



April 15, 2021

*Advancing Synergistic Waste Utilization as  
Biofuels Feedstocks: Preprocessing, Co-  
products, and Sustainability Workshop*  
DOE-BETO

# Utilization of waste PLA

and assessment of its environmental  
sustainability

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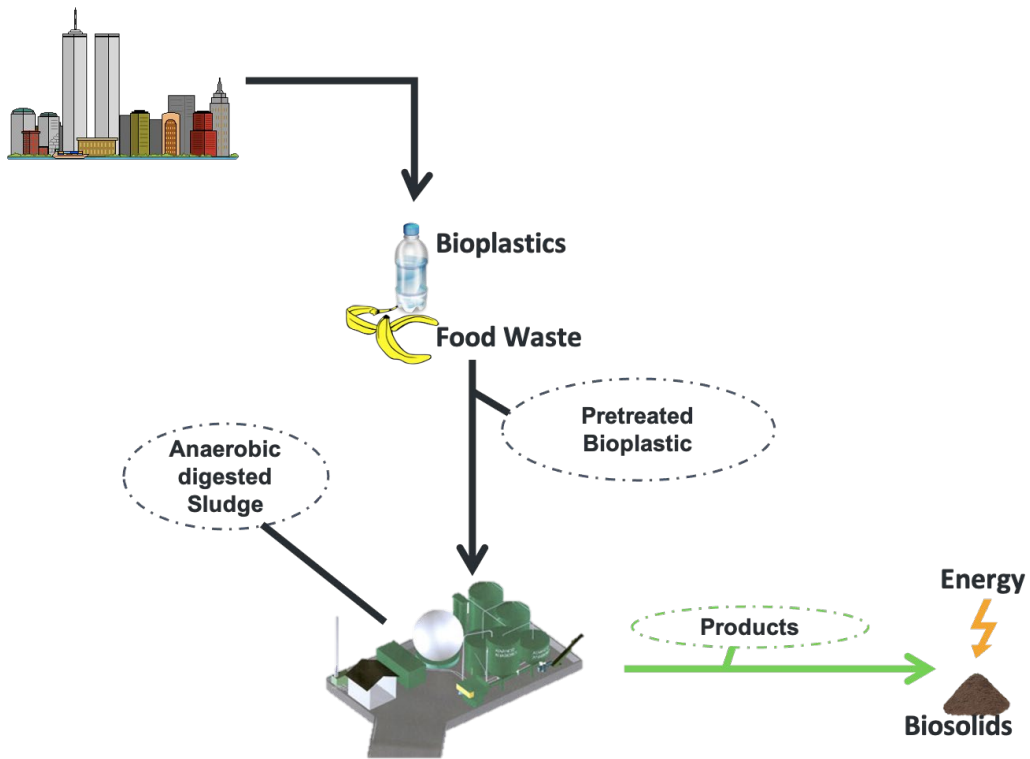
Civil Engineering



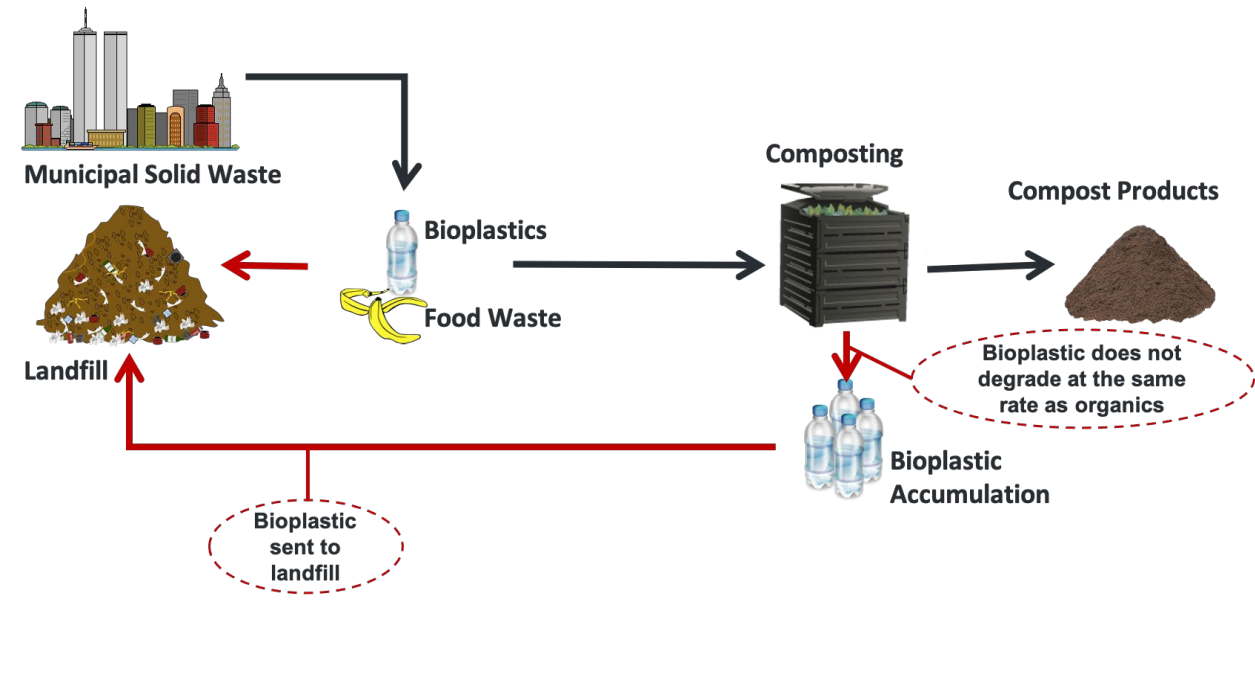
College of  
Engineering

# PLA does not degrade well and assist with zero waste goals

Conventional methods do not meet zero waste goals



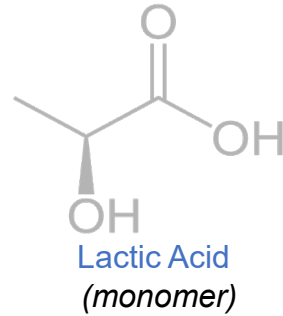
Anaerobic digestion solves food waste and bioplastic challenges



# alkaline pretreatment of bioplastic accelerates the hydrolysis process



Hydrolysis  
(depolymerase)



Anaerobic Degradation

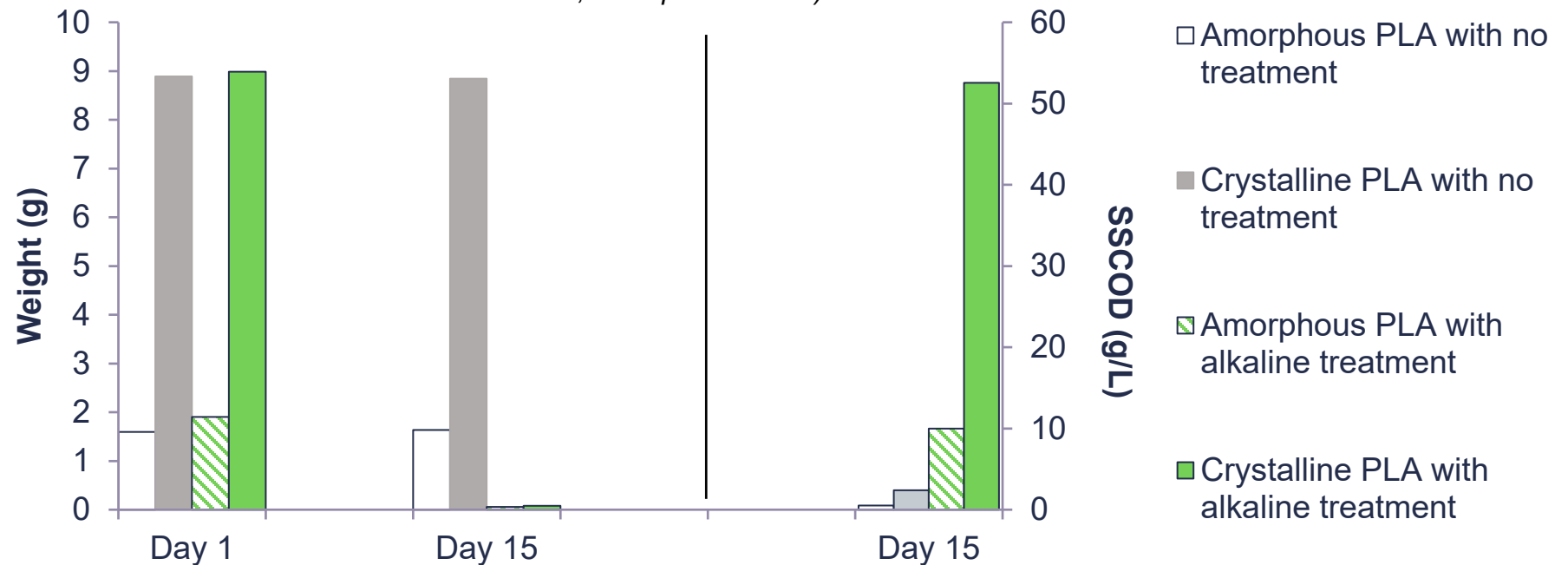
Microorganisms (*Penicillium roquefort*,  
*Amycolatopsis* sp., *Bacillus brevis*, *Rhizopus delemar*)

Microbial Biomass & Bioenergy  
(mineralization)

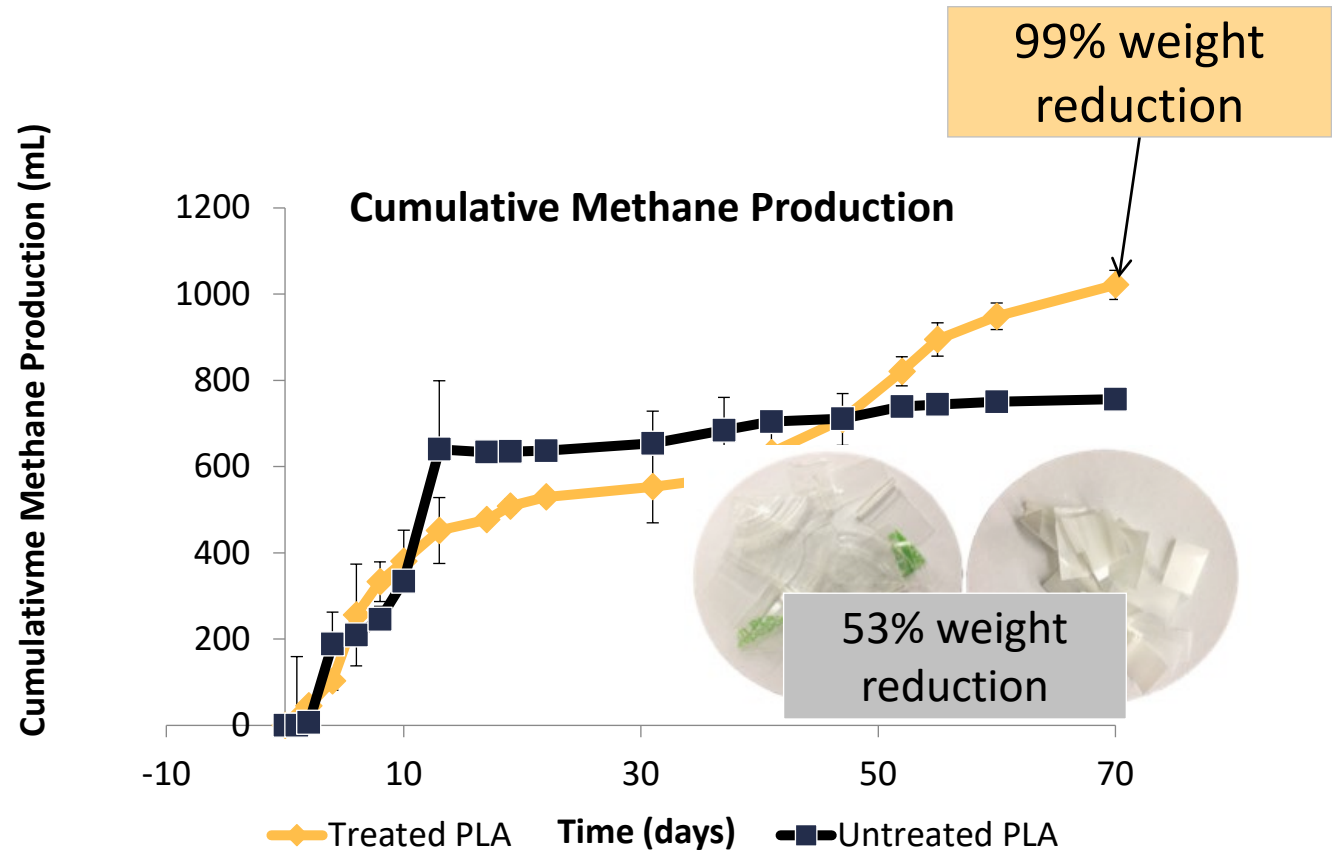
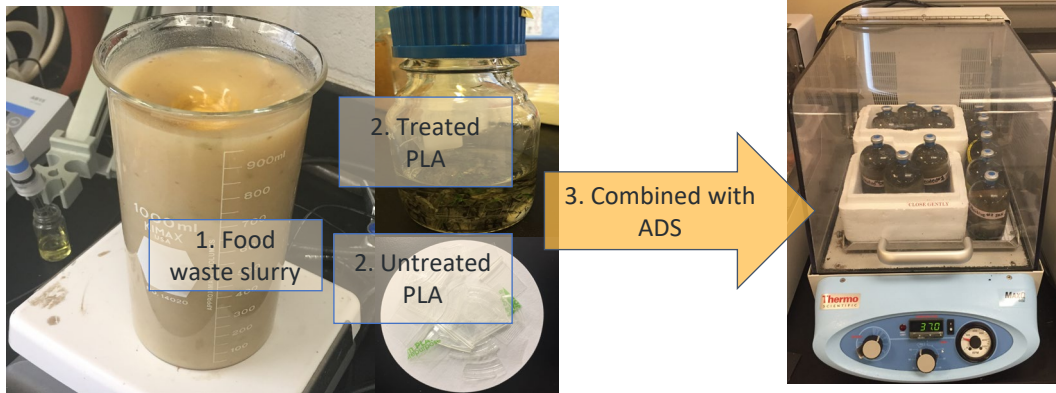
CO<sub>2</sub> CH<sub>4</sub> H<sub>2</sub>O

Polylactic Acid  
(single-use water bottle)

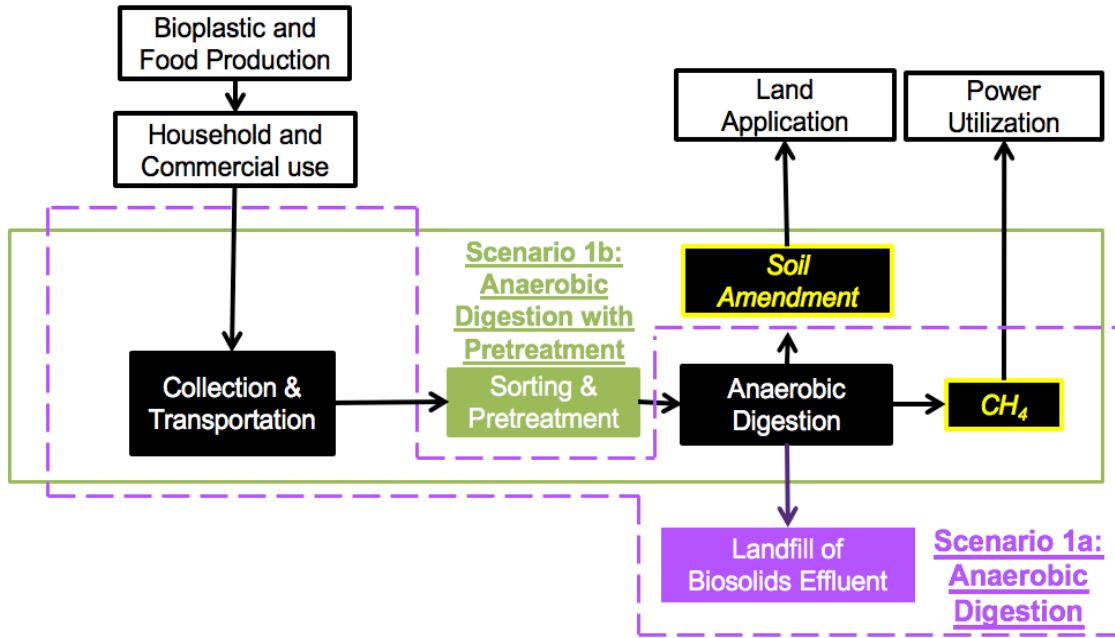
**pretreatment  
method of PLA is  
highly effective**



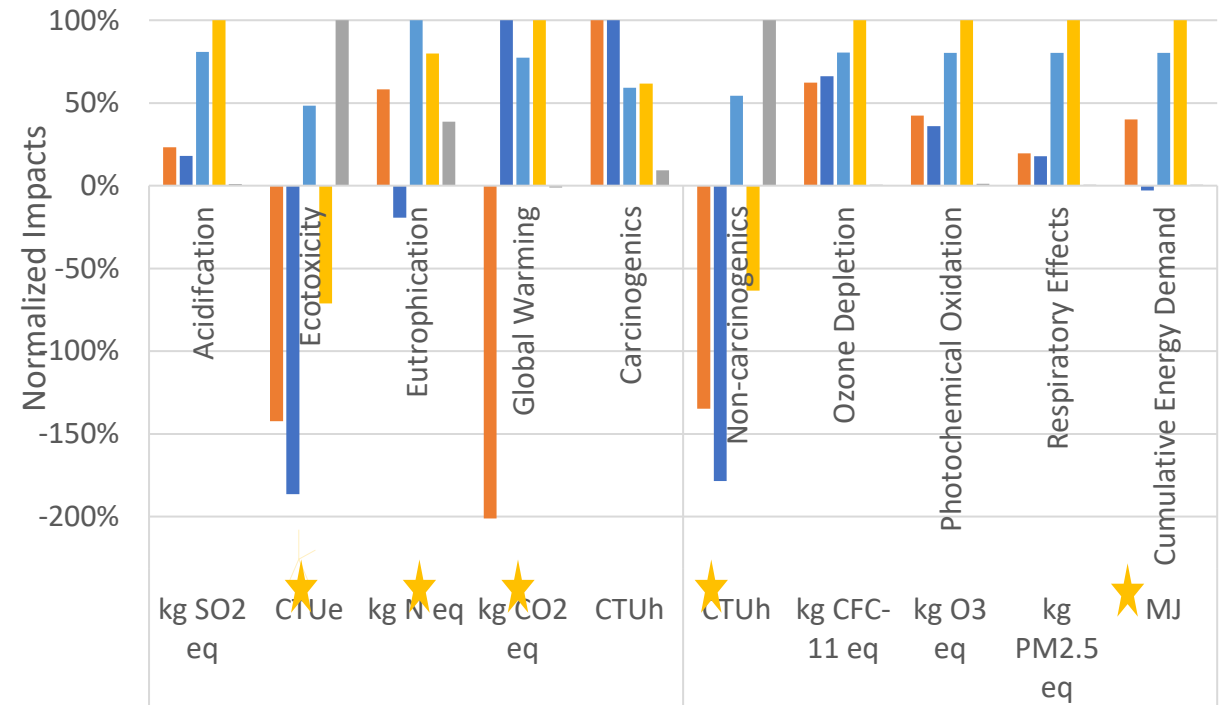
# treated PLA produced the most CH<sub>4</sub> & achieved solubilization



# life cycle assessment assist in quantifying environmental impacts



- Scenario 1a: Anaerobic Digestion of food waste and bioplastics
- Scenario 1b: Anaerobic Digestion of food waste and pretreated bioplastics
- Outside system boundary
- Anaerobic Digestion processes
- Anaerobic Digestion with pretreatment processes
- Shared processes
- Credits / Offsets



- Scenario 1a (AD)
- Scenario 1b (AD with pretreatment)
- Scenario 2a (Compost)
- Scenario 2b (Compost with pretreatment)
- Scenario 3 (Landfill)

N=Nitrogen eq., SO<sub>2</sub>= Sulfur Dioxide eq., CTUe= Comparative Toxic Unit for Aquatic Ecotoxicity , CO<sub>2</sub>= Carbon Dioxide eq., CFC-11= Trichlorofluoromethane eq., O<sub>3</sub> =Ozone eq., CTUh =Comparative Toxic Unit health eq., CTUh =Comparative Toxic Unit Health eq., PM<sub>2.5</sub> Particulate Matter 2.5 eq., MJ=Mega Joules).