SIIC035

REMOVAL OF LEAD AND COBALT USING SILVER NANOPARTICLES IMMOBILISED TITANIUM DIOXIDE NANOTUBES

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Abstract:
This study is conducted to synthesis the silver nanoparticle (AgNPs) and immobilization on titanium dioxide (TiO2) nanotubes. Evaluation of TiO_2/AgNPs catalytic activity is performed to eliminate Co and Pb heavy metals. In order to achieve the objectives, several scopes need to be study .The preparation of AgNPs by salt reduction method. The reducing agent and metal precursor in this study are K. Breivifolia leaves and silver nitrate respectively. The factors that need to be consider are pH at 6, temperature where it is in a room temperature and the concentration of reducing agent and metal precursor. Preparation of silver nanoparticle (AgNPs) immobilized titanium dioxide (TiO2) nanotubes as a substrate by anodisation method. Ti wire will be used as anode and platinum electrode as cathode. The electrolyte for anodisation are 97 ml of ethylene glycol, 0.3 g of ammonium fluoride (NH4F) and 3 ml of 1.0 M potassium carbonate (K2CO3). The voltage which it is at 60V for 20 mins. Preparation of TiO2/AgNPs nanocatalyst was carried out by wet impregnation method. Furthermore, the characterization of the, TNTs, AgNPs and TNTs / AgNPs were done by using Field Emission Scanning Electron Microscopy (FESEM) and High-Resolution Transmission Electron Microscopy (HRTEM) and for lead and cobalt ion removal were analysing it by using Inductively Coupled Plasma – Optical Emission Spectrometry (ICP-OES). Catalytic analysis was performed by using the TiO_2/AgNPs nanocatalyst to extract lead and cobalt ions with different initial concentration which are 5, 10 and 15 ppm. The maximum removal for Pb is at concentration 10 ppm with time contact at 210 min. The maximum removal of Co is at concentration 10 ppm with time contact 210 mins.

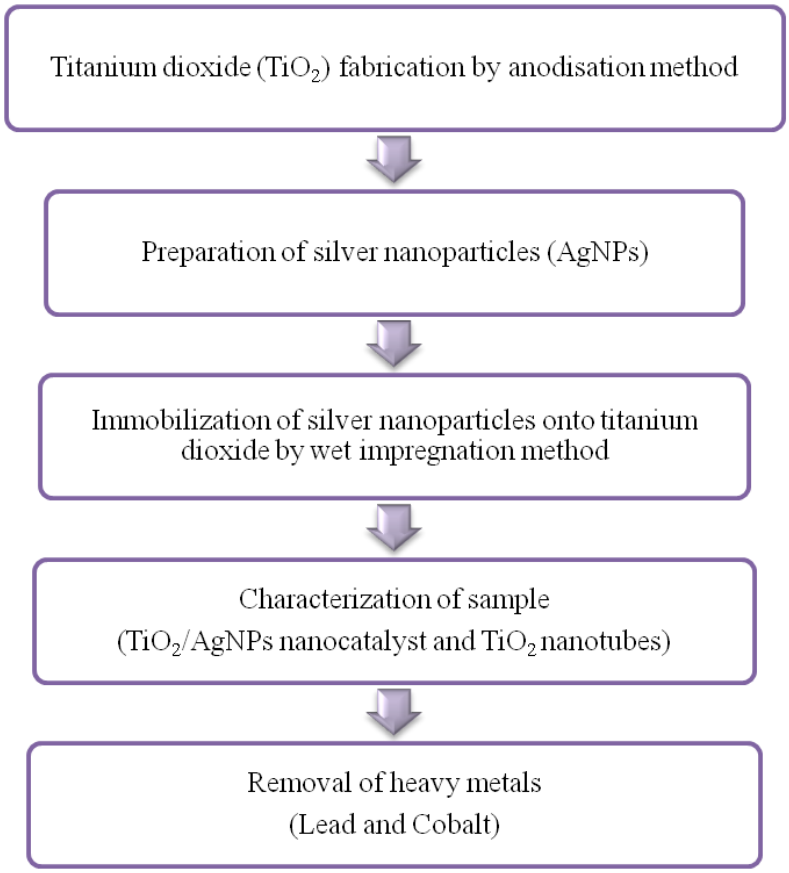
***Keywords*:**
Heavy metals, Lead, Cobalt, Titanium dioxide nanoparticles

Objectives:

- To synthesis the silver nanoparticle (AgNPs) and immobilization on titanium dioxide (TiO_2) nanotubes.
- To evaluate the catalytic activity of TiO2/AgNPs nanocatalyst for removal of Co and Pb.

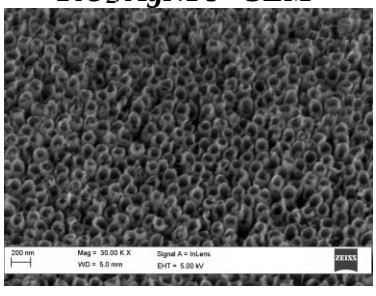
Methodology:

There are 5 main steps includes in this study which are titanium dioxide (TiO_2) nanotubes fabrication by anodisation method, preparation of silver nanoparticles, immobilization of silver nanoparticles onto titanium dioxide by wet impregnation method, characterization of the sample and removal of heavy metals accordingly.

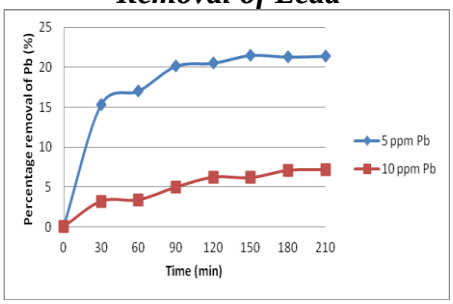


Results:

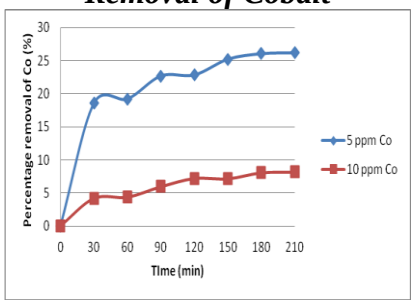
TiO_2/AgNPs - SEM



Removal of Lead



Removal of Cobalt



Conclusion:

In summary, TiO_2/AgNPs nanotubes were successfully prepared using electrochemical anodization and wet impregnation technique. AgNPs nanocatalysts from *K. brevifolia* extract were successfully synthesized. As a conclusion, TiO_2 were successfully synthesized using anodisation method in ethylene glycol, NH_4F and K_2CO_3 as anodising bath at 60 V and 20 min of anodising time were found having better TiO_2 with length, inner diameter and wall thickness were 7.30 μm, 74.59 nm and 33.51 nm respectively. Apart from that, the AgNPs were successfully synthesized via salt reduction method using *Kyllinga brevifolia* extract as reductant and silver nitrate as metal precursor with average particle size 17.64 nm and 22.3 nm. Next, the shape of the AgNPs was spherical shape. Futhermore, SEM images verified the formation of welldispersed and quasi-spherical shape of nanoparticles with size variation from 10 to 30 nm with an average size 22.3 nm. The AgNPs were highly crystalline. The AgNPs showed good catalytic performance for reductive-degradation of heavy metal and slower reaction was observed in solution of combination of KBE and AgNPs. Cobalt and lead removal were investigated using TiO_2/AgNPs. Percentage of Pb and Co removal on TiO_2/AgNPs increases with increasing in contact time. The maximum removal of 5 ppm Co is at time contact of 210 min which is 26%. The lower percentage removal of Pb is because small number of formations of silver nanoparticle nanotubes. When the least number of nanotubes attached at the TiO_2, the least number of active sites for absorption of heavy metals. Thus, it was affecting the percentage removal on the Pb ions. Furthermore, during the synthesis of TiO_2/AgNPs there was no toxic chemical used that can be harmful to the environment and this synthesis process was environmentally friendly and safe.