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Removal of Neutral Violet Dye From Aqueous Solution by Using *Psidium guajava* Leaf Powder

CH. SRINIVAS*, CH. NAGAMANI, M. GANGADHAR and M. RAJA SEKHAR†
Department of Chemical Engineering, Andhra University, Visakhapatnam-530 003, India
E-mail: csvasi.2007@gmail.com; nagamani_chittumuri@yahoo.com

Present research work deals with the bleaching of neutral violet dye have been carried out in presence of adsorbent guava leaf powder. The source used for energy is visible light. Various parameters like dosage of adsorbent, pH, concentration of neutral violet dye *etc*., are studied. Experiments are carried out to remove the neutral violet dye stuff by using adsorbent guava leaf powder. It is observed that the dye concentration increases with the decrease in bleaching rate. For an amount of 0.10 g at a pH value of 9 maintained of adsorbant. The bleaching rate is maximum and found to be decreasing with increasing pH and amount of adsorbent. The maximum bleaching rate is observed at the optimum time at 90 min. Neutral violet dye was removed up to 91.3 % by using adsorbant guava leaf powder.

Key Words: Neutral violet dye stuff, Guava leaf powder, UV- Spectrophotometer, Digital pH meter and Sigma plots.

INTRODUCTION

Now a days environmental pollution control plays main role in society. Colour is a visible pollutant in most of the industries which use dyes and pigments to colour their products in large amounts of dyes are annually produced and consumed by textile industry, cosmetics, paper, leather (tanning), pharmaceutical, food, beverages and other several industries[1,2]. The textile industry accounts for two third of the total dye stuff market[3,4]. Even small amount of dye in water (10-50 g/L) effects the aesthelic value, water transparency and air solubility in water bodies. It affects photochemical activities in aquatic system by reducing light penetration. It has also been reported that several commonly used dyes are carcinogenic and mutagenic for aquatic organisms. Physico-chemical processes such as electro-coagulation, ozonization, photo catalysis, membrane filtration and adsorption have been employed for the treatment of dye containing wastewater[5]. Among these technologies, adsorption process is considered to be a promising technology which involves phase transfer of dye molecules on to adsorbent leaving behind the clear effluent. The removal of colour from the dye bearing effect is a major problem due to the difficulty in treating such wastewater[6].

In the present work, adsorption capacity of untreated guava leaf powder was investigated, using neutral violet as a model basic dye involving various parameters

†Department of Engineering Chemistry, Andhra University, Visakhapatnam-530 003, India.

like pH, contact time, initial dye concentration and biosorbent dosage. Guava or *Psidium guajava* of Myrtaceae family is a tropical and semi tropical plant. It is common in back yards and waste places. Its seeds and leaves possess medicinal value and are traditionally used to treat a number of human ailments. During preliminary studies carried out in our laboratory, guava leaf powder had shown excellent adsorption capacity for neutral violet. The objective of the present study is to examine the adsorption characteristics of guava leaf powder as low cost adsorbent to determine the maximum possible % of adsorption capacity. Due to its abundant availability and low cost it can be disposed off after use without need for expensive regeneration. The present work deals with removal of neutral violet dye from the industrial effluents by using guava leaf powder as an adsorbent.

EXPERIMENTAL

Preparation of adsorbent of guava leaf powder (GLP): Mature guava leaves used in the present study was collected from Andhra University College of Engineering, Visakhapatnam. The collected material was thoroughly washed with distilled water 3-4 times to remove dust and other impurities. Then sun dried the washed leaves. Dried leaves were then grinded, screened. Dried guava leaf powder was keeping in plastic containers stored in humidifier for further use. The physical and chemical characteristics of the guava leaf powder were determined and showed below:

Physical and chemical properties of guava leaf powder used in the experiments

Moisture content (%)	:	4.77
Volatile matter (%)	:	69.91
Ash (%)	:	19.56
Fixed carbon (%)	:	5.76
Average particle size (μm)	:	75-300

Preparation of neutral violet dye solution: Stock solution[7,8] of neutral violet dye concentration 1 g/L has been prepared by dissolving 1 g of neutral violet dye in 1 L 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 with distilled water.

Variation of dye concentration at different contact times (min): The effect of contact time was determined by adding 0.1 g of adsorbent guava leaf powder in 20 mL of solution of initial dye concentration of 20 mg/L and shaking well at various time intervals such as 0, 10, 20, 30 and soon up to 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 neutral violet dye is obtained.

Variation of dye concentration at different pH: The effect of pH of dye solution is determined by adding 0.1 g of guava leaf powder and 20 mL of dye solution with initial dye concentration of 20 mg/L and shaking well at various pH ranges from 1-10 maintained by adding 0.1 N of NaOH (or) 0.1 N of HCl solution and finally the concentration of the neutral violet dye in each case is determined.

Determination of concentration of dye solution[7,10]: To determine the concentration of dye solution, 0.1 g of guava leaf powder is mixed with 20 mL of synthetic solution concentration of 20 mL/L. It is then mixed with constant speed for optimum time. Same procedure is repeated with 20 mL of stock solution, but with different concentration of neutral violet dye such as 20, 40 mg/L and so on up to 100 mg/L. Finally amount of neutral violet dye in each case is analyzed.

Determination of concentration of dye solution at different dosage of guava leaf powder[9,10]: 20 mL of 20 mg/L dye solution with known amount of 0.02 g of guava leaf powder in conical flask is taken and mixed well with constant shaking. The procedure is repeated for different dosage of guava leaf powder added (guava leaf powder dosage ranging from 0.02, 0.04 up to 0.16 g). Finally the concentration of neutral violet dye stuff using UV spectrophotometer is determined.

RESULTS AND DISCUSSION

Effect of contact time: Fig. 1 shows the effect of contact time on percentage removal of neutral violet dye. The percentage of the dye removed is increased with increasing period of contact time. From the graph it is observed that the maximum bleaching rate of dye using guava leaf powder is 91.3 % at optimum time 1.5 h further increase the time, the bleaching rate of dye is slowly decreased.

Effect of pH: 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 adsorbent dosage 0.1 g. The biosorption of neutral violet was observed to increase with increase in pH up to a value of 5. With further increase in pH, the amount of dye adsorbed decreased slowly.

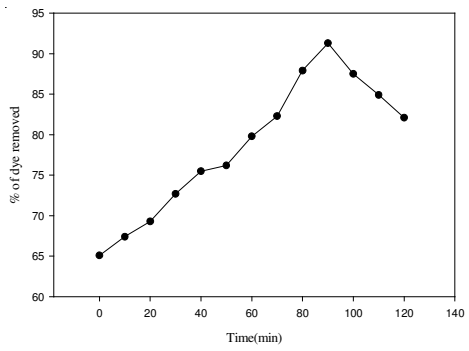

Fig. 1. Time (min) *versus* percentage of neutral violet dye removed

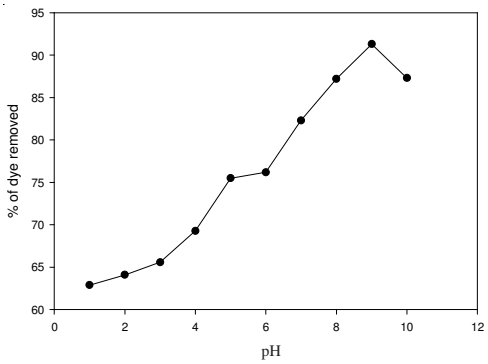

Fig. 2. pH *versus* percentage of the neutral violet dye removed

Effect of initial concentration: The percentage biosorption at higher concentration levels shows a decreasing trend whereas the equilibrium uptake of dye displays an opposite trend (Fig. 3). At lower concentrations, all neutral violet present in solution could interact with the binding sites and thus the percentage biosorption

was higher than those at higher initial neutral violet concentrations. At higher concentrations, lower biosorption yield is due to the saturation of biosorption sites. As a result, diluting the wastewaters containing high dye concentrations can increase the purification yield.

Effect of biosorbent dosage: Effect of biosorbent dosage on removal of neutral violet, 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 biosorbent dosage the percentage biosorption increases and the dye uptake was decreases.

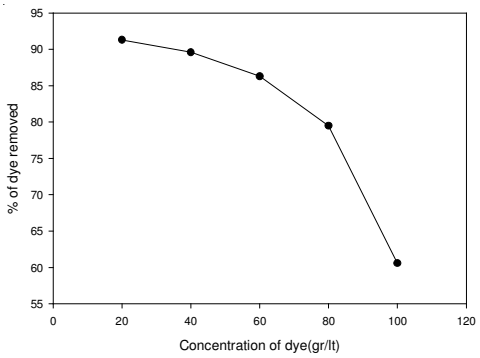

Fig. 3. Concentration of neutral violet dye *versus* percentage of the neutral violet dye removed

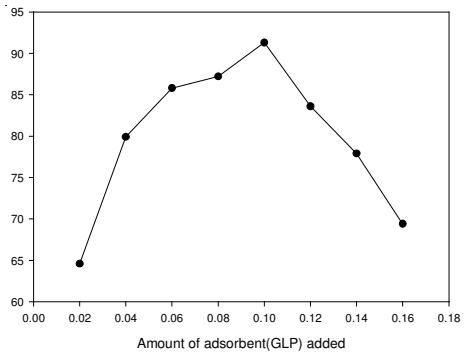

Fig. 4. Amount of guava leaf powder adsorbent added *versus* percentage of neutral violet dye removed

Conclusion

It is evident that guava leaves, a commercially available natural material, is a good sorbent for neutral violet and it can be suggested for removal of basic dye from wastewater. It is concluded that the neutral violet dye is removed up to 91.3 % at optimum time 1.5 h and pH 9 by using low cost and naturally available adsorbent guava leaf power from industrial effluents and wastewater.

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