Development of a Mathematical Algorithm Modeling the Bioaccumulation of Styrene in the New Hanover County Materials Recovery Facility Through the Analysis of Volatiles Emitted from Recyclable Plastics

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In the past several decades, research regarding volatile organic compounds (VOCs) released from various sources, particularly plastics, has found them to create massively adverse health effects in exposed populations. Locally in New Hanover County, the population most exposed to VOCs is that of recycling workers at the county's Materials Recovery Facility (MRF); as the population of the county increases and thereby utilizes more recyclable plastics, the concentration of VOCs to which workers are exposed will magnify. In determining whether an algorithm could be created to model the bioaccumulation of prominent VOC styrene, I hypothesized that not only could it be developed, but that I could also pinpoint when the concentration of styrene in the MRF surpassed federal regulations, estimating it to be in 2040. Recyclable plastics were sampled from different New Hanover County drop-off locations, rinsed with DI water, cut into pieces no larger than 2.25 sq. cm., heated to 150.0°C, and run in three separate trials for each location through a Shimadzu GC-MS instrument. Further statistics from county sources, the EPA, and journal articles, among other sources, were utilized for dimensional analysis in order to develop my algorithm, in addition to the population estimation function developed. The concentration of styrene was found to rise to 19.68 mg/m3 by 2050, only surpassing one minor regulation, and to 58% of the next regulation. In conclusion, styrene levels in the MRF will remain minimal as to not pose a health threat to workers over the next thirty years.

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