575d Thermodynamic Analysis of Alternative Metabolically Derived Chemical Feedstocks

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Many biochemical engineers envision a future where microbial organisms serve as “biorefineries” capable of producing feedstocks for the chemical process industry. This work presents a thermodynamic analysis of the likely candidate molecules. In particular, efficiency of energy capture, the loss of mass as carbon dioxide, and the challenges of product recovery are considered. The analysis is carried out for two classes of organisms: photosynthetic organisms using carbon dioxide as the sole carbon source and bacteria using five and six carbon sugars as their carbon source. Challenges in product recovery are analyzed from the standpoint of current yields, methods of separation, and the energy involved in those separations. Finally, the value of the final product is analyzed from the standpoint of its raw energy content. By balancing these competing objectives, conclusions are drawn as to which molecules appear to offer the best potential for future feedstocks.