Rewired Anaerobic Digestion: Developing more sustainable chemical factories

Jorge L. Rico, Kenneth Reardon, and Susan De Long
Colorado State University

Abstract. The growing demand for food, energy, and water seems unstoppable on a crowded planet. Each year, considerable amounts of waste are added to landfills and open dumps globally. Most of the waste generated is “organic”; in other words, it is biodegradable and comes from either plants or animals primarily associated with our food systems. Despite efforts to valorize this waste through composting or anaerobic digestion; municipalities, farmers, and food industries, currently, landfill their waste due to a lack of techno-economic incentives. One opportunity to address this challenge relies on rewiring anaerobic digestion for transforming organic waste into more profitable products like fatty acids. These molecules are petrochemicals widely used in several industries, including pharmaceuticals, food preservatives, fuels, and polymers. Using organic residues to produce these chemicals is an opportunity to transition from petrochemical systems and reduce currently landfilled waste. This presentation provides insights into the ability of microbes to convert organic waste into short and medium-chain fatty acids. We have found that we can get more or less of the fatty acids we want to produce depending on what set of microbes we use. However, rewired anaerobic digestion is still a complex and not-fully understood system. Our ongoing work uses advanced molecular biology tools to characterize genomes and fatty acid production pathways. This knowledge will be crucial in discovering and developing more sustainable chemical factories to integrate into current waste management systems.