CODEN [USA]: IAJPS ISSN: 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES

Available online at: http://www.iajps.com Research Article

REMOVAL OF ACID DYE FROM POLLUTED WATER USING AGRO WASTE MATERIAL

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Abstract:
Among various promising methods, adsorption techniques are preferred for purifying waste water contaminated with coloring pollutants such as acid dyes. Due to offering the significant advantages like the low-cost, availability, profitability, ease of operation and efficiency, agro waste materials are good deal to use it as bio-adsorbent for bio-sorption techniques in purification of water to make it free from color dyes. Activated carbon prepared from Madhuca Longifolia Seeds Hull (MLSH) belonging to family Sapotaceae was used for removal of Direct Yellow (DY12) dyes from the aqueous solution. Batch adsorption methods were performed depended on the controlling parameters such as pH, contact time, adsorbent dosage, and temperature. Kinetic data were suggestive of pseudo second order. Freundlich isotherm data fitted well with the sorption studies. The results concluded that use of MLSH as bio-adsorbent is effective and ecofriendly.

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Please cite this article in press as G. C. Upadhye et al., ***Removal of Acid Dye from Polluted Water Using Agro Waste Material****, Indo Am. J. P. Sci, 2018(Suppl.); 05(01).*

INTRODUCTION:

To fulfill the ever increasing demand of textile with vibrant and dazzling properties, approximately over 10,000 different textile dyes and pigments are used industrially and production of synthetic dyes had crossed 7 x 10^5 tons annually produced worldwide [1,2]. Inadequacy or inefficiency in dying process, nearly two lakh tons of synthetic dyes are released as effluents [4]. These synthetic dyes hinder the path of sunlight from accessing the surface of water on the earth and minimize the natural and aquatic biological processes such as growth of bacteria and photosynthesis in aquatic plants. In addition, the complex aromatic structures of the dyes provide little stability to the dyes imposing difficulties in biodegradation of the dyes [5]. Though there are legal guidelines pertaining to environmental concerns for industries to make effluents free from dye before exit from the industries [4]. However, in practice process used in the water treatments are incineration, biological treatment, absorption onto solid matrices, etc. which are reported in literature [6].

Due to several benefits of adsorption methods such as availability, low cost equipments and instruments, these techniques are opted by various researchers for treatment of water effluent [7].

High surface area of activated carbon makes it a obvious choice for sorption techniques, but its high cost and reduction in adsorption efficiency directed the researchers to seek for suitable alternatives [8]. In search of cheaper adsorbents, agricultural waste materials which have little economic value can be of importance in the studies [9]. Hence, herein we are attempting to report agricultural waste material such *Madhuca logifolia* seed hull as bio-adsorbent for treatment of water contaminated with direct dyes. The effect of various parameters such as effect of time, pH, temperature, adsorbent dose, isotherms and kinetic studies had been investigated in batch experiments using Direct Yellow (DY 12) dye and agricultural waste adsorbent as *Madhuca longifolia* seed hull (MLSH).

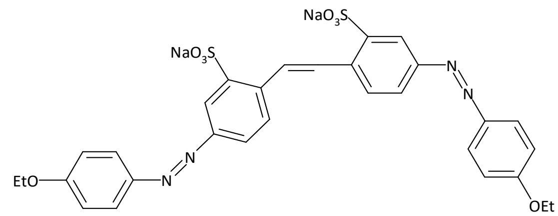
MATERIAL AND METHODS:

Material: Powdered MLSH was treated with conc. in the weight ratio 1:1 (w/v) activated by heating for 10 hours in a furnace at 110^0 C. The resulting mass washed till a constant pH and dried for 5 hours at 1100^0 C in a hot air oven. The treated MLSH was again grinded and sieved to get fine and uniform particle size. AR grade chemicals were used. 1000 ppm of dye was used as stock solution.

Methods:

50 ml of 100 ppm diluted Direct Yellow 12 dye solution was combined with 75 mg of sieved carbon adsorbent and allowed to stir for fix interval of time using mechanical stirrer. The resulting slurry was filtered and then they were analyzed in UV-visible spectrophotometer. Desorption studies were carried out using the spent carbon. The dye with activated carbon was agitated with 50 ml of water for 80 minutes at various pH. The carbon loaded with dye was separated and gently washed with distilled water to remove any absorbed dyes.

Structure of Adsorbate:



Batch adsorption studies:

Adsorption Experiments: MLSH activated carbon (Mass = 75 mg) were used to study the extent of uptake of dye by Batch experiments.

Effect of Contact time: 100 ppm of dye solution (50 ml) with 75 mg MLSH activated carbon was stirred at room temperature fixed at its natural pH at 180 rpm for different time intervals.

Effect of adsorbent dose: This was studied by agitating 50 ml of 100 ppm dye solution with different doses of MLSH activated carbon (0.05 – 2.5 g) maintained at is natural pH at 180 rpm in stirrer.

Effect of pH: Different pH (between 2 - 12) were attained with 0.1 M HCl or 0.1 M NaOH to investigate the uptake of dye by mixing 50 ml of 100 ppm dye solution with 75 mg of MLSH activated carbon at 180 rpm for 80 minutes.

Desorption Study: This was investigated by mixing 75 mg of MLSH activated carbon with 50 ml of 100 ppm dye maintained at different pH ranges.

RESULTS AND DISCUSSION:

Effect of Contact Time: With 75 mg of adsorbent, maximum percentage of dye removal was seen at 70 minutes. Before reaching to equilibrium, initially high rate of adsorption was noted. Results obtained were shown in figure 1.

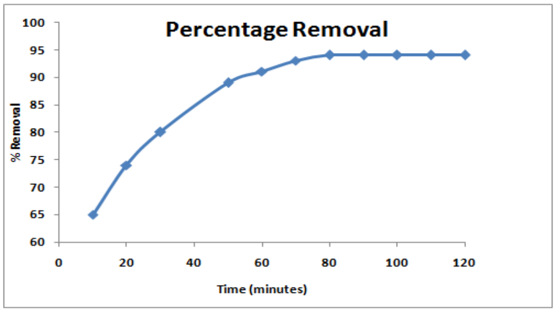


Fig. 1: Percentage removal Vs Time (minutes)

Effect of adsorbent dose: With increase in adsorbent dose, active surface area and binding sites on the surface of adsorbent increases. Increase in uptake of dye was seen in the range of 75 to 94 %.

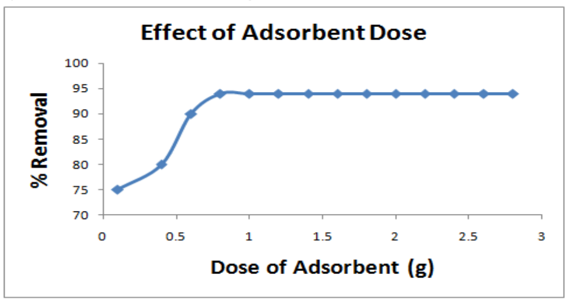


Fig.2: Percentage removal Vs Dose adsorbent

Effect of pH : It was observed that percentage removal decreases with increase in pH of the dye. Findings had shown that effective uptake of DY 12 by bioadsorbent MLSH was in lower pH between 2 to 5.

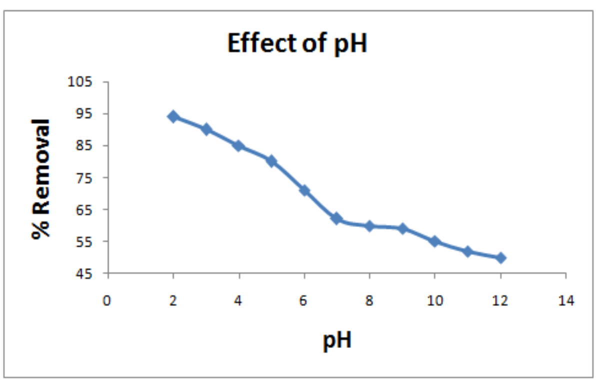


Fig. 3: Percentage removal Vs pH

Desorption Study: Viability and recyclability of adsorbent was investigated and plotted. Figure 4 showed that with increase of pH extent of desorption gradually decreased from 48 to 22 percent within pH range (2 - 12).

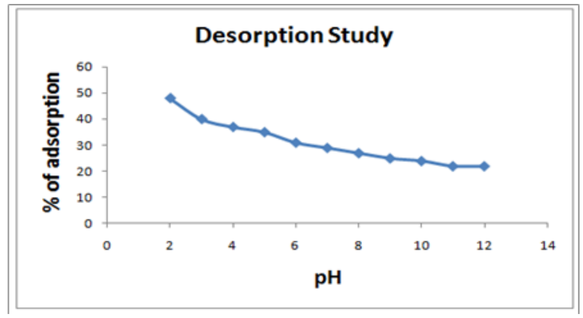


Fig. 4: percentage of Adsorption Vs pH

CONCLUSION:

There is no perfect method or adsorbent for hundred percent removal of dyes from affected water, however proper treatment of industrial water is to performed and washing fastness of the colored fabrics can resolve the issue to some extent. MLSH activated carbon can be a potential bio-adsorbent for treatment of DY 12 from effluents. The MLSH is effective in lower pH of the dye solution. It was thought that it followed a chemisorptions process. Agro-waste material MLSH is cheaper, easily available, efficient and ecofriendly bio-adsorbent for treatment of industrial effluents polluted with DY 12. Treatment of MLSH with actual industrial water is to be performed.

REFERENCES:

1.Zollinger, H. Synthesis, Properties of Organic Dyes and Pigments. In: Color Chemistry. New York, USA: VCH Publishers; **1987**. p. 92-102.
2.Robinson T, McMullan G, Marchant R, Nigam P. Remediation of dyes in textile effluent: a critical review on current treatment technologies with a proposed alternative. Bioresource Technology **2001**; 77 (12): 247-255.
3.Ogugbue CJ, Sawidis T. Bioremediation and Detoxification of Synthetic Wastewater Containing Triarylmethane Dyes by Aeromonas hydrophila Isolated from Industrial Effluent. Biotechnology Research International 2011; DOI 10.4061/**2011**/967925.
4.Forgacs E, Cserháti T, Oros G. Removal of synthetic dyes from wastewaters: a review. Environment International **2004**; 30 (7) :953- 971
5.Pearce CI, Lloyd JR, Guthrie JT,The removal of colour from textile wastewater using whole bacterial cells: a review. Dyes Pigment 2003;58:179–196
6.Babel S, Kurniawan TA. Low-cost adsorbents for heavy metals uptake from contaminated water: a review. Journal of Hazardous Materials. **2003**; 97(1-3): 219-243.

7.Kapdan IK, Kargi F (**2002**) Simultaneous bio degradation and adsorption of textile dye stuff in an activated sludge unit. Process Bio Chem ,37:973–981
8.Waranusantigul P, Pokethitiyook P, Kruatrachue M, Upatham ES **(2003)** Kinetics of basic dye methylene blue biosorption by giant duck week Spirodela polyrrhiza. Environ Poll, 385:92
9.Geopaul N, Some methods for the utilization of waste from fiber crops and fiber waste from other crops. Agric Waste Manage 1980;2(3):13–18