Reduction of COD in water-based paint wastewater using three types of activated carbon

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ABSTRACT

In this study, the reduction chemical oxygen demand (COD) in water-based paint wastewater using commercial activated carbon, activated date pits and rice husks was investigated. The process was studied in the batch mode with respect to the initial pH, contact time, and adsorbent dose. Adsorption equilibrium and kinetic data were determined for the three adsorbents and were fitted to several isotherm and kinetic models accordingly. The results indicated that activated rice husks (ARH) and activated date pits (ADP) were as effective as commercial activated charcoal (CAC) in the reduction of the effluent COD reaching a maximum of 83% using 180 g/L ARH and 76% using 120 g/L ADP. Kinetically, the results showed that reduction of COD onto both ADP and ARH was better fitted to pseudo-second-order model which involved particle/pore diffusion. In addition, equilibrium adsorption data for the reduction of COD effluent ADP and ARH was best represented by the Langmuir model.

Keywords: COD reduction; Low-cost adsorbents; Water-based paints; Industrial wastewater treatment

1. Introduction

Water-based paints generally consist of organic and inorganic pigments and dyestuffs, extenders, cellulosic and noncellulosic thickeners, latexes, emulsifying agents, antifoaming agents, preservatives, solvents, and coalescing agents [1–6]. About 60–80% of the wastewater generated from the production of water-based paints arise from the cleaning operations of mixers, reactors, blender, packing machines, and floors [1,2,4]. The strength of the generated effluent varies significantly depending on the chemicals used and the type of paint produced. Generally, these wastewaters contain appreciable concentrations of biochemical oxygen demand (BOD), chemical oxygen demand (COD), suspended solids, highly toxic compounds, and color [1,2,5–8]. Due to the toxic nature and the persistence of its components, effective and economical treatment is required to decrease its pollutant load and remove the associated suspended solids, metal ions, and microorganisms prior to discharge or reuse.

Several methods have been developed for the decontamination of a variety of industrial wastewaters to reduce the associated COD, total organic carbon (TOC), and color [2,5,6,9,10]. However, some of these