Abstract

This study aims to determine the removal efficiency of dyes, other physicochemical parameters and evaluate the energy efficacy by physical treatment with adsorption and coagulation, chemical treatment with AOPs and biological treatment with macrophytes. In addition, linear regression of TDS and EC of all the treatments were evaluated to understand the reaction mechanism. The Nishat Dyeing and Finishing unit was studied for this purpose. In this regard, the characterization of physicochemical parameters of wastewater quality such as DO, pH, EC, turbidity, TDS, TSS, COD and chlorides were analyzed to measure the removal efficiency of each treatment method. The electrical energy consumption of all aforementioned treatment methods was also compared. Comparison of maximum dye removal efficiency by physical, chemical and biological treatment method was also evaluated. The maximum removal efficiency of azo dyes AY-17, AY-36, DY-4, DR-28, EBT, AB-1 was 35%, 87%, 89%, 95%, 94%, 78% and basic dyes MV-10B, BG-4, BB-9 was 80%, 76%, 94% and reactive dyes RO-4, RO-16 and RB-5 was 89%, 78%, 95% after physical treatment on pure sample. The maximum removal efficiency of azo dyes AY-17, AY-36, DY-4, DR-28, EBT, AB-1 was 74%, 91%, 94%, 88%, 89%, 92% and basic dyes MV-10B, BG-4, BB-9 was 89%, 87%, 94% and reactive dyes RO-4, RO-16 and RB-5 was 82%, 68%, 86% after chemical treatment on pure sample. The maximum removal efficiency of azo dyes AY-17, AY-36, DY-4, DR-28, EBT, AB-1 was 62%, 78%, 80%, 92%, 89%, 69% and basic dyes MV-10B, BG-4, BB-9 was 90%, 80%, 80% and reactive dyes RO-4, RO-16 and RB-5 was 90%, 84%, 62% after biological treatment on dilutions. All the R2 values of treatment processes were close to 1, which depicts the fitness of the rate of degradation and removal process reactions. Hence, the biological treatment of dilutions appeared to be the most eco-friendly, feasible and required no electrical energy if space is available for the setup. However, physical treatment required less electrical energy as compared to chemical treatment for the removal of dyes. That could lead to the treated textile wastewater for reuse and recycling purposes within the industry.

Keywords: Textile wastewater; Treatments; Adsorption; Coagulation; Advanced Oxidation Processes (AOPs); Macrophytes; Linear regression; Sustainability