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Editorial

ACS Sustainable Chemistry & Engineering Welcomes Manuscripts on Alternative Feedstocks

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This editorial highlights key research challenges associated with the use of feedstocks for sustainable transformations, with a particular focus on food and forest materials, areas in which *ACS Sustainable Chemistry & Engineering* welcomes manuscripts. This editorial complements previous editorials on circular processing of plastics[1] and e-wastes.[2]

Energy, chemicals, and polymers are still mostly produced from building blocks derived from petroleum, coal, and natural gas. As the demand for these commodities continues to increase, there is a need to develop sustainable production routes from renewable biobased resources. In the United States Department of Energy 2016 Billion-Ton Report, feedstock availability in the United States is projected to include up to one billion tons per year of crop residues, herbaceous energy crops, woody crops, algae, and urban construction residues. In addition to residues considered in the Billion-Ton Report, energy and commodity feedstocks could include carbon-rich materials such as marine and freshwater feedstocks, as well as food, textile, plastic, and water treatment wastes, as outlined below.

Typical marine feedstocks could consist of macroalgae and halobacteria, as well as residues from fishery and seafood industries.[3] Freshwater biomass could include cyanobacteria, fish residues, and predominantly water-cultured crops, such as water hyacinth.[4] These feedstocks and residues are sources of bioactive compounds, such as lipids, proteins, polysaccharides, and pigments, that find use in commercial sectors with high volume−low value (human food and animal feed) to low volume−high value (cosmetic, nutraceutical, pharmaceutical, and biomedicine) products.

Landfilled textiles and food wastes are significant and could be diverted if these carbon streams were refashioned into feedstocks instead of refuse. In the United States, textile waste in municipal solid waste (MSW) has increased by ∼40% over the past two decades, with approximately 11 million tons landfilled annually.[5] Textile wastes may include cotton and synthetic blends and ornamentation within garments.[6] Pretreatment methods can regenerate cellulose within the fabrics for use in conventional upgrading schemes for cellulose (i.e., biorefinery applications), but insights into unconventional uses with garment-based carbon are needed. Food waste is another significant feedstock alternative as it is produced globally at large rates with approximately 95% of food waste sent to the landfill.[5] Plastic wastes, which have been addressed in a separate editorial,[1] are often mixed with food wastes and other landfilled wastes. Synergistic methods for recycling the polymers, polymer−inorganic composites, and inorganic materials co-mingled with food wastes should be explored, since the recycling or upcycling of textile and plastics wastes is often limited due to the mixed nature of these materials. Residues from wastewater treatment plants are other sources of carbon feedstock. However, their use is challenging. Regional and large-scale studies on water−energy nexus in urban water systems and research on practical experiences are still missing.[7]

Carbon-rich wastes have potential for conversion to liquid fuels, to commodity and specialty chemicals, and also to methane. Often, an important hurdle to their use is point-source collection and consumer acceptance. However, it is critical that all feedstocks—whether stemming from renewable or nonrenewable sources—should be examined in the context of a circular economy. Their use should not be assessed simply on the fact that they are possibly derived from renewable resources but also on their potential for integration within downstream or upstream operations or processes that are respectful of economic constraints and environmental ramifications. To date, many research efforts have focused on developing feedstock conversion processes which are not integrated within the circularity of the operations and which have neglected the complexity of the mixtures in which these materials are embedded.

Broadly, the topical area of integration of novel or traditional feedstocks into upstream/downstream biorefinery or transformation operations respecting circularity will be welcomed. Specific cases addressing acute feedstock processing challenges that are current barriers to circularity will also be of interest. Manuscripts that address wholistically the integration of feedstocks in the circular economy will be welcomed. We look forward to your feedback and your manuscript submissions in these areas.

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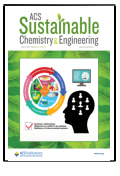

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Notes

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