Bioaugmentation involving a bacterial consortium isolated from a foaming agent conditioned soil from tunnelling

Ludovica Rolando1,2, Paola Grenni1, Tanita Pescatore2,3, Jasmin Rauseo1, Andrea Visca1, Gian Luigi Garbini1, Luisa Patrolecco3 and Anna Barra Caracciolo1

1 Water Research Institute, National Research Council (IRSA-CNR), Rome, ITALY; 2 Dipartimento di Scienze Ecologiche e Biologiche (DEB), Università della Tuscia, Viterbo, ITALY; 3 Institute of Polar Sciences (ISP-CNR), Rome, ITALY - Corresponding Author: barracaracciolo@irsa.cnr.it

- The anionic surfactant sodium lauryl ether sulphate (SLES) is the principal component of several commercial foaming agents (FA) used for soil conditioning in the tunnelling industry. Huge amounts of soil debris are produced during the excavation process and the presence of SLES can affect the re-use of this spoil material as a by-product in green areas and close to water bodies. Reducing waste production and re-using by-products are primary objectives of the “circular economy” and in this context the biodegradation of SLES becomes a key point1,2,3.

- Bioaugmentation is a nature-based solution for removing contaminants from soil and water.

- Bioaugmentation with a bacterial consortium able to promote a quick degradation of SLES can be a green solution for preventing an useless waste production as spoil material and consume of soil for its transferring to landfills4.

A bacterial consortium (BC) capable to degrade completely SLES by 24 hours was isolated in enrichment cultures, using a real excavated soil conditioned with a foaming agent containing this anionic surfactant. The bacterial consortium was identified and characterized by NGS and FISH analysis.

The capacity of the bacterial consortium to degrade a foaming agent in a bioaugmentation experiment was explored. For this purpose, microcosms containing uncontaminated soil and soil treated with various foaming agents containing SLES, both derived from a tunnelling construction site, were set-up. Half of the soils were inoculated with the SLES degrading bacterial consortium.

Analysis are still in progress, but preliminary results showed that the bacterial consortium can be effective for enhancing SLES biodegradation in real tunnelling construction sites. Bioaugmentation with this natural bacterial pool can be a low-cost and green solution for a prompt and safe re-use of the soil debris from tunnelling excavation for both industrial and green areas.

References

Safe spoil material re-use for different purposes

Most bacteria identified belonged to Gamma-Proteobacteria (99%) and the Pseudomonas genus (ca 90%) was the predominant one