

## **Symposium Proposal for the 23<sup>rd</sup> Green Chemistry & Engineering / 9<sup>th</sup> International Green & Sustainable Chemistry Conference**

**Title:** The Future is Garbage: Waste Biomass as a Renewable Feedstock

**Format:** Invited Talks, Submitted Talks, Interactive Discussion & Workshop

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### **Description/Rationale:**

Over the 20 years since *Green Chemistry: Theory and Practice* was published, we have seen a boost in the number of research publications focused on chemicals derived from purpose-grown renewable feedstocks. New chemistries to extract molecules from genetically optimized switchgrass, lab-grown algae, and even food crops like soy and corn have, by all standard measures, been incredibly successful and will no doubt continue to develop and see industrial adoption. These advances, however, highlight a common crutch for chemists: the desire to have a “clean” feedstock stream for new chemistries. While other areas of green chemistry focus on reduction of waste and energy usage, renewable feedstocks continue to be resource-intensive to grow, harvest, and process. As we continue to advance the field of green chemistry, it is important that we consider the existence of an abundant, energy-advantaged alternative. The planet's largest non-petroleum, non-food, renewable feedstock: **organic waste**.

This symposium will bring together experts in the areas of:

- organic waste collection, separation, and processing;
- the conversion of industrial biomass waste streams to mixed and single stream feedstocks;
- the commercialization of emerging waste-to-chemical and waste-to-material technologies in next-generation integrated biorefineries; and
- the development of educational curriculum in the chemistry and engineering fields around organic waste valorization and integrated biorefinery design.

The presentations and discussions will highlight current and emerging trends in organic waste valorization and the aforementioned topics from a range of scientists, engineers, and educators, from academia, industry, and government. It is our intent to demonstrate that a future where waste is a valuable resource is already emerging, and provide an environment to share knowledge and actionable pathways for the next generation of scientists and engineers interested in interdisciplinary solutions for our future closed-loop bioeconomy.

This symposium will be an excellent fit with the 2019 GC&E and IG&SC conferences. Our goal is to compliment the 2019 theme of “Closing the Loop”. The concept of chemical recycling has been demonstrated in many areas by the ability to capture high-value molecules and repurpose or reprocess them, but there is an additional need to highlight the capture of the valuable carbon that is trapped in our industrial and municipal organic waste streams. This symposium will provide a platform for discussion of these emerging topics, and serve to elevate the viability of waste as a valuable resource for the next generation of chemicals and

materials. As organic waste streams are internationally distributed, the sharing of knowledge and ideas during this session will provide value for scientists, engineers, educators, and policymakers worldwide that are interested in sustainable development.

### **Practice gaps to be highlighted and addressed in this symposium:**

- **Waste as a Resource** - The World Bank projects post-consumer urban organic waste production of 2.4 million tons per day by 2025. This number easily doubles with the inclusion of pre-consumer organic waste. Using pre- and post-consumer waste as a feedstock reduces energy usage, land usage, and landfill load. From agricultural byproducts to restaurant waste, this session will highlight researchers making trash into treasure.
- **Industrial Relevance** - Effective chemical technologies for the valorization of organic waste must be able to exist outside of the laboratory. However, many chemists are not involved in seeing their technologies beyond the laboratory scale. This symposium will offer insights for the effective demonstration of commercial viability for waste-to-value chemistries through the use of case studies from successful startups and partnerships between academia and industry.
- **Education** - Green chemistry education is critical to helping the next generation of chemists develop the right mindset. This session will include at least one presentation or discussion around incorporating waste valorization into chemistry education.

### **Proposed Speakers:**

This session will invite a mix of speakers from around the world, focusing on a diverse group of academic, industrial, and non-profit experts. While some presenters will share an in-depth view of their current research or products, others will focus on the big picture and potential for future innovation. Potential speakers could include:

Alice Fan (University of York)

*Microwave technology for efficient conversion of waste biomass to high-value chemicals*

Andrea Munoz Garcia/Lucie Pfaltzgraff (National Non-Food Crop Centre)

*Trends in adoption of non-food bio-feedstocks by SMEs in the UK*

Janet Scott (University of Bath)

*Biodegradable polymers from waste feedstocks*

Molly Morse/Anne Schauer-Gimenez (Mango Materials)

*Pilot-scale conversion of waste methane to valuable polyhydroxyalkanoates*

Felipe Fernandes (University of Warwick)

*Transformation of waste vegetable oils to epoxy resins*

Glenn Hurst (University of York)

*Incorporating use of waste feedstocks into chemical education*

This is not intended to be an exhaustive list, and as organizers we will continue to seek out others inside and outside of our network while actively promoting the session across the international green chemistry community.

### **Plans for an interactive environment:**

This session could include two interactive sessions to engage the audience and break up the presentations:

1. Interactive discussion about waste feedstocks in chemical education  
A 15-20 minute discussion led by a chemical educator, capturing ideas for the incorporation of waste valorization into green chemistry education. This will follow a presentation on green chemistry education, ensuring participants awareness of issues in curriculum development. This segment will engage diverse stakeholders, providing a valuable opportunity to generate curriculum ideas based on current topics in waste feedstocks.
2. Workshop on identifying valorization opportunities in waste feedstocks  
In this workshop, we will present a fictitious case study of a single-stream agricultural byproduct, and the decision making steps to identify available valorization chemistries, scale-up opportunities, market sizing, and a high-level financial projection to gauge the potential interest to industry. We will organize groups of 3-5 participants, and provide each with a different scenario and a prompt of possible technologies. Each group will draw on the provided information and their own knowledge to suggest a plan for valorization, and present their findings at each stage of the workshop.

A full-day session would allow for a diverse mixture of invited and contributed talks, plus these afternoon interactive activities.