

**PURIFICATION OF RUTILE IN SRI LANKAN BEACH
SAND FOR THE EXTRACTION OF TiO_2 BY
REDUCING IRON CONTENT**

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Degree of Master of Science

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University of Moratuwa

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Thesis submitted in partial fulfillment of the requirements for the degree Master of
Science in Materials Science and Engineering

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DECLARATION

“I declare that this is my own work and this dissertation does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief, it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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Signature of the supervisor:

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ABSTRACT

The Pulmuddai region in Sri Lanka is characterized by key constituents: 55-60% ilmenite, 6-8% rutile, and 5-6% iron. Iron's presence emerges as a critical impurity necessitating pre-extraction removal for titanium dioxide extraction from rutile. Attaining a TiO₂ purity exceeding 99% within rutile is attainable through targeted iron elimination and meticulous optimization of the purification process. The methodological approach commences with the initial screening and separation of beach sand, utilizing the Humphrey spiral technique to selectively isolate high-density minerals enriched with rutile and ilmenite. Subsequent separation of rutile from ilmenite employs a magnetic separator. The conclusive step involves the strategic removal of iron from rutile via leaching with hydrochloric acid (HCl). Optimization of leaching parameters, including the solid-to-liquid ratio (S/L ratio), HCl concentration, and reaction time, maximizes iron removal from rutile. A comprehensive analysis of samples before and after leaching employs a UV-visible spectrophotometer and scanning electron microscopy utilizing Energy Dispersive X-Ray Spectroscopy on the samples. Results indicate 83.3% reduction in iron content within rutile from the initial raw mineral, achieved under optimized conditions of 1:3 S/L ratio, 80°C, 4-hour reaction time, and 4M HCl concentration.

Keywords: *Titanium dioxide, Pulmuddai, Rutile, Purification.*

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LIST OF ABBREVIATIONS

Abbreviation	Description
TiO ₂	Titanium Dioxide
TEFS	Titanium-Bearing Electric Furnace Slag
HCl	Hydrochloric acid
EDX	Energy-dispersive X-ray spectroscopy
S/L	Solid to Liquid
w/w	Weight in Weight
UV	Ultraviolet
LMS	Low-intensity Magnetic Separation