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Investigation of Dyes Removing Ability by Differently Treated Selected Soil Material

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Abstract

In modern society, there are several kinds of industries that use dyes for their products. These dyes contain inorganic and organic substances, which finally enriched in the wastewater. This study aims to identify the effectiveness of deferent treatments on clay minerals to remove dyes in an aqueous solution. Naturally, available kaolin rich soil was selected as a dye removing agent after studying essential adsorption characteristics. The soil was collected from the western province of Sri Lanka by auger drilling method. Collected soils were air-dried about 48 hours to remove the excess moisture content. Air-dried soil was crushed to prepare powdered material (<63 µm). The methylene blue indicator was used to study the removal ability of material in the initial experiments. The removal capacity was measured using a UV spectrophotometer. Activated powdered soils were prepared by heating 750^{o} C for about 24 hours. Besides, sulfuric acid treatment was also used for acid activation. A series of experiments were conducted to study the most suitable structure to remove the dyes. Granular, finger, flat sheet, and cup-shaped structures were practiced by heat-activated, and acid-treated soil powders. According to the initial observations of the experiments, ball-shaped structures were selected to continue the research under industrial dyes. Six selected industrial dyes were used for detail experiments. Non-heated soil powder, non-heated soil ball, heated soil powder, heated soil ball, non-heated acid-treated soil powder, non-heated acid-treated soil ball, heated acid-treated soil powder, and heated acid-treated soil ball were used for the detail experiments under industrial dyes. Removal efficiencies were measured with 12 hours intervals. Results concluded that tested soil-based products are having higher removal efficiency for all the given dyes and removal abilities are vary according to the treatment patterns and type of dye. In contrast, results revealed that selected kaolin rich soil is having strong ability to remove the industrial dyes after necessary treatment.

Keywords: Soil, Kaolin, Dye, Removal, Treatment, Structure