**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**

Ilmenite in the red earth deposits of Aruwakkalu offers economic potential, but there are currently no efficient technologies for its extraction and purification. Developing a practical, cost-effective method is essential, addressing challenges like the complex mineral structure of ilmenite and the removal of surface impurities such as iron and aluminum.

**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**

First 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.

Next, the sample undergoes shaking table separation,

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.

The next major extraction is , Leaching by Hydrochloric Acid (HCl) in the Presence of Reductant (Metallic Fe) and Additive (MgSO4).

Adding metallic Fe powder at low solid-acid ratios improved iron leachability, with MgSO₄ proving more effective than Na₃PO₄ and NaF. Under Fe-MgSO₄-HCl conditions, 98.63% iron extraction was achieved after 120 minutes, with 97.3% titanium recovery from the leached residue. XRF analysis confirmed that titanium remained undissolved, showing about 91.4% TiO₂ in the solid residue.

**Finally the Expected Outcome is**

To develop an efficient method for extracting TiO₂ from ilmenite-rich materials, addressing the challenge of iron and aluminum oxide surface coatings that interfere with the process. The focus is on minimizing both operational costs and environmental impact. To achieve this, NaOH alkaline leaching is employed to remove aluminum impurities, while EDTA is used to selectively target and eliminate iron, ensuring a more refined extraction of TiO₂.