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Removal of Gentian Violet by activated carbon from mango kernel shells (Adams)

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ABSTRACT

This study aims to Gentian Violet (G.V) removal using activated carbon (AC). The AC was obtained by chemical activation of mango kernel shells (Adams) with potassium hydroxide (AC-BK), at 600°C and for 2h. AC-BK has been characterized by physico-chemical analyses such as: specific surface area, zero charge point pH, surface functions and morphology. With a specific surface area of 534 $m^2.g^{-1}$, AC-BK was used to remove Gentian Violet (G.V) in batch mode and under magnetic stirrer at 150 rpm. Thus, the effect of contact time, initial concentration, pH and temperature of the reaction medium was studied. The maximum abatement rate for G.V was 96.5 % at temperature of 25 °C and pH = 6. Among the models discussed, the Freundlich model seems to better reflect the elimination of G.V. by AC-BK with a coefficient of determination very close to 1 (R^2 > 0.99). In addition, this reaction is well fitted by pseudo-second order kinetics with a regression coefficient of 0.99. The adsorption of G.V by AC-BK is characterized by a multilayer on the surface of the AC. These results suggest that AC-BK was effective in removing of G.V with a maximum adsorption capacity of 160. 10 $mg.g^{-1}$ and could therefore be tested for the remediation of dye-laden industrial effluents.

1. Introduction

In recent years, Côte d'Ivoire, like other developing countries, has experienced significant development of its industrial activities. This ever increasing development of industry has negative impacts on the environment [1]. Indeed, Many industries discharge their wastewater directly into surface waters,without previous treatment[2]. This wastewater, most often loaded with non-biodegradable organic compounds such as textile dyes, considerably degrades the physico-chemical quality of receiving environments [3,4]. These wastewaters are also responsible for the disturbance and contamination of the aquatic environment; leading to the death of species through chronic or acute toxicity [5]. Today, water resources are exposed to many forms of pollution. We distinguish natural pollution caused by plant or animal debris, and pollution due to human activities. Pollution caused by human activity can be accidental or voluntary through industrial discharges, fertilizers or pesticides. If it is possible to control, even limit the pollution caused by human activity, it is not easy to prevent that due to the presence of plant and animal debris. Indeed, the presence of these debris degrades considerably the color, the smell and the taste of water [6]. Gentian violet, a dye widely used in the textile industry due to its high solubility in water, is unfortunately toxic, carcinogenic and can lead to renal failure [7].Thus, various water treatment processes have been used to remove recalcitrant dyes; these are: electrocoagulation [8]; membrane filtration [5]; photodegradation [9]; biodegradation [10]; and adsorption [11, 12, 13]. Among these techniques, adsorption appears to be one of the most appropriate methods due to its lower cost, ease and efficiency of application. It allows the capture of soluble or insoluble pollutants without creating hazardous by- products [2]. Adsorption allows the removal of several harmful

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