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ORIGINAL ARTICLE

Biobased carbon for effective removal of rhodamine B and Cr(VI) from aqueous solution: kinetic, isotherm and thermodynamic study

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Abstract
We synthesized waste biomass-based partly graphitized activated carbon from *Samanea saman* waste pods (SSWPAC) and used it to remove hazardous dye rhodamine B (Rh B) and metal Cr(VI) from aqueous solution. The prepared adsorbent showed a remarkable surface area of 546.016 $m^2 g^{-1}$. The adsorbent was characterized by applying Fourier transform infrared spectroscopy, field emission scanning electron microscopy, energy-dispersive x-ray analysis, Raman spectroscopy, and X-ray diffraction. Within 50 min, 99.2% elimination of Rh B dye was observed at pH 2 using 1.0 g L^{-1} of the adsorbent, while Cr(VI) removal was 98.3% at pH 2 using 2.5 g L^{-1} of the adsorbent within 120 min at room temperature. The correlation coefficient R^2 favored pseudo-second-order kinetics in kinetic analyses of both adsorption processes. The isotherm experimental values of Rh B and Cr(VI) fits to Freundlich adsorption systems with correlation coefficient $R^2 = 0.998$ and 0.999 respectively. The results showed maximum adsorption capacity of SSWPAC for Rh B (101.01 mg g^{-1}) and Cr(VI) (64.52 mg g^{-1}). The phytotoxicity study exhibited successful removal of these pollutants from the solutions under study.

Keywords Biomass · Adsorption · Rhodamine B · Cr(VI) · Isotherm

1 Introduction

With the growth in population and expansion of the industrial sector, water pollution has become an emerging concern. Various pollutants such as dyes, heavy metals, pharmaceuticals, pesticides, and radionuclides contribute to the adverse condition of water resources. Among these pollutants, dyes and heavy metals are major contributors to the toxicity of water [1]. Organic artificial dyes, which are of more than 10,000 types, plays a significant role in industrial manufacture such as textile, coatings and colorants, paper, cosmetics, and food [2]. The expulsion of these dyes in water bodies brings about alterations in the properties of water such as rise in chemical oxygen demand, resistant to penetration of light, and turbulences to photosynthetic activity, which creates threat to the aquatic system. Rh B is one of the most used, highly water-soluble cationic dye of xanthene class which is particularly useful in printing and dying industry [3]. Being more stable photothermally, it is difficult to degrade and consequently difficult to control its hazard to the environment. Rh B is considered to be a carcinogenic, genotoxic, and neurotoxic inducer of toxin in animals [4]. Carcinogenic amines are produced from reductive amination of Rh B due to anaerobic degradation [5].

The metal ions with relatively high density and toxicity present in aqueous form affects the living organisms including humans. Due to difficulty in decomposition and bioaccumulation, they create threat to the environment. With increase in industrial demand, chromium is used in wide extent for industrial operations including leather tanning, brass industry, cement industry, electroplating, photographic components, chromate manufacturing, and corrosive paint industry [6]. It mainly exists in hexavalent Cr(VI) and trivalent Cr(III) forms. Among these, Cr(VI) is highly dissoluble in aqueous medium and 100 times poisonous than Cr(III) and impose carcinogenic,

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Synthesis of tea waste/Fe_3O_4 magnetic composite (TWMC) for efficient adsorption of crystal violet dye: Isotherm, kinetic and thermodynamic studies

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ABSTRACT

We report the synthesis and application of tea waste/Fe_3O_4 magnetic composite (TWMC) for adsorption of crystal violet (CV) dye from aqueous solution. The best conditions were determined for 98.7% removal of CV dye using an adsorbent dosage of 1.0 g L^{-1}, contact time of 90 min, an initial dye concentration of 100 mg L^{-1}, and an initial pH of 7 at 298 K. In correlation with the results of kinetic study, the pseudo- second-order model fit for this study. The isotherm data of equilibrium study fitted well to Langmuir isotherm model. The composite's highest adsorption capacity for CV dye was 333.33 mg g^{-1}. CV adsorption onto TWMC was heat releasing and spontaneous process. Adsorption of CV dye from aqueous solutions on TWMC was significantly favored, according to the findings of thermodynamic study. CV dye was effectively removed from aqueous solution, according to a phytotoxicity investigation. The study shows application of waste to useful strategy to synthesize tea waste magnetic composite and its efficiency in removing toxic dye CV from aqueous system.

1. Introduction

The growth of science, technology and industry sectors comfort the human life. It laid parallel impact that had raised ecological contamination through discharge of effluents in water bodies [1]. Throughout the world, polluted water is unquestionably amongst the most attention grasping issues which has created an impact on the environment, humans, aquatic flora and wildlife [2–7]. Toxic substances like organic dyes, medicinal components, agricultural and industrial chemicals, industrial and societal waste effluents are hazardous constituents causing water contamination [8–10]. Among these, dyes have engrossed specific consideration in wastewater management due to their harmful and antagonistic effects on the environment [11–13]. The dyes have significantly improved human life and playing notable role in the areas of paints, cloths, leather industries, food processing industries, and so forth. The effluents from these sectors contrarily present serious environmental impact which is consequently unsafe for mankind and other species [14,15]. Due to the poisonous, carcinogenic, and mutagenic properties, organic dyes have emerged as a chief cause of water contamination [16]. Among the available dyes, crystal violet (CV) is a well-known organic cationic dye from the triphenylmethane family [17]. It is largely utilized in areas such as commercial fabric dyeing, leather processing, food industry, biological stain and in veterinary medicines [18–20]. Undue accumulation of CV dye in the human body causes problems such as increase in heartbeat, eye exasperation, tetraplegia and enduring damage to the transparent mucous membrane protecting eye balls [21]. Therefore, the amputation of CV from toxic waste water is very essential. For decontamination of CV dye, several techniques have been reported in literature to date. These are specifically biological treatment, electrolytic process, flocculation, adsorption, membrane filtration, photocatalytic degradation and advanced oxidation. Among these, adsorption technique has been considered as an adaptable method for managing waste water. It provides major benefits, including low cost, affordability, profitability, ease of service and performance in comparison with other conventional methods [22–30]. An adsorption technique is significant due to availability of wide range of adsorbents such as activated carbon, zeolite, nanomaterials and many agricultural and society waste after a significant laboratory treatment

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Research Article

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Effect of Herbicide Sweep Power (Glufosinate Ammonium) on Total Protein Content in Different Tissues of Freshwater Fish *Labeo rohita*

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ABSTRACT

Background: Sweep power (Glufosinate Ammonium) is the most commonly used herbicide in agriculture crop field to remove numerous weeds. Nowadays, the use of herbicides was increased in agriculture as well as an industrial area. Due to runoff water, these herbicides arrived at the nearest natural water bodies such as ponds, lakes, rivers etc. and adversely effect on the non-target organism.

Methods: In the present study, the freshwater fishes *Labeo rohita* were acclimatized in a glass aquarium and exposed to predetermined LC_0 and LC_{50} concentration (0.01 ppm and 0.05 ppm respectively) of herbicide sweep power (Glufosinate Ammonium) for 96 hours. The amount of total protein content from different tissue of fishes from each experimental group was estimated.

Results: It was observed that the total protein content in gills, liver, muscle, and brain tissues were significantly decreased in LC_0 and LC_{50} concentration group as compared to the control group.

Conclusion: From the present study, it confirms that the selected herbicide Sweep power (Glufosinate Ammonium), do interfere with normal metabolism and biochemical composition in freshwater fishes *L. rohita*.

Key-words: Glufosinate Ammonium, Herbicides, *Labeo rohita*, Protein, Sweep power

INTRODUCTION

Now-a-day numerous herbicides are used for the controlling of crop weeds. Most of the herbicides available in the market are synthetic, which is one of the major causes of water pollution. This is widely used to control weed and herbaceous pests. But, it greatly affects the quality and quantity of food production. These synthetic herbicides are directly used in the agricultural field and due to runoff water and soil erosion arrives at nearly water bodies such as a river, ponds, lakes, etc [1]. This can result in the accumulation of a large amount of herbicides in such water bodies. The normal aquatic flora and fauna including the fishes are greatly affected to change in the environment.

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The fishes are directly exposed to the aquatic environment and accumulate various toxic compounds in organs. The toxic chemicals easily penetrate the fish's body by various routes such as direct contact, respiration by gills and food. The feeding of poisoned insect and other fishes is one of the secondary causes of exposure. They are adverse effects on the normal function, growth, behaviour and physiology of the fishes because of low degradability, high rate of accumulation inside the aquatic fauna and long term persistence [2].

Glufosinate ammonium is a highly effective herbicide used to control weeds in more than 100 crops in many countries worldwide. Farmers rely on Glufosinate-ammonium because it ensures a high degree of crop safety, as it only affects the parts of the plant where it is applied. Glufosinate ammonium was first brought to market in 1984. Today it is registered for use to control weeds in a variety of crops worldwide, including soybeans, corn, canola and cotton, which have been modified through genetic engineering to be tolerant to Glufosinate-ammonium.

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Quantitative Analysis of Morphometry using G.I.S. of Pattankodoli Nala, Kolhapur, M.S., India

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Abstract

Drainage basin characteristics depends on various factors like geology of the area, soil type, hydrological setting of the area etc. Study of morphometric characters is helpful to know more about lithological structures, geomorphological features and conditions, lineaments and hydrological characteristics of the area which in turn throws light on ground water conditions and movement of the area. Study area is Pattankodoli Nala Basin, bounded by latitude 16°36'31" N to 16°40'44" N and longitude 74°18'37" E to 74°22'39" E in Survey of India (SIO) Toposheet numbers 47L/6 on the scale 1:50000. Morphometric analysis has been carried out and various morphometric aspects have been studied. On the basis of quantitative analysis of morphometric parameters, it found that the Pattankadoli Nala is 4th ordered and the whole river contains 50 streams. The low drainage density and low stream frequency indicates that the drainage nala has less runoff in the channel. The basin is having elongated shape and gentle slope. Both relief and drainage density are low to moderate. It is found that the South Western part of the basin has moderate to good ground water potential and is favorable for artificial recharge site construction.

Keywords: Drainage basin, morphometric characters, lineaments, quantitative analysis, relief, drainage density, ground water potential

INTRODUCTION

The groundwater prospecting is carried out by using various methods, out of which the Remote Sensing and Geographical Information System (GIS) technique is more beneficial and effective from point of view of area covered in short time. Satellite data of the Earth surface obtained by remote sensing, provides a first-hand tool [7–10] for demonstrating conditions as they exist at a particular time in a given area and help in differentiating surface and sub-surface features related to hydrogeomorphology, lineaments (fracture/joints), land use and land cover etc., which are indicators of groundwater movement and localization [1–4, 6].

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Drainage morphometry was first introduced by Horton in 1932 [10, 13]. It is important for understanding the underline lithological structures, geomorphological formations, hydrological characteristics [14], soil types and vegetation status of the area [12]. The origin and development of drainage system depends upon factors viz., underline geology, endogenetic and exogenetic processes operating in the area [17]. The drainage morphometry throws light on the hydrological set up and lithological characteristics of the area [19, 23]. Morphometry is the measurement and mathematical analysis of the configuration of the earth's surface, shape and dimension of its landforms [3, 16]. The Pattankadoli Nala show well