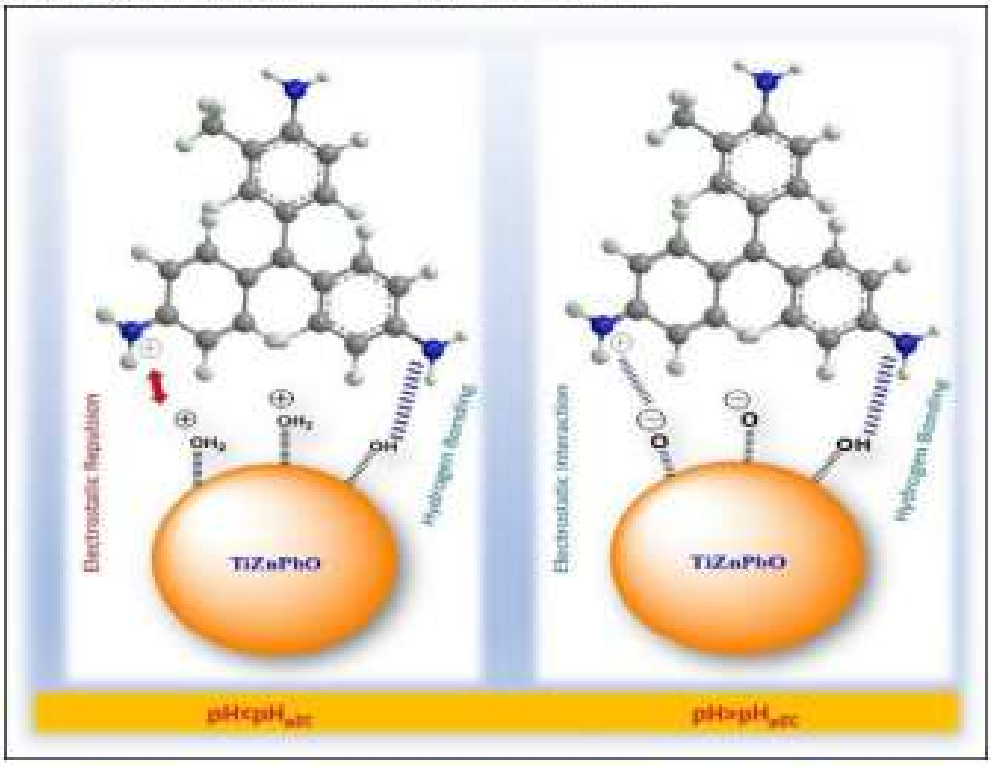
First published: 23 August 2023 | https://doi.org/10.1002/slct.202300678

Graphical Abstract

This study presents the adsorption of Fuchsin dye on TiZnPbO nanocomposites, employing analytical modeling. The results provide valuable insights into the adsorption process and its interpretation, contributing to the development of efficient dye removal techniques.



Abstract

In this study, the synthesis process of TiZnPbO nanocomposite and its use for the removal of Basic Fuchsin (BF) dye from wastewater was studied. The influence of contact duration (90 min), concentration (200 mg/L), solution pH (3.0), and adsorbent dosage (0.2 g) on adsorption studies were thoroughly examined. The kinetic models (pseudo-first-order and pseudo-second-order) and isotherm models (Langmuir and Freundlich) are used to understand the adsorption mechanism and behavior of BF over adsorbents. According to the kinetic data, the models fit a pseudo-second-order equation which is an indication of a heterogeneous chemisorption process. The Langmuir isotherm is best fitted with R^2 of 0.999 and a maximum adsorption capacity of 208.33 mg/g. It was determined that the values of n for the adsorption of BF on TiZnPbO at 298 K were less than unity (n=0.516, 0.504, and 0.501). This finding showed that the BF dyes should be adsorbed on this adsorbent in a non-parallel orientation. As for BF adsorption on TiZnPbO, the isotherm data indicated that it behaved more like a multilayer than a monolayer. The TiZnPbO adsorbent showed high recyclability at least 5 times.