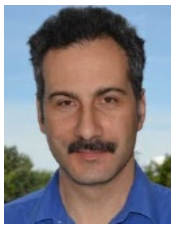

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EBNet Environmental Biotechnology

Biotechnology and Biological Sciences Research Council

Engineering and Physical Sciences Research Council

Bio-engineering of biochar for enhanced remediation of contaminated land

"Through the synergy of biochar and microorganisms, we can implement a sustainable alchemy, transforming oil-spill impacted soils into fertile grounds, where nature's resilience meets low-carbon solutions for a thriving Earth. It's not just a remedy: it's a testament to our dedication to coexist harmoniously with the planet, nurturing a greener, healthier future for generations to come." **Professor Fred Coulon, Cranfield University**

Aim

Based on a 2016 House of Commons report, there are ~300,000 contaminated sites in the UK with an economic value >£1 billion. Meanwhile, progress on remediation technologies has lacked momentum. This project proposes an innovative systematic approach that will marry specific physicochemical properties of biochar with selected bacterial species for enhancing the bioremediation of soils contaminated with persistent priority pollutants.

Our focus will be on polycyclic aromatic hydrocarbons (PAHs) and toxic heavy metals (i.e. Ni, Cr, Cd), including the metalloid arsenic (As). These are recognised as some of the most common and important contaminants in UK and European soils. Our approach will lead to producing new microbe-biochar composite materials that are tailor-made for the targeted and enhanced bioremediation of polluted soils.

Specifically, the project represents the first synthesis approach taken to evaluate a range of waste feedstock source materials to matchmake biochar with microbes for soil pollution remediation, with state-of-the-art techniques used to characterise the biochar materials to identify which are best suited for the colonisation of specific bioremediation microbes.

Results

Several methods were tested using different biochars amended with/without specific microbial species, and it was found that wheat straw biochar combined with two hydrocarbon-degrading bacterial species showed promise in terms of achieving substantial total petroleum hydrocarbon (TPH) reduction. Overall, the study demonstrated how specific combinations of biochar and bacterial strains influenced soil remediation efficiency, particularly in scenarios of recurrent oil spills.

By examining the microbial response and the dynamics between environmental variables, the study provided valuable insights into tailoring effective strategies for managing and remediating oil-contaminated soil in areas prone to repeated spills. Additional experiments are ongoing with a view to produce a generic, bespoke microbe-biochar composite material for the targeted and enhanced bioremediation of polluted soils.

This work endeavours to take a scientific leap in demonstrating biochar as a cheap and effective, carbon negative matrix to marry with microbes for tailored and enhanced bioremediation of contaminated land, and which may form the basis of sustainable business opportunities in the UK, Europe and elsewhere on land reclamation.

"There is growing interest in the use of biochars for soil applications including, but not limited to, remediation of contaminated soils. Involvement in this research project is of value to ERS to evaluate the potential technical benefits of biochar-based bioremediation over established bioremediation approaches."

Dr Tom Aspray, ERS Ltd