

Plastic Waste Management in South Korea : Current Situation, Limitations, and Potential Solutions

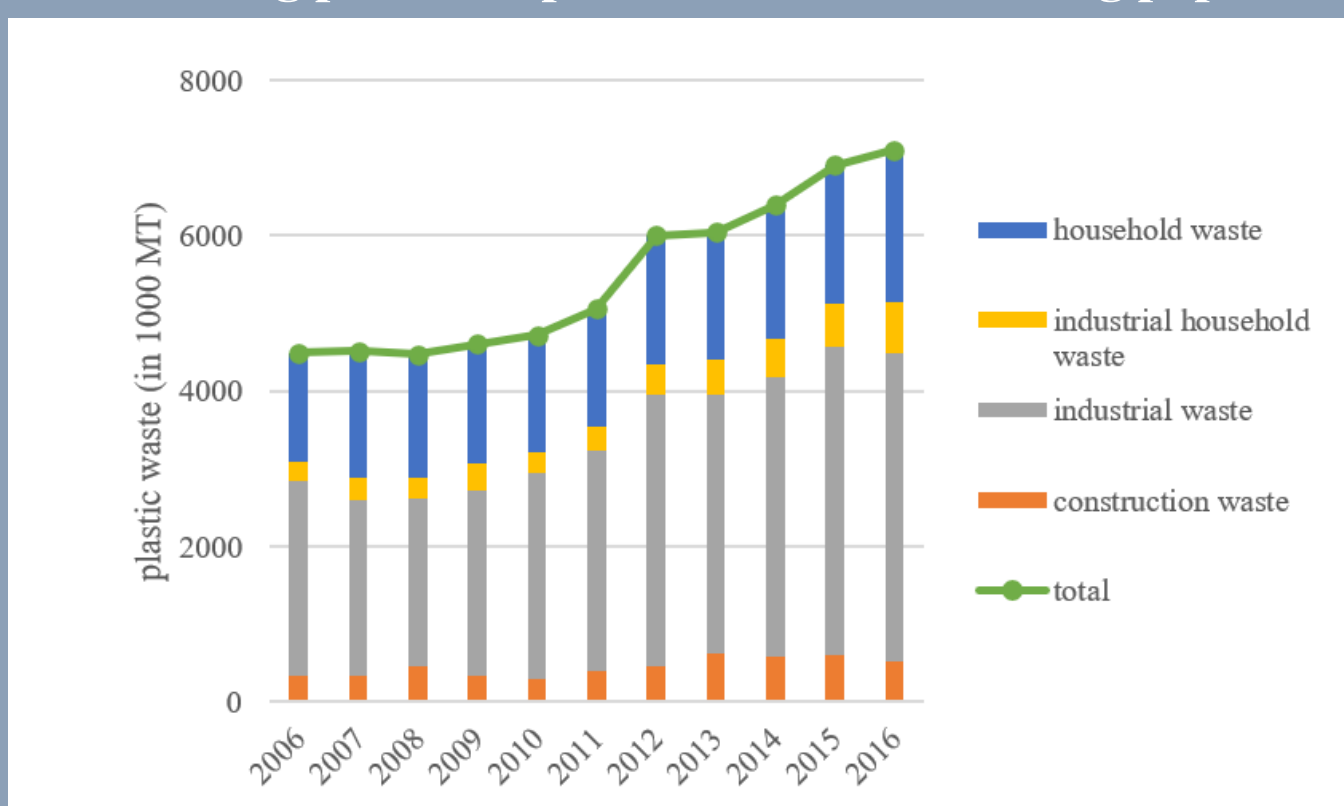
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Abstract

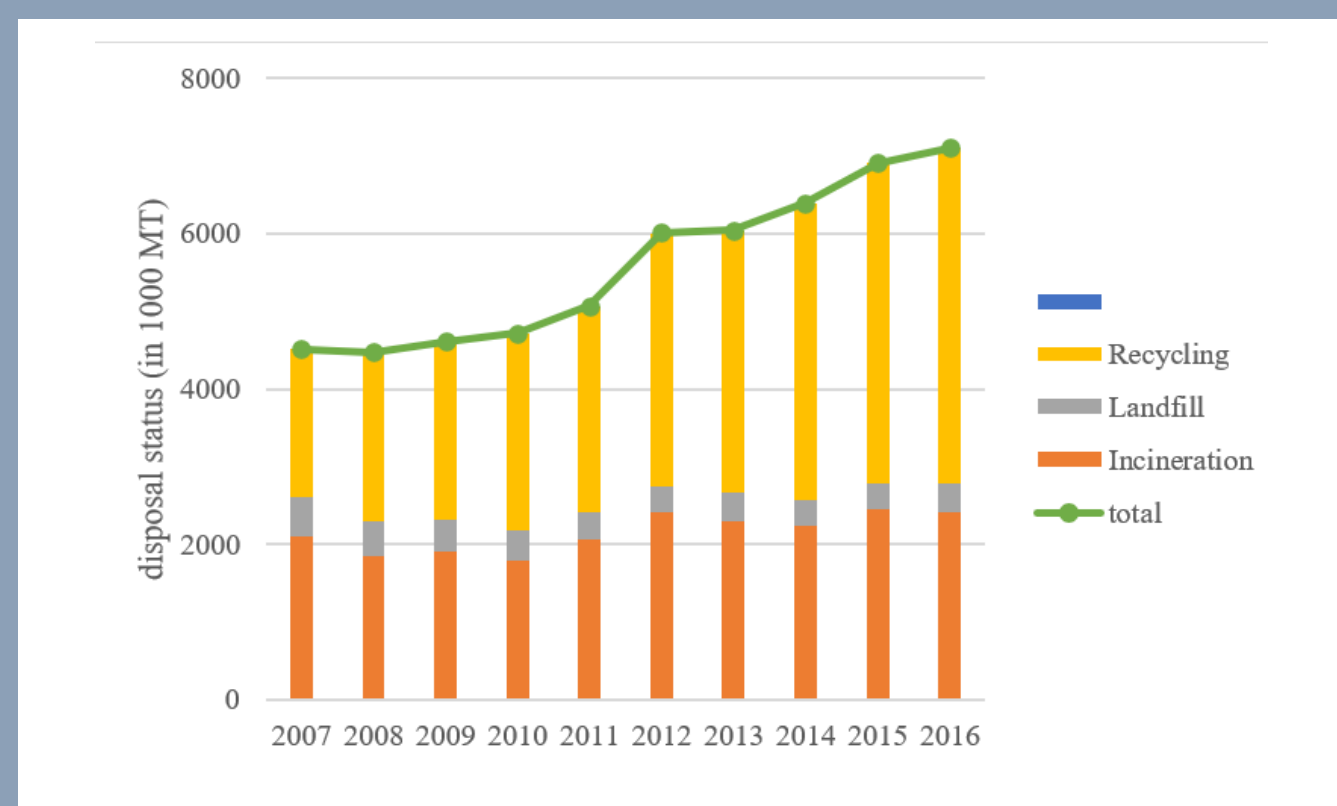
Due to the ever-increasing need for plastics, its production has been on the rise over the past decades and even more during the COVID-19 era due to consumer behaviour. This has resulted to a global environmental challenge which requires fast innovative approaches and circular economic frameworks for proper mitigation. Many of such approaches are already in existence, however, there is the need for continuous improvement to meet the underlining challenges. This is a preliminary study for ELECTRO project which is aimed at converting plastic waste to high purity oils using electrified pyrolysis. In this study we examined the current state of South Korea's recycling system and technology in managing the increasing plastic waste. The data was obtained from the Korea Resource Recirculation Information Center and Korean Statistical Information Service to evaluate plastic disposal and recycling rates. Findings show a rising trend in domestic plastic waste disposal, projected to reach 40,000 tons per day by 2030. Furthermore, additional research on policies is required to enhance current recycling methods. They can be used to develop more effective strategies to address the negative impacts of plastic waste in South Korea. Moreover, the conversion of plastic waste into energy through pyrolysis presents a prospective solution to the plastic waste problem in South Korea.

Figure 1. Increasing plastic disposal rate with increasing population in Korea



(Korea Statistics, 2020)

Figure 2. Waste plastic treating status in Korea (2007-2016)



(Greenpeace Korea, 2023)

Figure 3. Detail of actual (2021) waste plastic recycling.

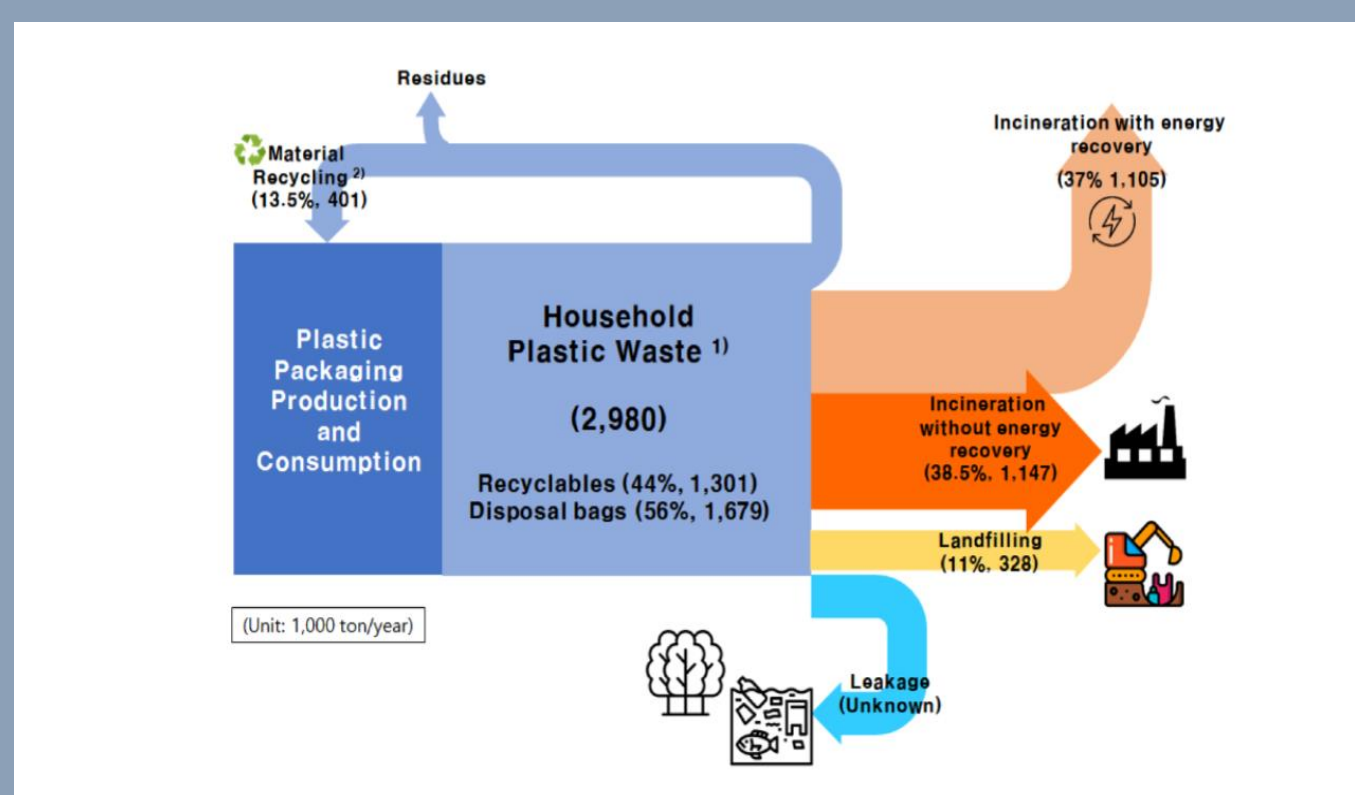


Figure 4. Plastic waste composition (input) versus pyrolysis oil composition (output)

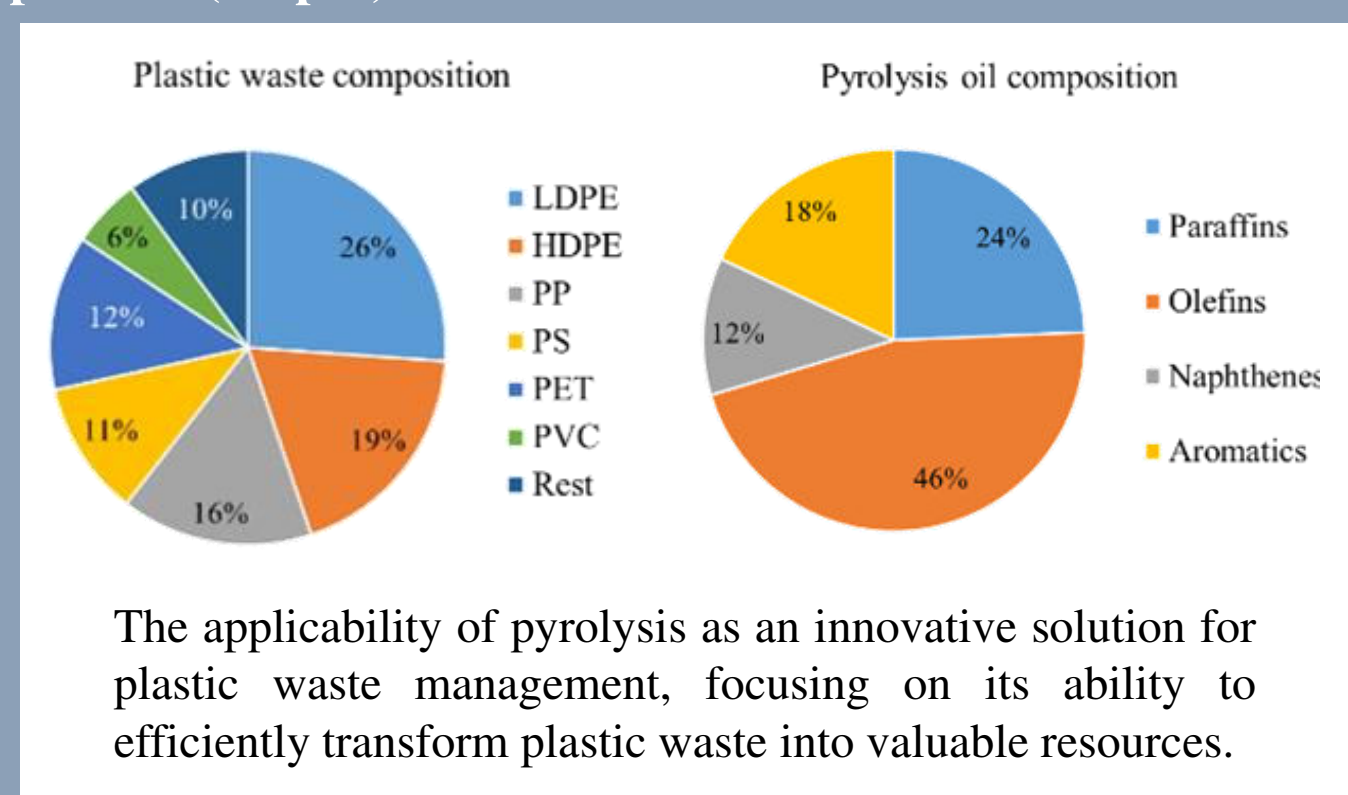
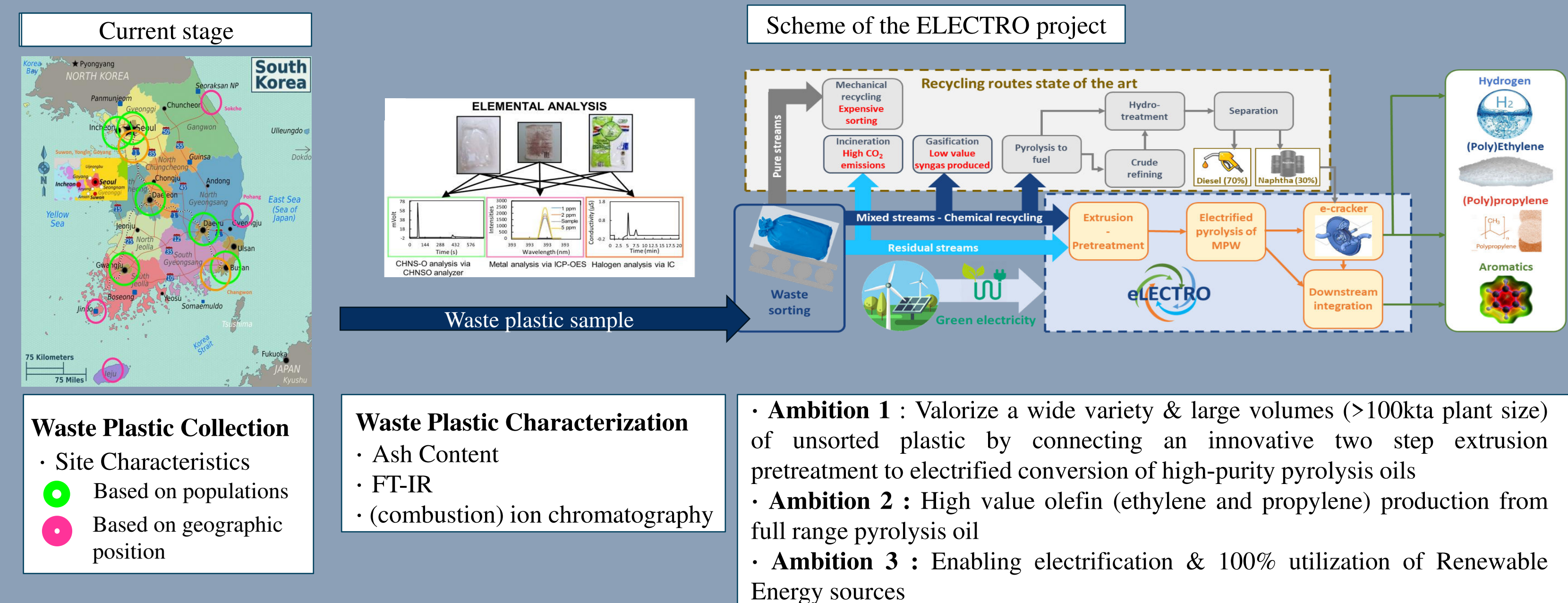


Figure 5 . Verification ELECTRO project with plastic waste from Korea (Scheme of the ELECTRO project)



Conclusion

Our research highlights the increasing plastic waste disposal trend in South Korea and the urgent need for alternative actions. Taking into consideration the challenges of landfilling, incineration, and the overwhelming increase of plastic waste, it is of necessity to prioritize cost effective and ecofriendly technologies and approaches. With high unrecycled plastic ratio in Korea, suggestion of pyrolysis of plastic waste is excellent and advanced future oriented technology. Waste will be combined with an electrically heated reactor for the catalytic pyrolysis of plastic waste. The proposed electrified pyrolysis technology will be able to convert plastic waste back to new feedstocks with minimal release of harmful gases and cutting down on conventional plastic feed stocks such as crude oil. As a validation step in part of ELECTRO project, collecting sample from South Korea will be done as a first step and characterized to find its applicability.

Reference

Korea Statistics. (2020). Annual statistics on recycling of waste by material type, South Korea, 2017-2020 [Data table]. https://kosis.kr/statHtml/statHtml.do?orgId=106&tblId=DT_106N_99_3300351&con_n_path=12
 Greenpeace Korea. (2023). Report: Disposable Korea Ver.2. Retrieved from <https://www.greenpeace.org/korea/update/25774/report-disposable-korea-ver2/>

Acknowledgement

This work was also supported by a grant from the National Research Foundation of Korea (NRF) (Grant No: 1711173852).
 This project has received funding from the European Union's Horizon Europe research and innovation program under the HORIZON-CL4-2021-TWIN-TRANSITION-01.
 This work is an extract of the ongoing electrified pyrolysis of plastic waste to high purity oils.