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**Efficient Method for  $\alpha$ -TiP Synthesis using Alkaline Decomposition Pretreatment of Ilmenite Natural Beach Sand**

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**Abstract**

The layered, acidic compound;  $\alpha$ -TiP is widely popularized as a sorbent material for heavy metal removal from wastewater, as catalysts for biomass conversion and as an intermediate to produce high purity titanium dioxide particles. One of the conventional route for its synthesis is to react ilmenite with orthophosphoric acid under reflux conditions. However, the major drawback of this method is that the titanium recovery is only 35 wt. % and about 10 wt. % of the initial ilmenite remain unreacted as the residue. The conversion of ilmenite into an easily acid digestible compound could be attained via alkaline roasting. The objective of this research was to increase the yield of  $\alpha$ -TiP from ilmenite using an additional alkaline roasting pre-treatment step to the acid leaching. Potassium hydroxide was selected for the alkaline roasting step since it is regarded to be an environmentally benign chemical. The pre-treatment of ilmenite with a 1:4 molar ratio of KOH to ilmenite at 700° C generated potassium iron oxides and potassium titanium oxides as intermediate compounds which were then washed with distilled water, filtered and dried at 100° C for 24 hours. The solid compound was reacted with orthophosphoric acid with a solid to liquid ratio of 1/8 under reflux conditions for 4 hours. Then the remaining acid leachate was decanted and the white precipitate from the leach liquor was filtered, washed and dried at 100° C for 24 hours. The obtained powder was characterized using X-Ray Diffraction (XRD) analysis, X-Ray Fluorescence (XRF) spectroscopy, FTIR spectroscopy and Raman spectrophotometry and was confirmed to be  $\alpha$ -TiP. The parameters; the effect of KOH/ilmenite ore molar ratio, calcination temperature, solid to liquid ratio in the acid leaching step, acid leaching reflux time on the titanium recovery were fine tuned. This research concluded the possibility of increasing the titanium extraction. Therefore the research concludes the increment of  $\alpha$ -TiP yield after the pre-treatment step using KOH.

**Keywords:** Ilmenite, Titanium phosphate, Alkaline roasting, Alkaline pretreatment