# Characterization of Beach Waste Plastics by Analytical Py-GC/MS

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### INTRODUCTION

- Non-biodegradable in nature, thrown-away culture of post-consumed plastics, toxicity and potential health hazard of chemicals present in plastics have made the plastic pollution a looming threat on human civilization.
- Plastic pollution is a growing concern to the natural environment in terms of global warming, climate change, loss of ecosystem and bio-diversity.
- Ocean debris comprises 80% of plastic waste which can be used as a source



RESULTS

#### of energy and feedstock recovery.

PYRO

# **OBJECTIVES**

- Identifying the type of polymers and the contaminants in real environmental samples using a variety of analytical techniques like Thermogravimetric Analysis (TGA) CHNS Elemental Analysis Fourier-transform Infrared Spectroscopy (FTIR) Scanning Electron Microscope-EDAX (SEM-EDAX) Pyrolysis-Gas Chromatography / Mass Spectroscopy (Py-GC/MS)
- Evaluating the resource recovery potential from plastic packaging wastes collected from beach.

# **EXPERIMENTAL SECTION**



- Assigned wavenumbers represents signature functionalities of polyolefins.
- SEM-EDAX demonstrated irregular surface texture with presence of inorganics.
  Product Distribution Product Quantification

1.4 -

PY:600 <sup>O</sup>C, 30 sec

#### **Collected Beach Waste Plastics**

### Edward Elliot's Beach (<u>12.999529°N 80.272411°E</u>)

- TA Instruments (SDT-Q600) Nitrogen (100 mL/min), 10 °C/min.
- Elemental Analysis (Thermo Flash 2000, Thermo Fisher Scientific, U.S.A.).
- Bomb Calorimeter (IKA C200, IKA, Germany).
- FTIR Spectrometer (Agilent Cary 630, 4 cm<sup>-1</sup>, ATR Mode).
- SEM-EDAX (Hitachi S-4800, Ibaraki, Japan).
- Micro-furnace pyrolyzer (EGA/Py-3030D, Frontier Laboratory, Japan)
- GC/MS (GC-2010 and QP-2010 Plus, Shimadzu, Japan)
- GC Column (UA-5, 40 °C 2 min to 300 °C @10 °C min<sup>-1</sup>, 300 °C for 10 min)
- MS (70 eV, 19 500 Da)
- Thermal Desorption (100 °C to 320 °C @ 10 °C min<sup>-1</sup>, 320 °C for 2 min)
- Flash Pyrolysis (at 600 °C for 30 s)

### Pathway to sample measurement (Py-GC/MS)





• Quantification done using standards.

- Thermal desorption regime showed the presence of contaminants and additives.
- Flash pyrolysis produced the oligomers of increasing carbon numbers with chain length.

## **SUMMARY**

- Ultimate analysis elucidated waste plastics are rich in carbon and hydrogen.
- SEM-EDAX analysis showed irregular surface morphology and presence of inorganics such as Na, Mg, Al, Si etc.

Sample Code	C (wt.%)	H (wt.%)	HHV (MJ/Kg)	Na (wt.%)	Mg (wt.%)	Al (wt.%)
S3	75.52	12.34	43.67	-	-	1.25
S6	85.67	14.34	50.03	0.32	0.28	0.34
S7	74.85	11.12	41.69	0.52	-	0.21
S8	78.74	12.69	45.28	0.71	-	-
S10	84.64	14.17	49.44	-	-	0.60
S11	74.49	10.33	40.42	0.83	0.45	0.30
S14	67.44	10.83	38.72	0.90	0.54	0.33
S16	85.17	14.28	49.77	1.74	0.68	1.96

- Analysis of pyrolysates confirmed the presence of 43% PE and 21% PP among beach waste plastics.
- Thermal desorption revealed the presence of long-chain acids, phthalates and non-phthalate plasticizers.
- Fast pyrolysis of polyolefin showed the order of elution are alkadienes first, followed by alkenes with the alkane last.

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For further details, visit: https://crestgroupiitm.wixsite.com/crestresearch/vinu

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