



**FACULTY OF ENGINEERING AND
TECHNOLOGY**

**DEPARTMENT OF MINING ENGINEERING
FINAL YEAR PROJECT REPORT**

**INVESTIGATING THE EFFECTIVENESS OF
ACIDITHIOBACILLUS FERROOXIDANS IN GOLD RECOVERY**

CASE STUDY: GREENSTONE RESOURCES LTD, TIRA.

By:

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ABSTRACT.

This study investigates the effectiveness of *Acidithiobacillus ferrooxidans* in enhancing gold recovery from refractory ores at the Tira Gold Mine in Busia, Uganda. Conventional extraction methods, such as cyanidation and mercury amalgamation, rely on hazardous chemicals, posing environmental risks and yielding low recovery rates for sulfide-bound gold. As a sustainable alternative, bioleaching with *A. ferrooxidans* was explored to dissolve sulfides and liberate encapsulated gold without toxic reagents.

Laboratory experiments on bioleaching at conditions (pH 2.0–3.0, 25–30°C, 5% pulp density) using ore samples characterized by XRF (42.5% SiO₂, 28.8% Fe₂O₃) and AAS (45.83 g/t Au). *A. ferrooxidans* was successfully isolated from local tailings, with growth confirmed via Gram staining and OD600 monitoring. Over 12 days, bioleaching achieved **54.64% gold recovery**, significantly outperforming the control (0.31% recovery). Validation of the microbial role in gold dissolution is supported by pH decline (2.45 → 2.31) and the relatively stable mesophilic temperatures.

The results demonstrate *A. ferrooxidans* as a viable, eco-friendly alternative for refractory ore processing, aligning with Sustainable Development Goals (SDGs) by reducing chemical reliance. Future work should scale trials to heap leaching and assess trace element impacts. This study contributes to advancing green mining technologies in artisanal and small-scale gold mining (ASGM) sectors.

Keywords: *Acidithiobacillus ferrooxidans*, bioleaching, refractory gold ore, sustainable mining, Uganda.

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DEDICATION.

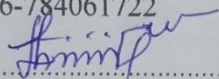
This research is dedicated to my family and friends whose constant support has been a lasting source of strength and inspiration throughout my academic journey.

DECLARATION

I, **ETYEKU JOHN FRANCIS**, hereby declare that this research report titled "**Investigating the Effectiveness of Acidithiobacillus ferrooxidans in gold Recovery.**" is my original work and has not been submitted to any other University or institution for academic Award of a degree. All outside sources used have been correctly cited and credited.

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APPROVAL.

I hereby confirm that this project report was written and compiled by **ETYEKU JOHN FRANCIS** and has been approved for submission to the Department of Mining Engineering, Faculty of Engineering and Technology of Busitema University.

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List of Acronyms

AAS	Atomic Absorption Spectroscopy
AMD	Acid Mine Drainage
ANOVA	Analysis of Variance
ASGM	Artisanal and Small-Scale Gold Mining
ICP-MS	Inductively Coupled Plasma Mass Spectrometry
NEMA	National Environment Management Authority
ORP	Oxidation-Reduction Potential
pH	Potential of Hydrogen
QEMSCAN	Quantitative Evaluation of Minerals by Scanning Electron Microscopy
SDGs	Sustainable Development Goals
SEM	Scanning Electron Microscopy
SEM-EDX	Scanning Electron Microscopy with Energy-Dispersive X-Ray
A. ferrooxidans	Acidithiobacillus ferrooxidans
XRD	X-Ray Diffraction

Conclusions

A. ferrooxidans achieved 54.64% gold recovery from refractory ore, demonstrating its potential as a sustainable alternative to cyanidation. The ore's iron-rich composition and fine particle size were advantageous. The process aligns with Uganda's efforts to reduce mercury use in ASGM.

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