PennState College of Earth and Mineral Sciences

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Database Development for Plastic Waste Pyrolysis

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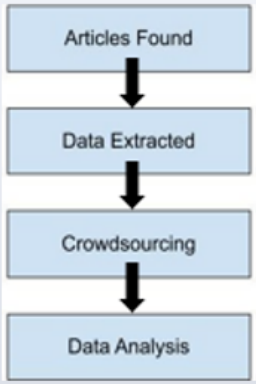
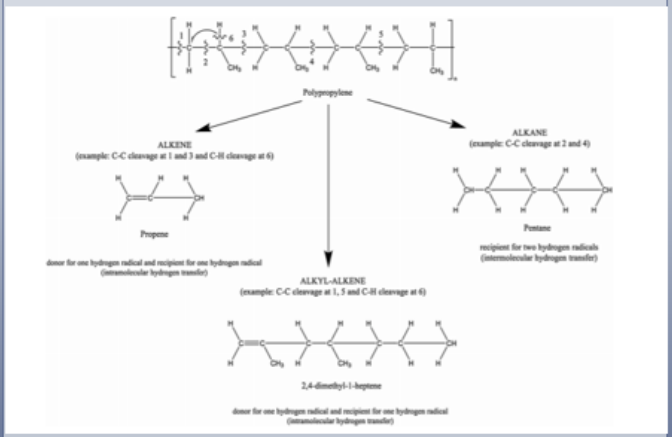
Introduction

Cycle of recycled Plastics going in landfills (1)



Flowchart of database creation

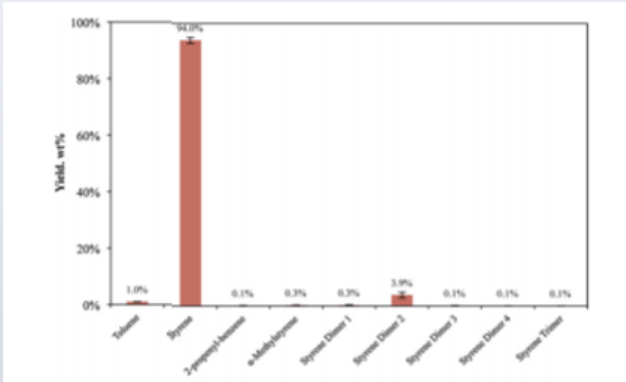


Products of a pyrolysis with Polypropylene (4)

Objectives

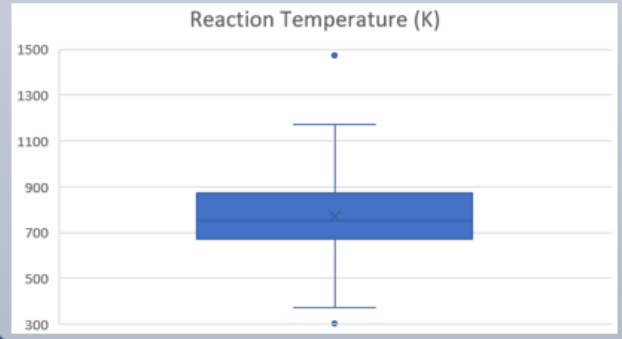
- Find articles
- Check data
- Data Analysis

Details such as axis titles, units, and more analyzed (3)



Results

- Over 40 articles inside the database
- Pre 2000: 5
- 2000-2010: 10
- 2011-2015: 11
- 2016-2021: 17
- Variety of reactors--Multi-purpose thermal analyzer, Micro Furnace, Degradation vessel, etc.
- Temperatures range from 303-1473K
- Average temperature: 833 K
- Average residence time: 7.0 s
- Average reaction time: 86 min



Methods

Google Scholar, Web of Science

Data extracted, put in Excel table

Data checked over

Inputs: Feedstock composition, feedstock initial mass (mg), inert gas flow rate (ml/min),reaction time (min), reactor type, reaction time (min), residence time (s),

Outputs: %C Yield, %Wt Yield, various products %mole fraction, products % weight yield, normalized yield (mmol species/mole starting polymer), gas composition (%wt), gas volatile at room temperature (%mole), gas comp. (%vol), liquid comp (% weight), solid composition (%wt), yield (%Area), % Selectivity, Products Peak Area %,

Inputs and outputs of database

Conclusions

- Over 40 articles found/extracted
- Articles were from a variety of years
- Most articles from 2016-2021
- Variety of articles analyzed
- Most common products were C4H8, C4H10, C5H10, and C5H12

References

1. 13, R. C. |M., Cho, R., Piazza, J., Villegas, V., Gordon, D., B, E., kuemin, J., Anonymous, L, P., Doe, J., Barry, Thaler, J., Fecht, S., S, D., Forest, D., Bill, Smith, A. R., M, L., Pavilon, M., … Meyre, J. (2020, December 8). *Recycling in the U.S. Is Broken. How Do We Fix It?* State of the Planet. https://news.climate.columbia.edu/2020/03/13/fix-recycling-america/.

2. Armenise, S., SyieLuing, W., Ramírez-Velásquez, J. M., Launay, F., Wuebben, D., Ngadi, N., Rams, J., & Muñoz, M. (2021). Plastic waste recycling via pyrolysis: A bibliometric survey and literature review. *Journal of Analytical and Applied Pyrolysis*, *158*, 105265. https://doi.org/10.1016/j.jaap.2021.105265

3, Supriyanto, Ylitervo, P., & Richards, T. (2021). Gaseous products from primary reactions of fast plastic pyrolysis. *Journal of Analytical and Applied Pyrolysis*, *158*, 105248. https://doi.org/10.1016/j.jaap.2021.105248

4. What is Pyrolysis? . What is Pyrolysis? : USDA ARS. (n.d.). https://www.ars.usda.gov/northeast-area/wyndmoor-pa/eastern-regional-research-center/docs/biomass-pyrolysis-research-1/what-is-pyrolysis/.

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