

An Indian-Australian research partnership

Project Title: Building Artificial Soils from Industrial Waste Products for Mine Rehabilitation: A Case Study of Iron & Steel Industry

Project Number IMURA0350

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Research Academy Themes:

Highlight which of the Academy's Theme(s) this project will address?

(Feel free to nominate more than one. For more information, see www.iitbmonash.org)

1. Advanced computational engineering, simulation and manufacture
2. Infrastructure Engineering
3. Clean Energy
4. Water
5. Nanotechnology
6. Biotechnology and Stem Cell Research

The research problem

Steel industry is characterised by the generation of wastes in large quantities and wide ranging characteristics. The sustainable steel production calls for their efficient management and eco-friendly disposal. While most of these wastes traditionally end up as landfill, the need of the hour is to find a viable solution for the same, i.e. to create 'wealth from these potentially useful waste streams' for productive purposes.

This project will investigate the potential and will develop technologies for converting these wastes into artificial soil capable of replacing topsoil for mine rehabilitation purposes.

Project aims

The steel plant at Vijayanagar generates wastes such as Blast Furnace Slags, Steelmaking Slags and Tailing wastes from the beneficiation plant. These wastes are usually high in Lime, Silica and Alumina content with minor amounts of Iron oxide in them. The project would look to convert these slags and tailing wastes into a viable medium for replenishment of topsoil at various locations.

Expected outcomes

- This project will demonstrate how to transform open-cut mine and steel plant wastes into soils that can satisfy the demand for soils and simultaneously reduce waste volumes, both of which are environmentally desirable and practically essential.
- The innovation lies in the reuse of mine waste products to assist the sustained mine development and reduce future environmental risks from eventual closure of the mines. It will provide a strategy to mitigate existing environmental hazards arising from the disposal of the mine
- Wastes and the reduced requirement for remedial measures to deal with these hazards.
- Its products will assist the reduction of mining whole-of-life costs.

How will the project address the Goals of the above Themes?

The project goal is to develop a soil that meets all stability and ecological requirements for the different stages of mine rehabilitation. The objectives stated above will be met by a tightly-integrated program of field investigations coupled with modelling using a experimental plots (lab and field-scale) specifically established for the study.

Capabilities and Degrees Required

A post-graduate engineer (M.E./M.Tech. in any branch of engineering) or a science postgraduate with an interest and background in soil science, geochemistry and geotechnical areas; a sound understanding of statistical methods; excellent computer programming skills.

For Industry Partners: Potential Collaborators

JSW

Major Milestones:

Please add major intended milestones for the project

#	Milestone	Deliverable	Timeline	Responsible
A	• Student recruitment		1 month	The Academy
B	• Experimental plot design, Site preparation & Field Investigations	Detailed designs for the experiments to be carried out during the project will be undertaken	4 months	CESE, IITB & Monash Uni
C	• Physical sampling and analyses	classification of soils, particle size distribution and hydrometer analyses, bulk density, permeability, moisture content, maximum dry density and optimum moisture content and specific gravity.	6 months	PhD student both at Monash Uni
D	• Chemical sampling and analyses	pH and EC, sodicity, heavy metals, as well as standard cation/anions, TOC and NPK. Vertically integrated point soil sampling will also be undertaken for soil chemistry determination. Synthetic Precipitate Leachate analyses SPLP and TCLP.	12 months	PhD student both at CESE, IITB & Monash Uni
E	• Analysis and interpretation	Finding the right mix which meets regulatory requirement and at the same time will achieve the objectives in mine rehabilitation	8 months	PhD student both at CESE, IITB & Monash Uni
F	• Thesis writing		6 months	PhD student