## ESAI Best Organic Waste Recycling Presentation at Environ 2024

Shon Shiju, University College Cork

# Biorefining Digestate into Biostimulants and Soil Conditioners in the Context of the Circular Bioeconomy

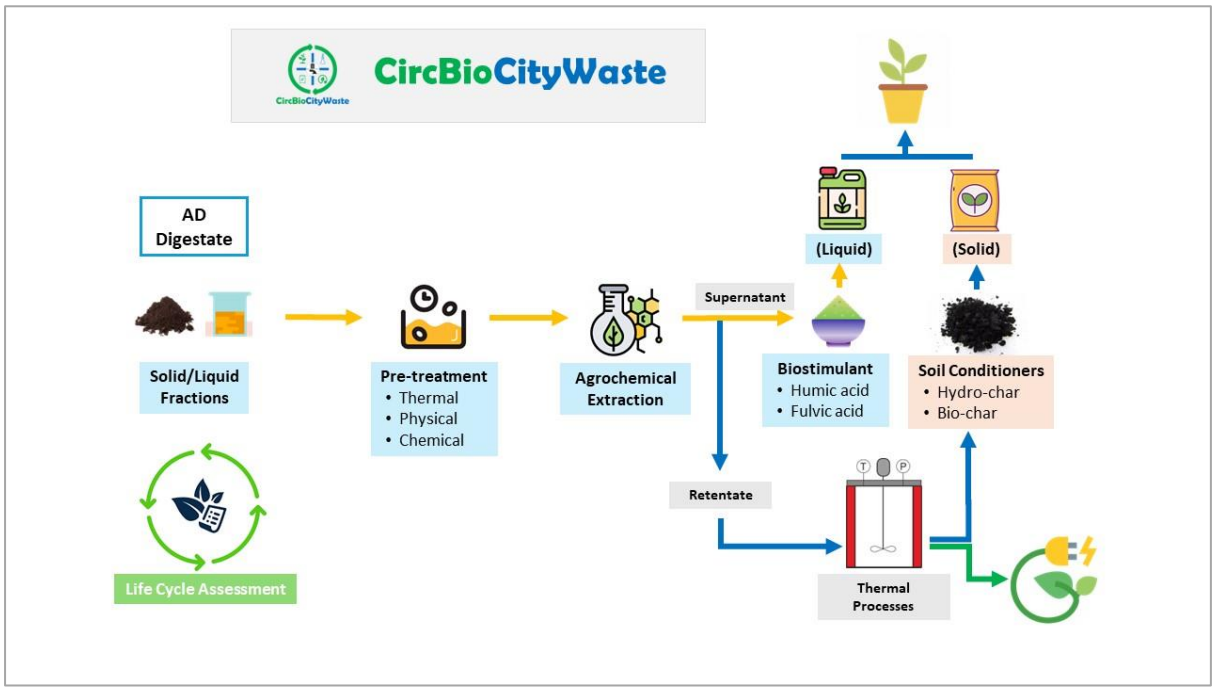
Biowaste generation in the EU and globally has exhibited a consistent upward trend annually. The adoption of anaerobic digestion (AD) process for conversion of biowaste into biogas has been highly successful in energy recovery. However, concomitant with AD's efficacy, it generates huge amount of residual by-products known as digestate. Within the anaerobic digester, accelerated microbial humification processes result in digestates with substantial quantities of humic substances (HS). HS represents the organic matter that have shown positive impact on soil structure, soil fertility, and nutrient uptake, thus improve plant physiology.

Presently, the predominant mode of digestate disposal involves land spreading (due to its nutrients content), however, it causes a myriad of environmental concerns. These include residual fermentation within the soil matrix, greenhouse gas emissions, and the potential for contamination of arable land and water with heavy metals or pathogens, among others. To achieve a domestic biomethane production target, the government has a plan to build more AD plants by 2030. This surge in AD plants will lead to a corresponding rise in digestate production. However, without proper management, the increased digestate output poses risks to soil health and water and food chain contamination. Notably, existing disposal methods fail to capitalize on opportunities for value creation through the recovery and production of value-added products from digestate. Furthermore, logistical challenges such as storage and transport, compounded by regulatory constraints, further complicate the management of this bioresource.

Shon, PhD student on the CircBioCityWaste project at University College Cork, has developed an advanced biorefining process utilising ultrasound and microwave technologies (at Teagasc) for recovering biostimulant from digestates. The resulting process is fast, efficient, cleaner and environmentally friendly. To close the loop for a zero waste biorefinery process, thermal technologies such as pyrolysis and hydrothermal carbonisation are being tested on the residual waste generated from the developed process, for recovering soil conditioners (biochar and hydrochar), through project partner at University of Limerick. The recovered agrochemicals are being tested by Shon for their effectiveness in pot trials and compared to existing

commercial products at Shannon ABC, Munster Technological University. The developed biorefinery process will be tested for its environmental and economic sustainability by project partner at Maynooth University, and resulted bio-based agrochemicals will be formulated in accordance with the new EU-Fertilizer Product Regulation (EU 2019/1009), under various Product Function Categories (PFCs). Overall, the research outcome aims to benefit stakeholders from end-users, waste management organizations, policymakers, and the environment.

The CircBioCityWaste project, led by Dr Gaurav Rajauria at UCC, holistically approaches this challenge by utilizing digestate as a feedstock in a cascading biorefinery to sequentially recover humic-based biostimulant, green energy, and soil conditioners (biochar, hydrochar), with a zero-waste approach. The multi-partners project is funded by the Environmental Protection Agency (EPA), Ireland and Department of Agriculture, Food and the Marine (DAFM) under the 2021 EPA Research Call - Facilitating a Green and Circular Economy.




**More information:**

grajauria@ucc.ie

@CirBioCityWaste

https://www.linkedin.com/company/circbiocitywaste