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Synthesis of titanium dioxide nanoparticles using extract of *Azadirachta indica* flowers and their photocatalytic degradation ability with methylene blue

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Titanium dioxide (TiO₂) nanoparticles have been widely used in many applications due to its stronger oxidizing power, low cost, non-toxicity and high stability. In this study, anatase TiO₂ nanoparticles were synthesized using a green synthesis approach. *Azadirachta indica* (Neem) is abundant in Sri Lanka and several studies reveal that different parts of the plant consist of various bioactive compounds. Titanium tetraisopropoxide was used as the precursor and the flower extract of *Azadirachta indica* was used as the stabilizing and reducing agent for the synthesis of nanoparticles. The formation of nanoparticles was confirmed using UV-Visible spectroscopic data. The specific absorbance peak at 315 nm confirmed the formation of TiO₂ nanoparticles. The crystallinity and crystal phase of synthesized TiO₂ nanoparticles were analyzed using X-Ray powder diffraction (XRD). The distinct XRD peaks corresponded to the tetragonal structure of anatase phase TiO₂ nanoparticles. The average particles size was calculated by Scherrer equation and was found to be 18.79 nm. The photocatalytic degradation of the synthesized nanoparticles was evaluated using methylene blue (MB). Degradation was carried out at pH values of 5, 7 and 8, under sunlight. The degradation was monitored using a UV-Visible spectrophotometer at 30-minute time intervals. The time taken for degradation was found to be dependent on the pH; a longer time of 240 minutes was recorded at pH 5 and a lower time of 120 minutes was recorded at pH values of 7 and 8. The results from this study reveal that the degradation percentage was dependent on the pH of the solution. The highest degradation percentage of 99.27% was attained at pH 8 at 165 minutes while 98.67% and 97.80% were attained at pH 7 and pH 5 at 240 minutes, respectively while the kinetic studies of the degradation of MB fitted to a pseudo-first order reaction. The rate constant of the reaction was found to increase with increasing pH among the studied reactions. The above results from the study showed that green synthesised TiO₂ could exhibit effective photodegradation of MB.

Keywords: green synthesis, TiO₂, methylene blue, photocatalytic degradation

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