POWERED BY PLASTIC: PLASTICS TO FUEL

OSU School of Chemical, Biological and Environmental Engineering

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Collaborators: Ocean Plastics Recovery Project and PDO Tech Inc.

BACKGROUND
THE PLASTICS CRISIS

- As of 2018, only 8-10% of consumer plastics in the US were recycled
- This is even lower in rural communities, where it is extremely difficult to install plastic processing facilities

Landfill in Botswana, Africa

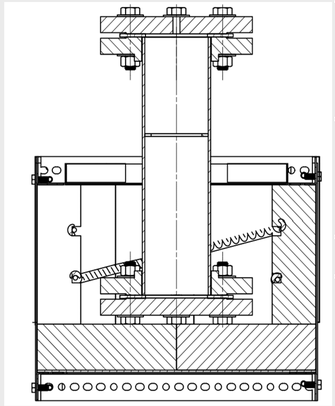
PLASTICS TO FUEL GOAL

- **Develop reactors for island and rural communities, allowing them to convert their waste plastic directly to diesel fuel**
- Provide a localized solution to the plastics crisis in underserved communities

POLYMER RECYCLING

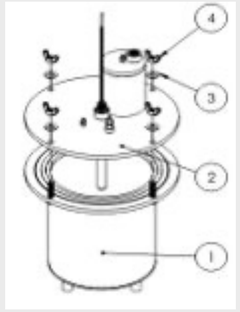
- Pyrolysis is the thermal degradation of organic molecules in the absence of oxygen.
- Common polymers can be broken down to produce chemical feedstocks and energy dense fuels

THE HELENATOR (PTF 2.0)



- Designed by **MIME Capstone Team** Winter 2022
- Kiln reactor – 120 V heated by circulating hot air
- Runs tend to be **5-8 hours**
- Pyrolysis is estimated to have an **energy of conversion of 1:6** (in to out)
- Depending on feedstock, **yield of 60-80%**

BIG BERTHA (PTF 3.0)

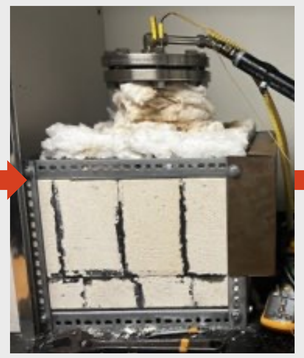


- Designed by a **MIME Capstone Team** Winter 2024 with an increased capacity: 5kg
- Will be implemented this summer by a team from the lab for a farming Cooperative in Malheur County, OR

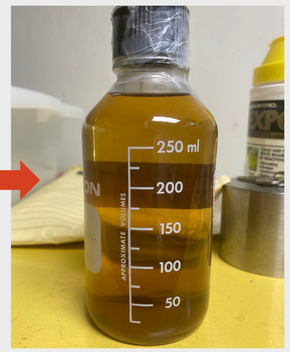
THE PROCESS

Plastic waste is collected

Plastic is cut down to size to be more easily compacted into the reactor



Plastic is heated in the reactor to ~460C



Diesel production will begin about 2.5 hours later

AGRICULTURAL CIRCULARITY

- Polyethylene Irrigation tubing cannot used for more than one growing season
- Currently the major of the material is burned, buried, or left to break down in the environment
- Unwashed tubing has a **60-75% yield**

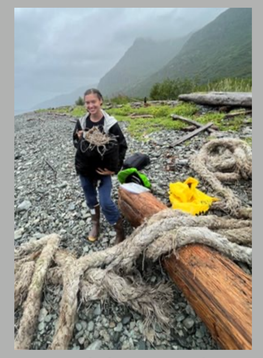
INDUSTRIAL CIRCULARITY

- ENTEK Polyethylenes (UHMWPE and HDPE) are plastics used in Lithium Ion Battery Production
- UHMWPE cannot be mechanically recycled
- ENTEK HDPE and UHMWPE have a **70-75% yield**

CURRENT PROJECTS

- Approximately 12.7 million tons of new plastic pollute the ocean each year
- No significant difference in **yield (65%) between washed and unwashed material**
- Summer 2024, four students going to Kodiak, Alaska in partnership with **Ocean Plastics Recovery Project** to establish a recycling facility
- Future work with Island Communities in Micronesia, Kawai, and Caymen Brac on ocean plastic accumulation

Ocean Plastic Feedstock



Madeline Pasche Summer 2023 Ocean Plastics Recovery Project Clean Up Crew

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