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The Preparation of Aminated Collagen Fiber and its Study on Adsorption of Dyes

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Abstract The aminated collagen fiber (ACF) was prepared by modifying collagen fiber (CF) with ethylenediamine and cynuric chloride as crosslinking agent. The appropriate modification conditions were optimized by single factor experiment method. The reaction molar ratio of CNC and -NH₂ was 1.4, the reaction time of ice water bath was 3h, the temperature of the second phase was 45°C and the reaction time was 4h, the temperature of the third phase was 70°C and the reaction time was 3h. The content of amino of collagen fiber and aminated were measured by the method of salicylaldehyde. The structures of collagen fiber and aminated collagen fiber were characterized by SEM and FTIR respectively. The adsorption capacities and the content of amino of CF and ACF were observed by dealing with acidic black dyeing and sturgeon skin dyeing wastewater.

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The preparation of aminated collagen fiber and its study on adsorption of dyes

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Keywords: ethylenediamine, cyanuric chloride, collagen fiber, dye, adsorption

Abstract. The aminated collagen fiber (ACF) was prepared by modifying collagen fiber (CF) with ethylenediamine and cyanuric chloride as crosslinking agent. The appropriate modification conditions were optimized by single factor experiment method. The reaction molar ratio of CNC and -NH₂ was 1.4, the reaction time of ice water bath was 3h, the temperature of the second phase was 45°C and the reaction time was 4h, the temperature of the third phase was 70°C and the reaction time was 3h. The content of amino of collagen fiber and aminated were measured by the method of salicylaldehyde. The structures of collagen fiber and aminated collagen fiber were characterized by SEM and FTIR respectively. The adsorption capacities and the content of amino of CF and ACF were observed by dealing with acidic black dyeing and sturgeon skin dyeing wastewater.

Introduction

Dyes are widely used in various industries, such as textiles, paper, plastics, cosmetics and leather, for coloring their final product. The release of colored wastewater from these industries may present an eco-toxic hazard and introduce the potential danger of bioaccumulation, which may eventually affect man through the food chain. It has been an important object to remove dyes of the industrial waste water in the environmental protection field. At present, the most commonly used method on dealing with dyeing wastewater is adsorption method. Activated carbon is the most popular adsorbent, which is capable of adsorbing many dyes with a high adsorption capacity[1]. But it is expensive and the costs of regeneration are high because desorption of the dye molecules is not easily achieved[2]. Various low-cost adsorbents were therefore investigated as an alternative to activated carbon[3]. In the leather manufacturing, only 30% to 50% raw skin was available to leather, so there was about 1.5×10⁶ t abandoned hide scrap in our country [4-5].

Collagen fiber, an abundant natural biomass, comes from the skin of animals and has been traditionally used as raw material in leather manufacturing. The collagen molecule is composed of three polypeptide chains with triple-helical structure, and they are aggregated through hydrogen bonds to form collagen fiber[6]. Collagen fiber has abundant functional groups ready to react with other chemicals; these functional groups include -OH, -COOH, -CONH₂ and -NH₂. Collagen fiber is water-insoluble but is a hydrophilic material. Therefore, collagen fiber is ready to be used as a carrier of dyes.

In the present study, an adsorbent based on collagen fiber was prepared with ethylenediamine as raw material and cyanuric chloride as a cross-linking agent, in order to increase the content of amino and strengthen the capacity of removal of anionic dyes in water.

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