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A study of the chlorination behaviour of various titania feedstocks

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Abstract

Due to the cost and availability of rutile (*i.e*. the preferred feedstock for the chloride process) a number of chloride producers are now forced to feed a blend of feedstock's to the chlorinator. Although the TiO_2 content of the feedstock's may be the same, the feedstock's (*i.e.* slag, rutile, synthetic rutile and ilmenite) vary in TiO_2 content, impurity content and physical properties (i.e. size distribution, density and shape factor). These factors can have a significant effect on chlorinator performance such as process stability, throughput, elutriation figures (*i.e.* blowover from the chlorinator), waste generation and thus influence the design of the chlorination circuit. In this research report, individual feedstock's (i.e. Slag A, Slag B and rutile) and a blend of Slag A and rutile were chlorinated. The study aims to highlight the difference in chlorination mechanism between rutile and slags, compare the chlorination of different TiO_2 containing slags and behaviour of a blend compared to the individual components.

The major findings of this investigation included the following:

- Due to its shape, density and particle size distribution rutile was found to be the ideal fluidising material in the hydrodynamic study. Addition of rutile to Slag A (i.e. 50 wt% Slag A and 50wt% Rutile) lowered the overall elutriation of slag.

- At 1000ºC, the blend (i.e. 50 wt% Slag A and 50wt% Rutile) had the highest chlorination conversion rate, followed by Slag B, Slag A and rutile. The blowover mass and degree of conversion of the blend of rutile and Slag A was better than the individual components. Blend samples (i.e. 50 wt% Rutile and 50wt% Slag A) of varying particle size was chlorinated and the mix with the widest particle size distribution exhibited the highest conversion rates.

- The mechanism for slag and rutile chlorination differs; slag becomes porous after the chlorination of FeO and MnO whilst rutile remains solid throughout the reaction. Porous material has a greater tendency to be elutriated from the bed

- The chlorination of Fe and Mn oxides is not significantly affected by the temperature whilst the chlorination of TiO_2 and Al_2O_3 is highly dependent on the temperature.

The most interesting findings of the experiments were that the blend of rutile and Slag A performed better than the individual components. This is most likely due to the particle size distribution of the mixture which yields better hydrodynamic characteristics. The performance of blends is of significant industrial importance, it is therefore recommended that the effect of particle size distribution is further investigated and that 3 or more component blends are also studied.