Industrial wastewater is produced in significant amounts and present two main challenges; high concentrations of soluble organic contaminants that can be toxic and threaten aquatic life and settling where fines consisting of slit and clay form a stable colloidal suspension hindering their ability to settle. Hence, they can remain suspended for decades. Technologies used today present several shortcomings whether they are not cost-effective, not environmentally friendly or are not efficient in achieving the desired outcome. Nanoparticles have a high adsorption affinity and capacity attributed to their surface functionalities; controlling the coordination/number of the atoms on the surface which in turn increases its uptake. In addition, owing to their nanoscale size, nanoparticles have a high dispersion ability and easily accessible external surface area per unit mass. Consequently, nanoparticles portray a high adsorption rate and present potent catalytic activity. These advantages resulted in the wide applications in environment related process including wastewater treatment. Nanoparticles alone don’t always have the affinity required towards certain contaminants or particles in the water. Therefore, polymer grafting is the best technique for enhancing the surface modification and functionalization of solid nanoparticles substrates. This study aims at reducing the environmental impacts resulting the oil extraction processes. It targets some of the challenges listed above. This research introduces tailor made nanoparticles that form strong bond with contaminants in the wastewater. The prepared nanoparticles are characterized to optimize their surface functionality and dispersibility in the wastewater medium. Computational modeling of the interaction between the contaminants and the nanoparticles is carried out along with batch experiments. Use of such an optimized grafted nanoparticle will reduce the amount of chemicals required for wastewater treatment. Therefore, presents a promising material for future application in wastewater treatment.

**Keywords:** Polymer grafting, wastewater treatment, characterization

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