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ENVIRONMENTAL FRIENDLY LOW COST ADSORBENTS FOR THE REMOVAL OF ORGANIC POLLUTANTS SUCH AS DYES FROM COLORED WASTE WATER

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Abstract

Today's entire world facing the severe water pollution due the excess use of different types of health hazard chemicals. Among that, dyes are an important class of pollutants, and can even be identified by the human eye. Disposal of dyes in precious water resources must be avoided, however, and for that various treatment technologies are in use. Among various methods, adsorption occupies a prominent place in dye removal. The growing demand for efficient and low-cost treatment methods and the importance of adsorption has given rise to low-cost alternative adsorbents (LCAs). In addition, various other methods used for dye removal from water and wastewater are compiled in brief. Various adsorbents have been used to remove different types of dyes and heavy metal ions from wastewater especially those that are harmful to mankind and aquatic animal and fauna. Activated carbons, plant or lignin, cellulosic wastes, clays and biopolymers are among the common adsorbents used. Organic dyes are considered as serious water pollutants. There are several ways for removal of these compounds from environment, which are mainly based on biological, chemical, and physical methods. In this chapter, we first classify the common organic dyes which are in use in today's industry, and methods of their elimination from environmental water and wastewater are also discussed very briefly, with an emphasis on adsorption techniques. At the end, some modern advanced adsorbents are presented.

Introduction

The presence of dyes in waterways is undesirable because it depletes the dissolved oxygen and reduces the sunlight penetration. In addition, dyes can escape from conventional wastewater treatment methods because they are generally designed to withstand physico-chemical and biological degradation [1-5]. The adsorption process is an attracting, simple and effective method to remove pollutants from wastewater. Low-cost adsorbents are produced on the basis of low-cost materials or even wastes and are economically attractive for practical application. Several materials such as agricultural wastes, natural compounds, and activated carbon, have been used as adsorbents [6-10]. They tend to remove pollutants indiscriminately. However, further improvement of adsorption capacities, mechanical strength, and other properties are needed for a wider application. Polymeric adsorbents, due to their vast surface area, perfect mechanical rigidity, adjustable surface chemistry and feasible regeneration under mild conditions, are a potential alternative to traditional adsorbents [11]. Polymeric adsorbents remove different pollutants from aqueous media. Adsorption capacity of a polymeric adsorbent toward pollutants can be improved using monomers which have functional groups such as amino group, due to the specific interaction of functional groups bound to the polymeric matrixes with the target pollutants.

Natural polymers are unique materials due to inexpensive, easily available, reproducible sources, hydrophilic and biopolymers, safe and devoid of side effects and flexible polymers. In addition, they have excellent adsorption specificity to remove pollutants including dyes from colored wastewater. Adsorption is a preferred method compared to other methods due to its simplicity and comfortable and inscrutable to toxic contaminants. The natural polymers also have excellent properties such as low initial production of nontoxic by-products, relatively simple design and productivity in time. Properties of an ideal and suitable adsorbent for dye removal include the following: extensive surface, high capacity and ability to absorb, the pores with appropriate size and comfortable accessible, efficient, economical, high mechanical stability, compatibility, easy regenerable, environmental friendly, high selectivity to elimination various dyes and needless of high processing techniques. Therefore, researchers have lately concentrated on expanding compounds based on natural polymers.

Some properties of dyes classified on their usage [12-13] are discussed in brief here.