Mesopot. J. Mar. Sci., 2017, 32(2): 88 - 103

Adsorption equilibrium, kinetics and thermodynamics of Rhodamine B dye from aqueous solution using Iraqi Porcellanite rocks

M.I. Abood[1*] and T.E. Jassim[2]
[1] Marine Sciences Center, [2] College of Education for Pure Science, University of Basrah, Basrah-Iraq
**e-mail: alshrhanm@yahoo.com*

(Received: 19 October 2017 - Accepted: 19 December 2017)

Abstract - Industrial wastewater and other polluted water need to be treated to make it possible to discharge into rivers and reuse them. Adsorption takes the importance of ways to remove organic and inorganic pollutants in water. The search for materials that are locally available and cheap to use as adsorbent surfaces. The Iraqi porcellanite powder can be used to remove the dye of Rhodamine B in batch method. The effect of various experimental parameters such as contact time, temperature, solution pH, weight of adsorbent initial dye concentration, ionic strength were investigated. The adsorption studies included both equilibrium adsorption isotherms and kinetics. The applicability of Langmuir and Freundlich equations was investigated at different temperature, and the Freundlich isotherm exhibited the best fit with experimental data. The thermodynamic parameters indicated that the adsorption was a spontaneous process (ΔG was negative), the negative value of ΔH indicate endothermic and ΔS was positive value (random), the kinetic data well described by Pseudo-second order kinetic model with intra particle diffusion as one of the rate limitring steps.

Key Words: Adsorption, Rhodamine B, Thermodynamic and Kinetic.

Introduction

Environmental pollution due to speedy development of industries causes harmful effect on human health and ecosystem. The textile dyeing industries have generated a massive pollution problem because it is considered one of the most industries which used a wide range of dyes in their production Consequently, it is the most polluting water sources (Kant, 2012). The basic dyes are the brightest class of soluble dyes used by the textile industry, but their tinctorial value is very high In addition to their use in the dyeing of various products, such as Rhodamine B dye are widely used in the paper industry, cosmetics, food and biomedical laboratories (Inbaraj and Sulochana, 2006).

To reduce the dyes in industrials water effluents chemical, physico-chemical, and biological methods such as photocatalytic degradation, extraction, chemical oxidation, microbiological decomposition, ion exchange, adsorption on activated carbon, combined of adsorption and degradation and ultrasonic decomposition were applied with highly cost (Ahmed and Kumar, 2010).

Among all these methods the cheapest and simplest is the physic-chemical adsorption. Activated carbon was regarded as the most effective material for removal the dyes (Walker and Weatherley, 1997), but due to its high cost and 10-15 % loss during regeneration, unconventional adsorbents like, wood (HO and Mckay,