BENEFICIATION AND ENVIRONMENTAL STUDIES

ON

TITANIFERROUS SANDS

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BY

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ABSTRACT

Much interest has been shown in the recent past to beneficiate ilmenite to produce 'synthetic rutile' or 'upgraded ilmenite', as substitute for rutile in the 'pigment' industry. Many reported processes have been developed. But most of them are not economical for developing countries as Sri Lanka.

Part 1 of this study reports an investigation for an economical process for beneficiating ilmenite using the Western Titanium Ltd. technique with sea water as rusting agent in place of the reported use of 2% NH_4Cl to remove iron from ilmenite.

Ilmenite is reported to be trirhombic with 'perovskite' structure, with chemical composition, $FeO.TiO_2$, and part of the iron being found in the oxidized form as Fe(III) in nature. This study shows the chemical composition of ilmenite as $3(FeO.TiO_2).2(Fe_2O_3.3TiO_2)$, with both Fe(II) and Fe(III) being highly magnetic. Studies have been carried out to break up the ilmenite lattice by oxidation of Fe(II) to Fe(III), followed by reduction to metallic iron.

Ferromagnetic character of reduced ilmenite enabled separation as magnetics from 'gangue' minerals as garnet. Incorporation of the magnetic separation stage, which is not included in most of the reported processes, except for the process by 'Western Titanium Ltd.' is shown to be advantageous.

The accelerated rusting technique, using acidified sea water instead of 2% NH_4Cl, enabled removal of 85% of the iron as a suspension of oxides. The accelerated rusting was compared to an electrochemical cell with Fe^{2+}/Fe and O_2/H_2O_2 electrodes. The results of these studies showed that the metallic iron within the ilmenite grains behaved as a metal electrode immersed in a well stirred electrolyte. Mechanism for the precipitation of suspended oxides is proposed.

'The aerated ilmenite' with a titania content of 80%, is leached with mineral acid. Studies on acid leaching by counter current washing using hydrochloric acid yielded a product with an analysis of 91.1% titania & 0.71% iron.

Studies were also carried out on plant - soil correlations for titanium and iron, with a view of determining any possible 'biogeochemical' prospecting for titaniferrous sands.

Part 2 of this study thus reports environmental studies on titaniferrous sands.

Studies on plant - soil correlations for titanium and iron showed very high correlations for these two metals, with correlation coefficient, $r=0.990$ ($p < 0.001$) & $r=0.955$ ($p < 0.001$) for titanium and iron respectively. The effect of pH on the absorption of these metals was also studied.

Distribution of iron in leaf extracts showed that the biological role of iron in this plant is the same as in other plants. The distribution of titanium also suggested a possible biological role for titanium. The results also suggested that both titanium and iron could promote growth.