

UNIVERSITY OF NAIROBI
SCHOOL OF PHYSICAL SCIENCES
DEPARTMENT OF CHEMISTRY

**SYNTHESIS, CHARACTERIZATION AND TESTING OF
TITANIUM (IV) OXIDE TUNGSTEN (VI) OXIDE
COMPOUND AS POTENTIAL CATALYSTS FOR WATER
PURIFICATION**

BY

SIMON NGIGI MBUGUA

(BSc. Chemistry, U.O.N.)

REGISTRATION No. I56/69325/2011

**THESIS SUBMITTED TO THE BOARD OF POSTGRADUATE STUDIES OF
THE UNIVERSITY OF NAIROBI IN PARTIAL FULFILMENT OF THE
REQUIREMENTS FOR THE AWARD OF MASTER OF SCIENCE DEGREE IN
ENVIRONMENTAL CHEMISTRY**

August, 2013

ABSTRACT

The objective of this study was to synthesize Titanium (IV) Oxides tungsten (VI) oxide compound and subsequently test them for use as photo catalysts in water purification. The synthesized compound was calcined at 575°C . An X-Ray Diffraction was taken for structure determination, at 2θ angles at a range of $0^{\circ}\text{C} - 80^{\circ}\text{C}$. The results showed particle size diameter of 18.99 nm using Copper k-alpha X-Rays of 1.54060nm and Scherrer constant of 0.89.

The the compound was then tested for efficacy in photodecomposition and deactivation of chemical and microbial loads in water. Using Methyl Orange and Methylene blue dyes, the best photo catalytic efficiency on exposure to visible light and solar radiation was achieved with synthesized compound at room temperature at a ratio of 1:1 Ti:W and 0.5g/L photo catalyst amount. The Photo catalytic decomposition of methylene blue was found to follow first order kinetics with a $t_{1/2}$ of 45minutes and a reaction rate constant, k , 0.0154 at pH 2. Reaction kinetics fitted the Langmuir-Hinshelwood model for pseudo first order rates.

Results on heavy metals showed a 98.77% efficiency removal of Copper (II) ions and 97.48% removal efficiency of Lead (II) ions from water. Solid Phase Extraction was used for the analysis of the following organochlorine pesticides; α -HCH, β -Lindane, BHC and δ -HCH. Irradiation was done using an 8W Blacklight Blue (BLB) low pressure mercury vapor lamp from Philips and gave results that indicated degradation for α -HCH, β -Lindane, BHC, and δ -HCH to be 95%, 91%, 98% and Below Detection Limit respectively. Results on inactivation of *Escherichia Coli* showed a log reduction of 3.415 corresponding to 99.9615% *E.coli* removal. Photo killing of total coliforms was carried out under solar illumination and the results indicated a log 2.4559 reduction corresponding to 99.6499% total coliform removal.