Intricate Study of Hydrothermally-synthesized Hexagonal K2W4O13 Nanowires for the Adsorption and Photodegradation of Organic Dyes and Heavy Metal Ions

Lim, Dillion (School: Hwa Chong Institution)

Lee Chong Han, Bryan (School: Hwa Chong Institution)

Ho, Shanley (School: Hwa Chong Institution)

Water pollution is a pertinent issue today, with pollutants such as dyes and heavy metal ions causing health issues. Potassium tungstate (K2W4O13) nanowires show huge potential in mitigating water pollution. However, the conventional synthesis method involves calcination, which is energy-intensive and economically unfriendly. In the present study, K2W4O13 nanowires were synthesized through a more eco-friendly hydrothermal method which does not require calcination. The K2W4O13 nanowires synthesized were evaluated in terms of their adsorption capabilities on brilliant green dye and lead(II) ions, both of which are common cationic species. Mechanism of adsorption was studied using isotherms. Results showed that K2W4O13 nanowires synthesized had aspect ratios (ratio of width to height) of 3.0 – 7.33 and were observed to be cylindrical in shape. K2W4O13 nanowires are also comparable to commercial activated carbon in the removal of brilliant green dye and lead(II) ions respectively, removing close to 100% of both pollutants. Interestingly, besides being an adsorbent, K2W4O13 nanowires could double up as a photocatalyst which can degrade dyes in the presence of visible light. They are also comparable to titanium dioxide in photodegrading methyl orange, an anionic azo dye, removing 99.9% of the dye. Due to the dual adsorptive and photocatalytic properties, K2W4O13 nanowires are highly versatile materials which are able to remove different classes of cationic and anionic pollutants. They have great potential to be used in wastewater treatment to remove dyes and heavy metal ions.

Awards Won:

Fourth Award of $500