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Spectrophotometric Studies on Removal of Brilliant Cresyl Blue From Aqueous Solution by Using Lead Sulphide

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The present research work deals with the bleaching of brilliant cresyl blue (BCB) dye has been carried out in presence of semiconductor, lead sulphide. The source used for energy is visible light. Various parameters like dosage of lead sulphide, pH, concentration of brilliant cresyl blue dye are studied. Experiments are carried out to remove the brilliant cresyl blue dye stuff by using lead sulphide. It is observed that the dye concentration increases with the decrease in bleaching rate. For an amount of 0.10 g and at a pH value of 8 of PbS the bleaching rate is maximum and found to be decreasing with increasing pH and amount of PbS. The maximum bleaching rate is observed at the optimum time at 75 min. Brilliant cresyl blue dye was removed up to 79.3 % by using semiconductor, lead sulphide.

Key Words: Brilliant cresyl blue dye stuff, Dosage of lead sulphate, UV- Spectrophotometer, Digital pH meter, Sigma plots.

INTRODUCTION

Now a days environmental pollution control is plays a major role in the society. Large amounts of dyes are annually produced and consumed by industries[1,2] *e.g.* textile, cosmetics, paper, leather (tanning), pharmaceutical, food, beverages. The textile industry itself only accounts for two third of the total dye stuff market[3,4]. Even a small amount of dye in water (10-50 mg/L) affects the aesthetic value, water transparency and air solubility in water bodies[5]. It may also affect photo-chemical activities in aquatic system by restricting light penetration. It has also been reported that several commonly used dyes are carcinogenic and mutagenic for aquatic organisms. The presence of visible colour pollutant even in a very minute amount makes it undesirable due to its appearance. The removal is a major problem because of the difficulty in treating such coloured dye containing wastewater[6]. Such dye stuff in industrial effluents is bleached using various semiconductors. The present research work deals with removal of brilliant cresyl blue dye from the industrial effluents by using PbS as a semiconductor.

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EXPERIMENTAL

Preparation of brilliant cresyl blue solution: Stock solution of brilliant cresyl blue concentration 1000 mg/L has been prepared by dissolving 1 g of brilliant cresyl blue in 1000 mL of distilled water. The range of concentration of the prepared dye solution varied between 20-100 mg/L. The solutions were prepared by diluting the stock solution, which is obtained by dissolving in distilled water.

Variation of dye concentration at different contact times[4,7] (min): The effect of contact time was determined by adding 0.1 g of PbS in 20 mL of solution of initial dye concentration of 20 mg/L and shaking well gently with constant speed in various time intervals such as 0, 10, 20, 30 upto 120 min. At every time interval the sample is analyzed for the amount of dye absorbed. From this data the optimum time period for bleaching of brilliant cresyl blue is obtained.

Variation of dye concentration at different pH[2,4]: The effect of pH of dye solution is determined by adding 0.1 g of PbS and 20 mL of dye solution with initial dye concentration of 20 mg/L and shaking well gently with constant agitated speed in various pH ranges from 5-10 maintained by adding 0.1 N of NaOH (or) 0.1 N of HCl solution and finally the concentration of the brilliant cresyl blue at each case is determined.

Determination of concentration of dye solution[4,8,9]: To determine the concentration of dye solution, 0.1 g of PbS is mixed with 20 mL of synthetic solution of concentration of 20 mL/L. It is then mixed rigorously with constant agitated speed for optimum time. Same procedure is repeated with 20 mL of stock solution, but with different concentration of brilliant cresyl blue such as 20, 40 and upto 100 mg/L. Finally amount of brilliant cresyl blue dye in each case is analyzed.

Determination of concentration of dye solution at different dosage of PbS[10]: 20 mL of 20 mg/L dye solution with known amount of 0.02 g of PbS in conical flask is taken and mixed well with constant agitated speed. The procedure is repeated for different dosage of PbS added (PbS dosage ranging from 0.02, 0.04 up to 0.16 g). Finally the concentration of brilliant cresyl blue dye stuff using UV spectrophotometer is determined.

RESULTS AND DISCUSSION

Effect of contact time on percentage of dye removed: Fig. 1 shows the effect of contact time on percentage of brilliant cresyl blue removal. The percentage of dye removal is increased with increase the contact time. The maximum value of dye removed at optimum time 75 min. Further increase the time, the percentage dye removal is slightly decreased.

Effect of pH on percentage of dye removed: Fig. 2 shows the effect of pH on percentage of dye at different pH of solution for an initial dye concentration of 20 mg/L and an adsorbant dosage 0.1 g. The biosorption of brilliant cresyl blue was observed to increase with increase in pH up to a value of 8. With further increase in

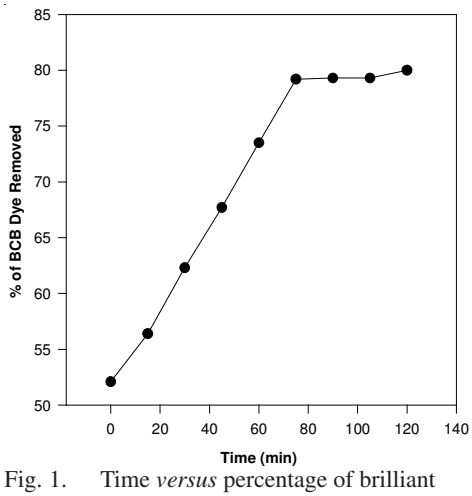

Fig. 1. Time *versus* percentage of brilliant cresyl blue removal

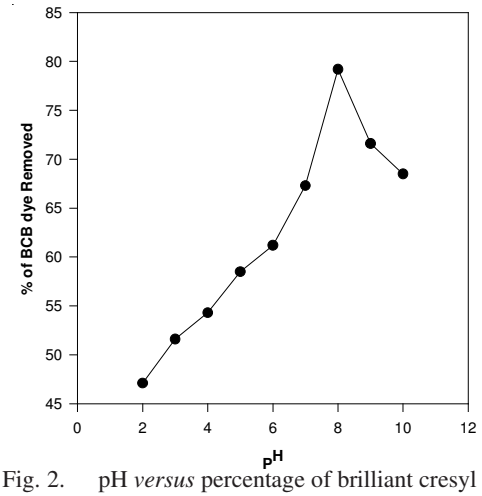

Fig. 2. pH *versus* percentage of brilliant cresyl blue removal

pH, the amount of dye adsorbed decreased slowly. As the pH increased the ligands such as carboxylate groups would be exposed, increasing the negative charge density on the biomass surface, increasing the attraction of dye ions with positive charge and allowing the biosorption onto the cell surface.

Effect of concentration of dye on percentage of dye removed: Fig. 3 shows the effect of concentration of dye on percentage of removal of brilliant cresyl blue. It is observed here that the dye concentration increases with the decrease in bleaching rate whereas the equilibrium uptake of dye displays an opposite trend. As a result, diluting the wastewaters containing high dye concentrations can increase the purification yield.

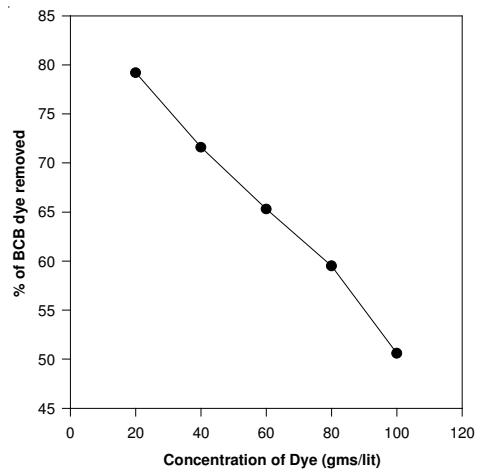

Fig. 3. Concentration of brilliant cresyl blue *versus* percentage of brilliant cresyl blue dye removal

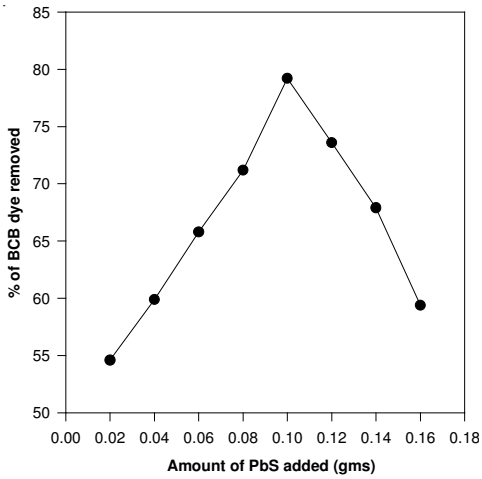

Fig. 4. Amount of PbS added *versus* percentage of brilliant cresyl blue dye removal

Effect of amount of PbS on percentage of dye removal: The effect of biosorbant dosage on removal of brilliant cresyl blue, the biosorbent dosage is changed from 0.02-0.10 g, fixing other parameters like initial concentration at 20 mg/L, pH 5 and contact time. The biosorption plot of Fig. 4 shows with an increase in biosorbant dosage the percentage of biosorption increases and the dye uptake was decreases. This is because of the availability of more binding sites for complexation of dye ions.

Conclusion

It is concluded that lead sulphide is more suitable for removal of brilliant cresyl blue dye. The removal of brilliant cresyl blue upto 79.3 % at optimum time period of 75 min using lead sulphide. It is suggested for removal of basic dye from wastewater by using lead sulphide as sorbent.

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