



**CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY**

Name(s) Pujita S. Tangirala	Project Number J0622
Project Title A Green, Low-Cost Adsorbent for the Removal of Dye from Aqueous Solutions	
Abstract Objectives/Goals Dyes are used in many industries, such as textiles, plastic, printing, and cosmetics. Because current methods of wastewater treatment are expensive and create toxic sludge, there is a need for a cost-effective method. The purpose of this project was to test the efficiency of spent tea leaves (STL) as a low cost adsorbent of dye using a column adsorption filter system. In this experiment, the effect of flow rate, adsorbent dose, and initial dye concentration on the adsorption of methylene blue by STL was studied. The hypothesis was that a lower flow rate, a higher adsorbent dose, and a lower dye concentration would all lead to higher adsorption. Methods/Materials STL was prepared by washing, drying, grinding, and sieving the tea residue. A homemade spectrophotometer was built and calibrated using known concentrations of methylene blue. A column adsorption filter system was built and three flow rates (4.4, 2.96, and 1.46 mL/min), three adsorbent doses (0.4, 0.5, and 0.6 g), and three initial concentrations (1, 2, and 3 mg/mL) were tested. Each test was repeated three times. All the samples were analyzed using the spectrophotometer. Results Dye removal efficiency (E%) increased as the flow rate was decreased. At a flow rate of 4.4, 2.96, and 1.46 mL/min, E% was 77.62%, 84.13%, and 98.70%, respectively. E% increased as the adsorbent dose increased. At an STL dose of 0.4, 0.5, and 0.6 g, E% was 98.98%, 99.03%, and 99.10%, respectively. E% increased from 1 mg/mL to 2 mg/mL and decreased from 2 mg/mL to 3 mg/mL. Even though the concentration was increased from 1 mg/mL to 2 mg/mL, free adsorption sites were still available. At a concentration of 1, 2, and 3 mg/mL, E% was 99.10%, 99.19%, and 98.70%, respectively. Conclusions/Discussion Maximum dye removal efficiency of up to 99% was attained depending on the adsorption conditions, and maximum adsorption capacity of 95.41 mg/g was attained. STL can be used as a low-cost adsorbent for the removal of methylene blue dye from aqueous solutions. The functional groups present on the surface of STL and its cellular components are responsible for the adsorption of dye. STL is abundantly available and requires no pre-treatment except washing and drying. This column filter system is also a cost-effective method, as it does not use any agitation or electric power. This system can be adapted to an industrial scale to be permanently installed where wastewater treatment is needed.	
Summary Statement Built a column adsorption filter system using spent tea leaves as adsorbent to remove dye from aqueous solutions and concluded that this could be a potential cost-effective alternative to expensive industrial wastewater treatment methods.	
Help Received My mom supervised this experiment. My parents bought the supplies for this experiment. My science teacher, Mrs. Mackewicz, guided me through this whole process.	