Nutrient Recovery Via Anaerobic Digestion Of Supermarket Food Waste And Re-Use As Fertiliser In Potting Media For The Urban Retail Market; A Proof Of Concept Using Digestate And Biochar.

BEDE S. MICKAN[1,2,3], SOMAYEH ZAREZADEH[4], SASHA JENKINS[1,2], AITIAN REN[1], ZAKARIA SOLAIMON[1,2], MEGAN H RYAN[1,2]

[1] UWA School of Agriculture and Environment (M079), The University of Western Australia, Perth WA 6009, Australia
[2] The UWA Institute of Agriculture (M082), The University of Western Australia, Perth WA 6009, Australia
[3] Richgro Garden Products, 203 Acourt Rd, Jandakot Western Australia 6164, Australia
[4] Faculty of Life Sciences and Biotechnology, Shahid Beheshti University, Tehran, Iran

Food waste can be diverted from landfill and utilised via anaerobic digestion (AD) to produce biogas. The liquid by-product of AD is commonly referred to as digestate, and this can be an organic certifiable biofertilizer. Digestate in Europe is frequently used in agriculture, though is not commonly used in the urban retail market. Biochar is another organic matter which can adsorb and retain the nutrients, and also could decrease the adverse effects of high nitrogen content of soil. It was hypothesized that high ammonium content of digestate will stimulate the plant growth and increase the abundance of nitrogen and carbon cycling genes in the rhizosphere with biochar inhibiting some N cycling capacity. A glasshouse experiment was designed to investigate the effect of direct addition of digestate and biochar into the potting media and its effect on plant growth. Food waste digestate from an operational commercial AD facility was added at 6 rates (0%, 2%, 4%, 6%, 8% and 10% v/v), with and without biochar (0% and 10% v/v) growing *Solanum lycopersicum*. After 45 days plant growth parameters were measured, and rhizosphere soil bacteria characterised using 16S rRNA gene with 27F and 519R bacterial primers on the Mi-seq DNA sequencing platform and combined with putative N cycling genes using PICRUSt. Results revealed the significant enhancement in root and shoot mass and root diameter and volume in all levels of digestate and digestate + biochar addition, with the exception for 2% digestate + biochar treatments. Addition of biochar and enhancement of digestate levels decreased the rhizosphere soil alpha diversity calculators, and biochar also inhibited nitrification genes. Relative abundances of Proteobacteria and Actinobacteria in digestate fertilized potting media were higher than digestate + biochar treatments while in rhizosphere soil of digestate + biochar, Bacteroidetes and Chloroflexi were abundant. This research demonstrates the potential sustainability of using food-waste derived digestate as a nutrient source for potting media for the urban retail market, which reduces the costs of transporting to other agricultural production systems.