The Plastics Problem: A Qualitative Life Cycle Analysis Case Study for Green and Sustainable Chemistry Education

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General Data Analysis

Student data was collected from all five (Monday – Friday) recitation sections in the spring semester of 2024. All student data was collected and anonymized using beSocratic in accordance with the IRB XXX from Michigan State University. All students submitted the weekly activities from beSocratic, but only one completed activity was required per group. Incomplete activities were discarded. Student responses were exported to Excel for analysis.

Effect of Monomer Sourcing on United Nation's Sustainable Development Goals (UNSDGs)

Students were asked about the effect a general change in monomer sourcing would have on UNSDGs. Students discussed changing from plant-based to oil-based monomers and vice versa. For analysis, all responses were normalized to represent a change from oil-based monomers to plant-based monomers. For example, a group response was that a switch to oil-based monomers would have a negative effect on UNSDG 14: Life Below Water. That response was normalized to a positive effect on UNSDG 14: Life Below Water.

Strengths and Weaknesses of Chemical Recycling Using the 12 Principles of Green Chemistry

Student responses were analyzed for which principle the students identified as a strength or weakness of the given chemical recycling method in separate questions. Identification of specific principles was assigned based on the following priority (1) explicit naming of a principle (2) if no principle was explicitly mentioned, the explanation was used to identify the likely principle being described. Some groups mentioned more than one principle explicitly, and all explicitly identified principles were counted.

Coding of Evolution of PETase Student Responses

Student responses where coded using the following scheme: (1) if responses discussed the similar reactivity of multiple carboxylic acid derivatives in biomolecules versus poly(ethylene terephthalate) (PET) the response was coded as Reactivity, (2) if responses discussed the extent of PET contamination in the environment the response was coded as Abundance, (3) if the

response discussed other topics it was coded as Non-Normative. A student response could fall under multiple classifications. Students in the Tuesday section were piloting a new iteration of the case study and were not asked this question.