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Development of eco-friendly and sustainable biostabiliser products for road construction

Veshara Malapermal[1, 2], R Lalloo[2], P Naicker[2], S Mukaratirwa[1], M Mgangira[2] and **S Ramchuran[1, 2]**
[1]University of KwaZulu Natal, South Africa
[2]CSIR, South Africa

The construction industry is rapidly exploring new and exciting opportunities involving the use of biological processes and products to modify the structural properties of the road subsurface, (e.g. strength, volume stability, durability, and permeability) through innovative engineering techniques. Enabled by interdisciplinary research at the confluence of microbiology, civil engineering, and geochemistry, this integrative approach has the potential to meet society's ever-expanding needs for innovative treatment processes that improve soil, supporting new and existing infrastructure. Several microorganisms and other existing bio-enzymatic products such as secondary metabolites, enzymes, endospores, and extracellular polymeric substances have been considered as potential alternatives to conventional chemical soil stabilisers for the development of sustainable road infrastructure. However, the primary challenge with this bio-based approach is the selection of the correct microorganisms which requires medium to high throughput strength testing methodology. This study focused on the testing of fermentation derived fractions of biological materials using *in vitro* miniaturised tests on selected soil types and waste (i.e. weathered granite, dolerite and fly ash) to validate screening and selection methodology, using an existing *Bacillus* strain hypothesised to have strength enhancing properties. Unique miniaturised test equipment was successfully developed using 3D CAD and 3D printing technologies, enabling the successful evaluation of biological components. This work forms the basis for in-vitro selection methodology to enable the development of improved biological stabiliser products for the construction industry.

VMalapermal@csir.co.za