Biomass Composting with Gaseous CO_2 Capture

Ethan Woods [a] (Postdoctoral Research Scholar), Jesse Daystar[b], William Joe Sagues[a]*

[a] Department of Biological & Agricultural Engineering, North Carolina State University, 3110 Faucette Dr., Raleigh, NC 27695-7625, USA
[b] Cotton Incorporated, 6399 Weston Pkwy, Cary, NC 27513, USA

Corresponding author: wjsagues@ncsu.edu (William Joe Sagues)

Abstract:

The techno-economic feasibility of removing atmospheric CO_2 via industrial composting of high-moisture, heterogeneous biomass waste with CO_2 capture is assessed. The novel composting process generates a relatively high concentration of biogenic CO_2 for capture, while avoiding the emission of methane and generating a nutrient-rich soil amendment. Empirical data generated from compost bioreactors at 0.5 L and 25 L scales inform the techno-economic assessment. The levelized cost of CO_2 capture is estimated to be USD 85 per tonne of$CO2$ (tCO_2), while the levelized cost of CO_2 removal is estimated to be USD 102/ tCO_2 under base case assumptions. Sensitivity analysis indicates that a biomass feed rate and tipping fee are the most sensitive parameters. A compost facility with a biomass feed rate of 45,990 dry t-biomass/year has the potential to remove over 26,500 tCO_2/year from the atmosphere with gaseous CO_2 capture. Industrial composting of biomass waste with CO_2 capture has the potential to be a viable biomass carbon removal and storage (BiCRS) technology and warrants further investigation.