Batch Adsorption of Methylene Blue Using Fresh Prickly Pear Cactus Cladodes as a Model Material for Textile Wastewater Remediation

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The textile industry is responsible for producing 20% of all water pollution.With Methylene Blue (MB) acting as the most commonly used basic dye in the textile industry, its usage is problematic as MB acts as a cancerous effluent, causing eutrophication in wastewater streams due to its dark color and non-biodegradability. Although previous studies have focused on the adsorption of MB onto chemically activated carbon, its usage results in release of silt into water which alters soil's composition, requiring high-cost treatment facilities for efficient usage to filter silt out. Using fresh, untreated biomass has been overlooked as a viable, accessible and cost-efficient solution for wastewater remediation; fresh cactus is harvested across 2.6 M ha globally, it's recoverable in water unlike AC, and thus, a useful remediation tool. This study aimed to develop an understanding of the effectiveness of Opuntia ficus-indica as a potential adsorbent for MB by understanding how the parameters, such as contact time, adsorbent dosage and temperature may affect adsorption. Results indicated that decreasing temperature (25C to 4C), increasing time (1H to 24H) and increasing dosage (1g to 12.5g) all increased the average percent-removal of MB (up to 50.7%). The average concentration of MB removed from solution (mM/ per gram of cactus) decreased as the dosage increased. Therefore, concluding that 1) the fresh prickly-pear cactus adsorbs the MB and 2) MB adsorption is dependent on contact time (H) and temperature (C). MB can be remediated using the cactus as a viable, but less efficient replacement for AC.

Awards Won:
Arizona State University: Arizona State University ISEF Scholarship (valued at up to $52,000 each)
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