**I am Ratheeskaran Lingaraj (UWU/MRT/20/002) I would like to extend a warm welcome to our esteemed professor and fellow students to today’s proposal presentation. It’s a great opportunity for us to share insights and findings on an important research project focused on extracting high-purity titanium dioxide from ilmenite-rich red earth.**

Today, I’d like to introduce our study on a fascinating and economically important resource found in the northwest coastal belt of Sri Lanka—Red Earth (RE). This deposit, excavated alongside limestone by Siam City Cement Lanka Limited, owes its characteristic reddish color to iron and aluminum oxides.

RE is rich in diverse minerals, including heavy minerals like ilmenite, magnetite, and rutile, as well as light rare earth elements and clay minerals. Among these, ilmenite, which makes up about 8-10% of RE, is particularly valuable. Ilmenite is an iron-black mineral consisting of iron and titanium oxide, and it's a key source for extracting titanium dioxide (TiO₂).

TiO₂ has remarkable properties like a high refractive index, UV-blocking capability, and photocatalytic activity, making it an essential component in industries ranging from paints and paper to sunscreens, toothpaste, and even food coloring. This study explores efficient methods to extract this valuable mineral, enhancing its potential benefits for various applications. Thank you.

**Next, Research Problem**

As many of you may know, titanium dioxide has a high global demand due to its widespread use in industries such as paint, plastics, and cosmetics. The red earth in the northwest coastal belt of Sri Lanka contains a significant percentage—about 8-10%—of economically viable ilmenite.

When separating ilmenite from red earth, we typically rely on gravity and magnetic separation techniques. Gravity separation works because ilmenite is denser than other minerals, allowing it to be isolated by its weight.

However, we encounter a challenge: the Fe-Al coating on the ilmenite particles negatively affects the magnetic separation process. This coating reduces the magnetic response of the ilmenite, making it harder to isolate efficiently.

Extracting TiO₂ from ilmenite in red earth presents significant challenges due to the complex mineral structure of ilmenite itself and the presence of various impurities. Ilmenite’s unique composition makes it difficult to break down effectively, and the impurities, including iron and aluminum coatings, further complicate the extraction process.

**objective of this study is,**

The main goal is to extract titanium dioxide (TiO₂) from ilmenite found in the red earth deposits of the Aruwakkalu region in Sri Lanka.

**Specific** Objectives of this research are,

1. To use and refine physical separation techniques to isolate ilmenite, reducing the presence of other contaminants.

2. To develop and optimize a chemical extraction method for producing titanium dioxide, focusing on minimizing impurities such as iron and aluminum.

**Research Methodolgy**

To begin with first, Red earth samples will be collected from the limestone quarry site belongs to INCEE cement lanka ltd near Aruwakkaru in Puttalam, Sri Lanka [3], where naturally occurring ilmenite-rich red earth are abundant.

First of all the sample goes under Physical Separation such as ,

In beginning our extraction process, the first essential step involves thoroughly washing the sample. This initial wash is critical because it removes surface impurities that could interfere with subsequent separation and extraction steps.

As the second step the sample goes under Physical Separation such as ,

This starts with the Humphrey spiral separation

The Humphrey spiral separation is a gravity-based technique used to separate heavier minerals from lighter ones by their specific gravity. In this method, a slurry is prepared by adding water to fine red earth particles, which is then processed through the spiral separator to collect concentrate and middling fractions. This process is repeated for better results.

Following this, the sample is processed using shaking table separation to effectively concentrate and isolate the target material.

Shaking table separation is a gravity-based technique that further concentrates heavier minerals based on density differences. After spiral separation, the concentrated heavy fraction undergoes shaking table processing to enhance the purity of ilmenite and other valuable minerals.

Then, we apply electromagnetic separation

Electromagnetic separation leverages the magnetic properties of minerals to distinguish them from non-magnetic ones. By passing the ore mixture through a magnetic field, magnetic or weakly magnetic minerals, like ilmenite, are selectively attracted and separated.

Finally before extraction methods begins, ilmenite goes under ball miling for grinding materials into fine powders,

**After the physical sepration the purified sample undergoes extraction to get TiO2 from ilmenite**

No.1 Alkaline leaching

The alkaline leaching method will be used to remove aluminum contamination from ilmenite. This involves treating >53 μm powdered ilmenite samples with varying concentrations of NaOH (30%, 40%, and 50%) at 200°C for 1 hour.

No.2 EDTA (Ethylene diamine tetraacetic acid) Selective Iron Removal

A >53 μm powdered sample of ilmenite will be treated with an EDTA solution at a pH of 1.68 for 150 minutes, achieving 94.8% titanium dioxide (TiO₂) purity. Increasing the EDTA/Fe³⁺ molar ratio to 3 boosts TiO₂ purity to 99.9%. EDTA also reduces TiO₂ hydrolysis and the need for deionized washing water by producing larger, easily filtrable meta-titanic acid grains.

After removing the impurities, sulfate process is used to extract TiO₂ from ilmenite. As a first step, here ilmenite is treated with concentrated sulfuric acid, which dissolves the iron and titanium components. The mixture is then heated, allowing iron to be separated as ferrous sulfate while the titanium is converted into a soluble sulfate compound. After further processing, the titanium sulfate solution is hydrolyzed, forming a titanium hydroxide precipitate, which is then filtered, washed, and calcined to produce high-purity TiO₂.

**Finally the Expected Outcome is**

To conclude, our research aims to establish an efficient method for extracting titanium dioxide from ilmenite-rich red earth. By leveraging both gravity and magnetic separation techniques.

A critical challenge we face is the Fe-Al oxide surface coating that naturally occurs on ilmenite. This coating interferes with the purity of extracted titanium dioxide, so overcoming it is essential. Through careful magnetic and acid leaching processes, we target the removal of these Fe and Al oxides. By doing so, we can improve the quality and concentration of TiO₂ extracted.

After extraction, we’ll evaluate the quality of the TiO₂ with specific attention to residual Fe and Al contamination. Our goal is to ensure that the TiO₂ meets high standards of purity and can compete in markets requiring pure titanium dioxide.

Thank you for your attention, and I look forward to any questions you may have about this process and its potential applications.

All the samples before and after the electromagnetic separation will be analyzed by Optical Microscope. XRF and XRD analysis will be conducted before and after the electromagnetic separation, after the Al2O3 removal treatment and after TiO2 extraction will be analyzed with the XRF analysis.