A Natural Biosorbent for the Removal of Methylene Blue (BB9) Dye: 
Pyracantha coccinea

Tamer Akar\textsuperscript{a}, Burcu Aylan\textsuperscript{b}, Ash Görgülü\textsuperscript{b}, Sibel Tunah Akar\textsuperscript{a}

\textsuperscript{a}Eskişehir Osmangazi University, Faculty of Arts and Science, Department of Chemistry, 26480, Eskişehir

\textsuperscript{b}Eskişehir Osmangazi University, Faculty of Education, Department of Chemistry Education, 26480, Eskişehir

burcu@ogu.edu.tr

In recent years, several adsorbents have been identified as possessing good dye-binding capabilities [1,2]. In particular, biomaterials of microbial or agricultural origin have been very effective because of their cell wall constituents. \textit{Pyracantha coccinea} was selected as the biosorbent since it is widely grown in Turkey and used as ornamental plant in gardens and parks. Methylene blue (Basic Blue 9, BB9) is one of the most important and widely used cationic dyes in the textile, printing calico, dyeing, printing cotton, tannin, dyeing leather and paper industries [3]. Thus, the effluents discharged from these industries often colored due to methylene blue and require proper treatment prior to their discharge [1]. In the interest of the environment, we utilized a low-cost biosorbent \textit{P. coccinea} to remove basic dye from aqueous solutions.

Hence, this study employed \textit{P. coccinea} for the biosorption of BB9 in batch process. The biosorption capacity of natural biosorbent was investigated as a function of initial pH, biosorbent dosage, contact time and temperature. The effect of initial pH on the biosorption of BB9 was examined in a pH range 1-10 and the original pH of the dye solution was found as optimum pH. The maximum biosorption yield was obtained in the biomass concentration of 0.2 g/50 mL. The contact time was varied between 5 and 85 min and the biosorption equilibrium was attained within 35 min. Kinetic analyses were conducted using pseudo-first-and pseudo-second-order models at different temperatures and it was found that the biosorption kinetics of BB9 on \textit{P. coccinea} obeyed pseudo-second-order biosorption kinetics. Biosorption equilibrium studies demonstrated that the biosorption process followed both Langmuir and Dubinin-Radushkevich isotherm models. The monolayer biosorption capacity was 1.98x10\textsuperscript{-4} mol g\textsuperscript{-1} at 45\textdegree C. The proposed biosorption method was also successfully applied to synthetic waste water containing BB9 dye. The BB9-biosorbent interaction was studied using FTIR and SEM analysis in order to evaluate the biosorption mechanism. The results in this study indicated that \textit{P. coccinea} was an attractive, new, low-cost and locally available candidate for removing MB from aqueous solutions.

References