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Laboratory Scale Production of Bio-Based Chemicals from Industrial Waste Feedstock in South Africa

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Abstract : South Africa is identified as one of the five emerging waste management markets, globally. The waste sector in South Africa influences the areas of energy, water and food at an economic and social level. Recently, South African industries have focused on waste valorization and diversification of the current product offerings in an attempt to reduce industrial waste, target a zero waste-to-landfill initiative and recover energy. South Africa has a number of waste streams including industrial and agricultural biomass, municipal waste and marine waste. Large volumes of agricultural and forestry residues, in particular, are generated which provides significant opportunity for production of bio-based fuels and chemicals. This could directly impact development of a rural economy. One of the largest agricultural industries is the sugar industry, which contributes significantly to the country's economy and job creation. However, the sugar industry is facing challenges due to fluctuations in sugar prices, increasing competition with low-cost global sugar producers, increasing energy and agricultural input costs, lower consumption and aging facilities. This study is aimed at technology development for the production of various bio-based chemicals using feedstock from the sugar refining process. Various indigenous bacteria and yeast species were assessed for the potential to produce platform chemicals in flask studies and at 30 L fermentation scale. Quantitative analysis of targeted bio-based chemicals was performed using either gas chromatography or high pressure liquid chromatography to assess production yields and techno-economics in order to compare performance to current commercial benchmark processes. The study also creates a decision platform for the research direction that is required for strain development using Industrial Synthetic Biology.

Keywords : bio-based chemicals, biorefinery, industrial synthetic biology, waste valorization
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