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REMOVAL OF CONGO RED DYE FROM AQUEOUS SOLUTION USING BRANCHES OF *Ficus religiosa*

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ABSTRACT

Present study focused on indigenous *Ficus religiosa* branches as a low cost agricultural by-product employed as biosorbent for the removal of Congo red (CR) dye from water solutions. Adsorption behavior with special characteristics was evaluated using established and effective process. Effect of various established parameters such as pH, adsorbent dosage, temperature, initial dye concentration and contact time was tested. The efficient uptake of CR was observed at pH 4.0, adsorbent dose 0.1 g/50 mL and dynamic equilibrium at 25 min. The data revealed that Langmuir model found fit than the Freundlich model and adsorption followed pseudo second order kinetics. The results showed that *Ficus religiosa* branches could be used as cost effective biosorbent for the removal of CR dye from polluted aqueous solution.

Key words: Biosorptive removal, Congo red*, Ficus religiosa*, Langmuir isotherm

INTRODUCTION

In the present era of industrial establishment in developing countries, a huge quantity of polluted water carrying color dyes and pigments from textile, leather, cosmetics, pharmaceutical and food industries is disposed of every day. This large quantity of undesired industrial effluents is one of the reasons responsible for water pollution (Rahman & Akter, 2016). These anthropogenic contaminants in the water thus disturb the photosynthetic activity of aquatic producers causing eco toxicity and results in increase of pH, biological oxygen demand (BOD), chemical oxygen demand (COD) and temperature of water (Verma *et al.*, 2012).

Azo dyes are one of the important classes of dyes and removal of azo dyes is much more challenging because these dyes are synthetic in origin and show stability towards most of the decolorizing reagents (Purkait *et al.*, 2007; Willmott *et al.*, 1998). Congo red (CR) is a sodium salt of 3, 3'-([1, 1'-biphenyl]-4, 4'-diyl) bis (4-amino-naphthalene-1-sulfonic acid). It is an anionic (Fig. 1), heat and light sensitive dye that metabolizes to benzedene causing chronic affects to humans in the form of cancer, allergic dermatitis and skin irritation (Rouf *et al.*, 2015). According to a rough estimate, an amount 10,000 tons of CR is being used by industry and then excessive amount is discharged into water per anum (Forgacs *et al.*, 2004). For the safety of aquatic life and environment, the removal of dyes from industrial waste water before discharge is therefore very essential (Dawood & Sen, 2012; Vimonses *et al.,* 2009). Recently, different methods and techniques including ion exchange, reverse osmosis, precipitation, solvent extraction, membrane technologies, electrochemical treatment, and adsorption etcetera are being used for uptake of dyes from aquatic environment. Among these available schemes and systems, adsorption is the most adaptable and broadly used method. As far as the importance of adsorption is concerned in recent years, numerous cost effective agricultural waste materials have been tested as potential biosorbents for the removal of dyes (Bharathi & Ramesh, 2013).

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