

# Exergy and energy analysis of pyrolysis of pretreated single-use waste plastics

Uduak Bassey<sup>1,2</sup>, Mordi Collins U<sup>3</sup>, Gesa Beck<sup>1</sup>, Satyanarayana Narra<sup>2</sup>, Michael Nelles<sup>2</sup>, Michael Hartmann<sup>1</sup>.

<sup>1</sup>Berlin School of Technology, SRH Berlin University of Applied Sciences, Berlin, 10587, Germany

<sup>2</sup>Department of Waste and Resource Management, Faculty of Agricultural and Environmental Sciences, University of Rostock, Rostock, 18051, Germany

<sup>3</sup>Department of Chemical Engineering, University of Port Harcourt, Port Harcourt, Nigeria

Keywords: Waste-management, Plastics, Pyrolysis, Energy, Waste-to-Energy

Email: [uduak.bassey@srh.de](mailto:uduak.bassey@srh.de)

## Abstract

The pyrolysis kinetics, energy and exergy analysis during the pyrolysis of pretreated real-life mixed single-use waste plastics was assessed. Furthermore, the effects of the pretreatment on the yield, energy and exergy efficiency of the pyrolysis process was investigated. Thermodynamic parameters including enthalpy ( $\Delta H$ ) Gibbs free energy ( $\Delta G$ ) and entropy ( $\Delta S$ ) were calculated with the activation values ( $E$ ) obtained. The energy and exergy efficiencies obtained from pyrolyzing the mixed single-use waste plastics were in the range of 59 – 65 % and 60 – 68 % respectively. It was found that the pretreatment of waste plastics improved the product yield and the overall energy efficiency of the pyrolysis process. This work provided a reliable assessment of the potential of pyrolysis to efficiently convert mixed waste plastics to fuel.

**Keywords:** Waste-plastics, energy, exergy, pyrolysis, efficiency.

## Introduction

With a growing public awareness of climate change and the unreliability of fossil fuels, the generation of clean energy is becoming a necessity. An environmentally friendly social structure that allows for the recycling of wastes should ideally have minimal effects on the environment. Utilizing waste to energy technologies to recover useful energy is regarded as one of the most optimal and cleanest method to treat waste. This has also been found to reduce environmental pollution and energy crisis (Barbarias et al., 2018).

## Material and methods

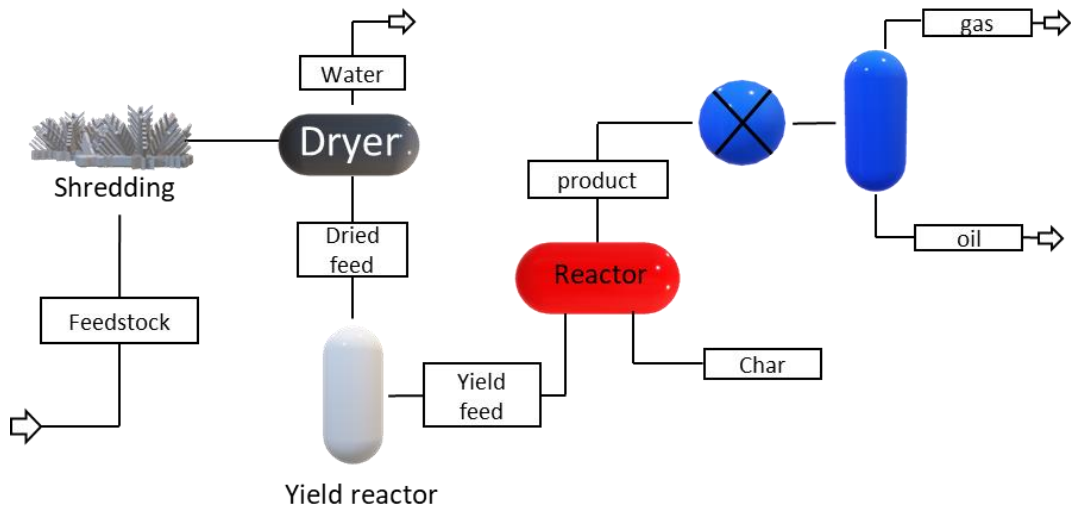
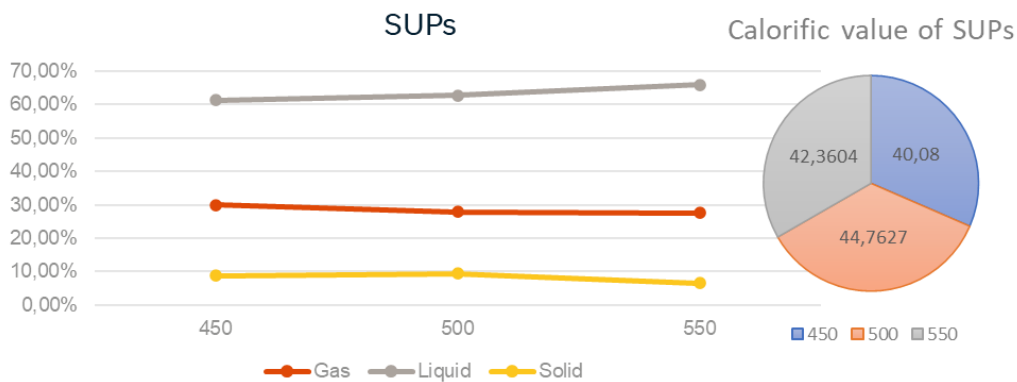


Figure 1: Pyrolysis process flow

## Results and Discussion



## Conclusion

## References

- Barbarias, I., Lopez, G., Artetxe, M., Arregi, A., Bilbao, J., & Olazar, M. (2018). Valorisation of different waste plastics by pyrolysis and in-line catalytic steam reforming for hydrogen production. *Energy Conversion and Management*, 156. <https://doi.org/10.1016/j.enconman.2017.11.048>