Individual Introduction

Bastian Saputra/ESR 9

(Work Package 3)

I am a PhD student at the University of Sheffield, United Kingdom. My research is focused on the development of bacteria based biosensors as monitoring tools to assess the performance of contaminated soil remediation. This research is part of work package 3 project focusing on restoring marginal land for agriculture using low cost amendments and bioremediation.

I graduated from Institute Technology of Bandung (Indonesia, 2011) with BSc in Microbiology with specialization in the coal bio-solubilization by white-rot fungus, *Phanerochaete chrysosporium*. I have several years of working experience as Bioremediation Engineer and Waste Water Treatment Engineer in Indonesia. I continued my study in the MSc program Environmental and Energy Engineering at the University of Sheffield in 2016 focusing on the application of Microbubble Technology to enhance the production of Acetaldehyde and Ethanol from *Zymomonas mobilis* fermentation.

The objective of my research is to to develop and apply the biosensors to monitor the bioavailability of heavy metals (HMs) in response to remediation method (in this case biochar amendment) applied to contaminated soil. Biochar amendment in contaminated soil can reduce the bioavailability of heavy metals to microorganisms and plants through adsorption processes. This mechanism can decrease the toxicity of HMs to soil microorganisms thus increasing soil function and productivity. Sequential extraction and chemical analysis of soil samples only measure the concentration of HMs in different soil phases without considering the impact of HMs at the cellular level. Therefore, bacterial-based biosensors is an attractive approach to measure the HMs toxicity on cell physiology.

This research is focusing on the development of FRET (Förster Resonance Energy Transfer) biosensors that directly report the concentration of intracellular HMs. The FRET biosensors exploit the capability of metallothionein (MT) as intracellular binding proteins for Cd, Zn and Pb. The construction of this biosensor involved the insertion of a MT protein between cyan (eCFP) and Venus fluorescent proteins. Changes in emission of the fluorescent proteins due to MT metal binding will allow the quantification of HMs inside the host cells. Developing FRET biosensors inside the soil bacteria is expected as a robust host cell for biosensor application in contaminated soil.

Following the biosensors development and testing, they will be used as tools to measure the change of bioavailable HMs due to biochar amendments at contaminated soil remediation experiments (in collaboration with ESR 8, Rosa Soria). The biosensor measurements will be integrated with an analysis of soil microbial activity and plant-bioavailable contaminant concentrations to assess the remediation performance of biochar more precisely.