

Development of universal biosorbents to remove various dyes with different charges in the wastewater

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Dyes are noticeable even at low concentrations and have an adverse effect on hindering the growth of aquatic life. Biosorption which mainly adsorbs dyes by electrostatic forces is known to be an effective and efficiency way to remove dyes. Dyes are classified into basic (cationic), reactive (anionic), and disperse (neutral) ones according to their charges. Therefore, it is very difficult to remove these dyes at the same time using one type of biosorbents. In this study, polyethylenimine–alginate–activated carbon composite fiber (PEI–Alg–ACF) was manufactured by crosslinking polyethylenimine and alginate on activated carbon to simultaneously remove dyes of various charges. The adsorption performance through batch and continuous processes using methylene blue (MB, cation), remazol brilliant violet 5R (RBV 5R, anion), and mixed (MB and RBV 5R) dyes. The maximum adsorption capacity was 295.81 mg/g for MB, 178.47 mg/g for RBV 5R, 258.65 mg/g for mixed dyes at pH 7, respectively. Finally, continuous column experiments with mixed dyes were operated, resulting in successful treatment of 2000 bed volumes with a breakthrough point of 10% of initial concentration.