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SYNTHESIS ZIRCONIA (ZrO_2) AND IRON DOPED ZIRCONIA (Fe/ZrO_2) PHOTOCATALYST FOR HEAVY METAL REMOVAL

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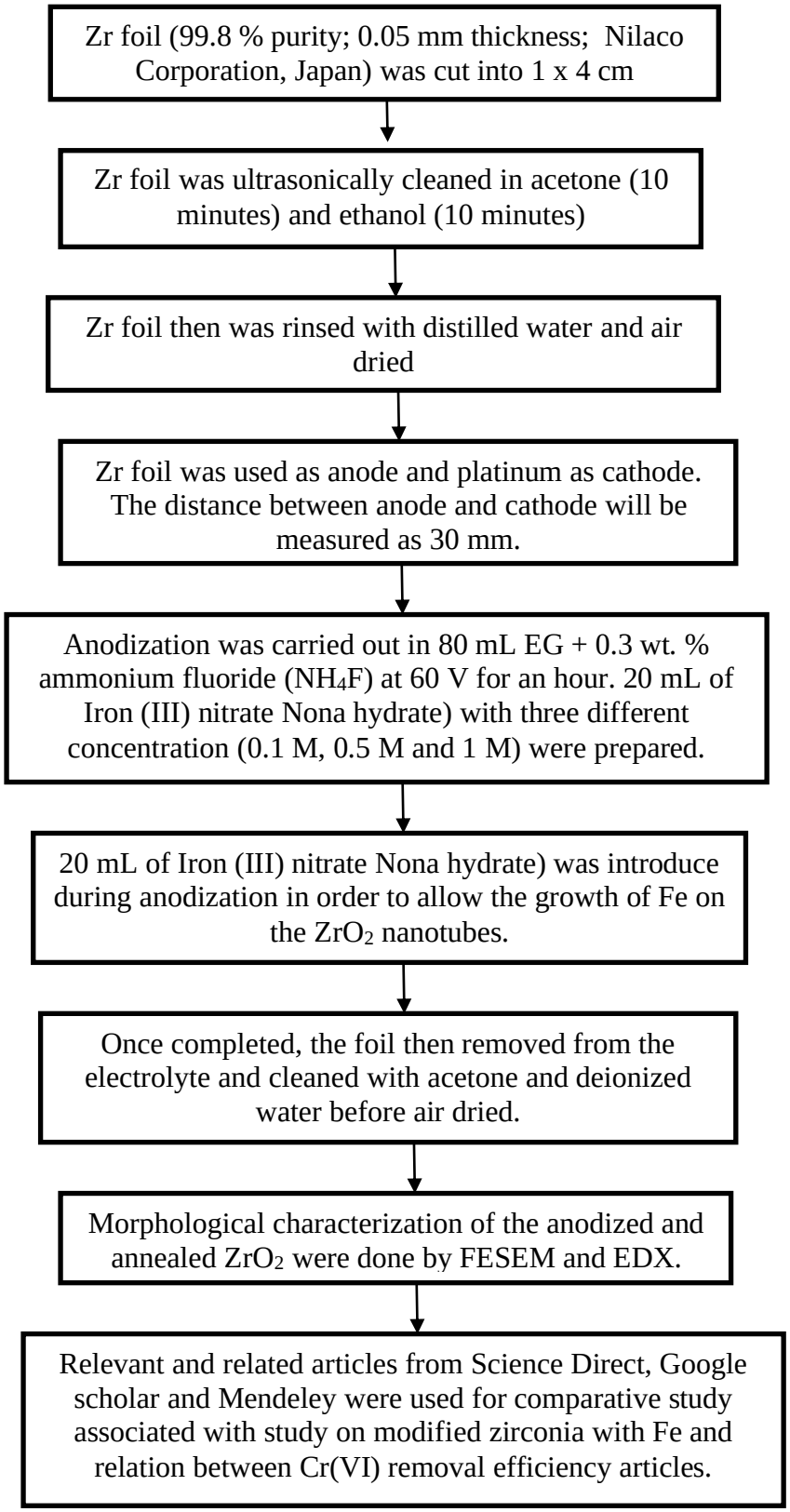
Abstract:
Zirconia modified with iron (III) nitrate nonahydrate were synthesized by using anodization method as photocatalyst. Irridation of UV light is needed to ZrO_2 photocatalyst for photo degradation of pollutant such as chromium (Cr(VI)). Removal of hexavalent chromium (Cr(VI)) is essential because this pollutant classified as carcinogen in group 1 by means it triggers cancer development. UV light is utilized in photocatalytic process because ZrO_2 has large band gap which is around 3.37 eV to 5.0 eV. Doping method has been used and considered for improving the photoactivity of ZrO_2 and reducing band gap. Doping process was done by using anodization method with different iron (III) nitrate nonahydrate concentration ($Fe(NO_3)_3.9H_2O$) (0.1 M, 0.5 M and 1 M). The results of morphologies and characterization that carried out by using EDX and FESEM shows that 0.5 M of Fe-doped ZrO_2 contain high Fe weight % compared to the other concentration used (0.1 M and 1 M). Comparative studies had been made on the morphologies and characterization between the doped photocatalyst and un-doped photocatalyst from literature survey. Also, comparative studies for this paper includes the application of the modified photocatalyst in the wastewater. From the comparative study, metal-doped photocatalyst nano-size particle such as Ag, Fe, Mo and Cu can enhance the photocatalytic activity. Also, by using Fe doping, band gap of the ZrO_2 nanoparticles were reduced from 4.97 eV to to 1.77 eV. Study shows that 95 % Cr(VI) removal was observed on ZrO_2 after 5 hours. Degradation performance of Cr(VI) might be increase by using Fe-doped ZrO_2 compare to pure ZrO_2 as the properties of the Fe-doped ZrO_2 can be enhanced in dopant ions.

***Keywords*:**
Fe-doped ZrO_2, anodization, photocatalyst, hexavalent chromium.

Objectives:

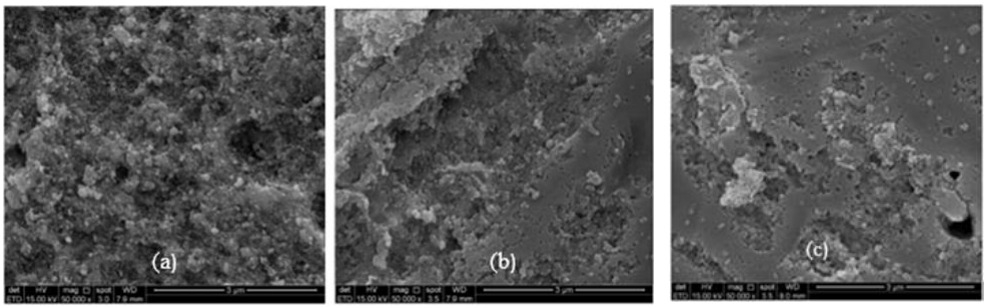
- To synthesis and characterize the zirconia (ZrO_2) and iron (Fe) doped zirconia dioxide (ZrO_2).
- To compare from the literature of the removal of heavy metal (Cr(VI)) efficiency by using zirconia (ZrO_2) and modified zirconia photocatalyst.

Methodology:

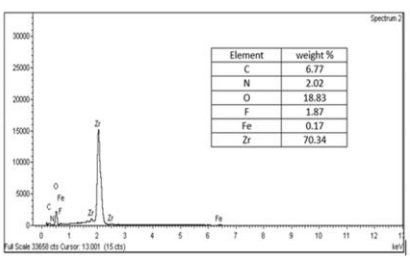


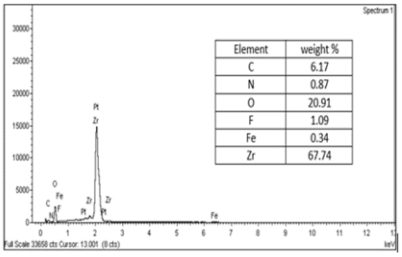
Results:

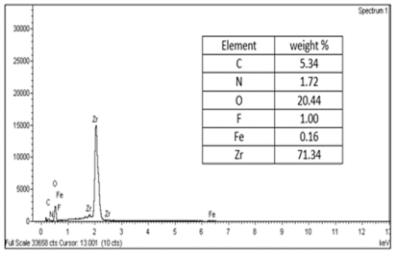
Fe-doped Zr nanoporous (a) 0.1 M, (b) 0.5 M and (c) 1 M Fe-doped ZrO_2 - FESEM



EDX Analysis of 0.1 M, 0.5 M and 1 M Fe-doped ZrO_2







Conclusion:

This paper report on the result of Fe-doped ZrO_2 by using different Fe (III) nitrate nonahydrate concentration (0.1 M, 0.5 M and 1 M). Doping process was done by using anodization method. The results of characterization that carried out by using EDX shows that 0.5 M of Fe-doped ZrO_2 contain high Fe weight % compared to the other concentration used (0.1 M and 1 M). Also, comparative studies for this paper includes the application of the modified photocatalyst in the wastewater. From the comparative study, metal-doped photocatalyst nano-size particle such as Ag, Fe, Mo and Cu can enhance the photocatalytic activity. Also, by using Fe doping, band gap of the ZrO_2 nanoparticles were reduced from 4.97 to to 1.77 eV. 95 % Cr(VI) removal was observed by using ZrO_2 photocatalyst after 5 hours by previous study. Degradation performance of Cr(VI) might be increase by using Fe-doped ZrO_2 compare to pure ZrO_2 as the properties of the Fe-doped ZrO_2 can be enhanced in dopant ions as stated from related studies. For the future, degradation of the Cr(VI) by using Fe-doped ZrO_2 should be fully study in order to proof the performance of Fe-doped ZrO_2.