

Our plastic problem

- Global plastic waste generated is currently over 300 million tons per year, with the united states alone producing over 35,000,000 tons in 2018
- Current trends indicate an annual increase of plastic waste generated by 9%

Generation Tonnages, 1960-2018

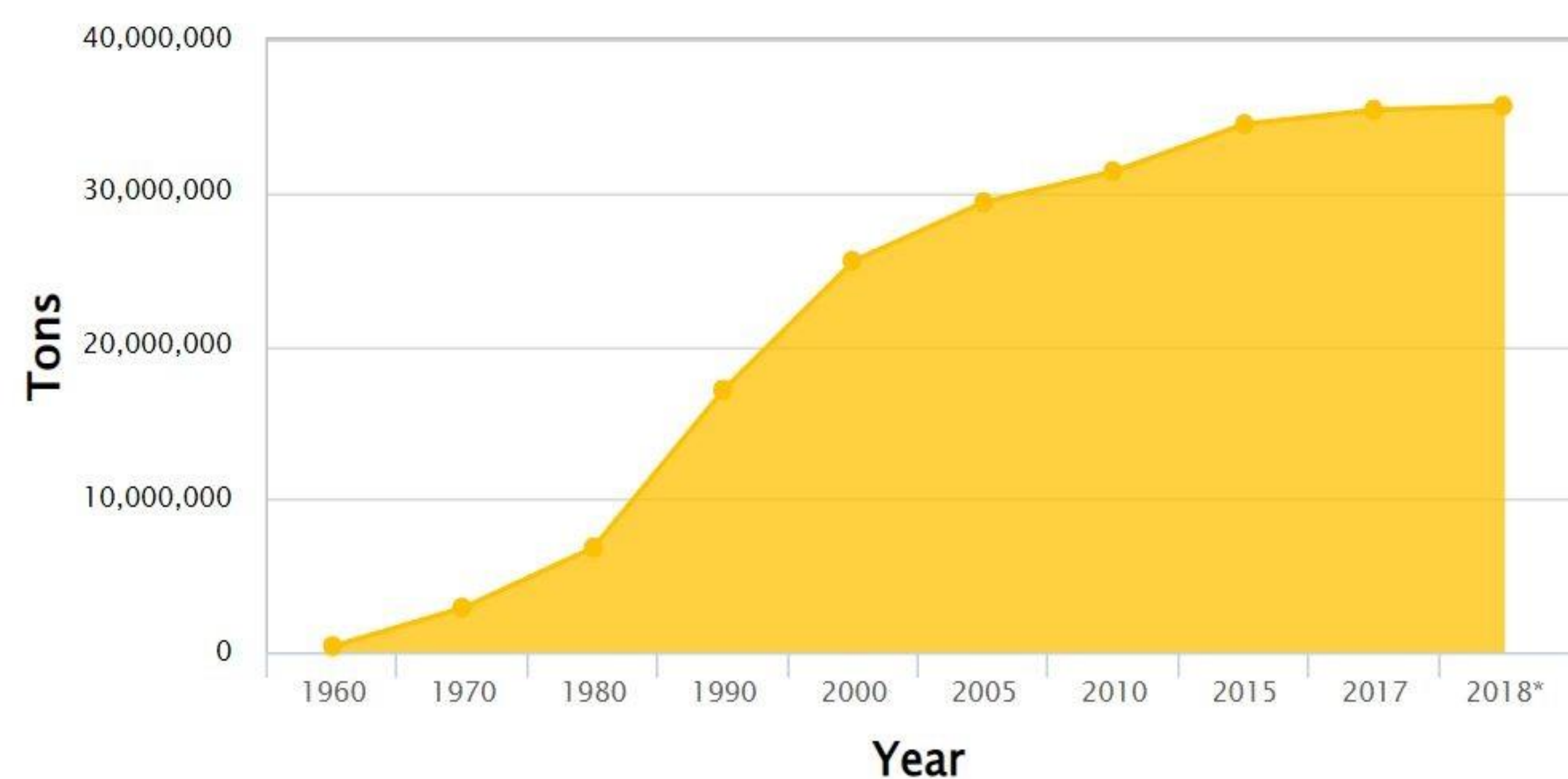


Fig 1: "Total municipal waste generated by material 2018" EPA.gov, December 3, 2022

- Only 9% of plastic globally is recycled, with the US recycling only 4.47% of its plastic waste in 2018

Total MSW Recycling by Material, 2018

69.1 million tons

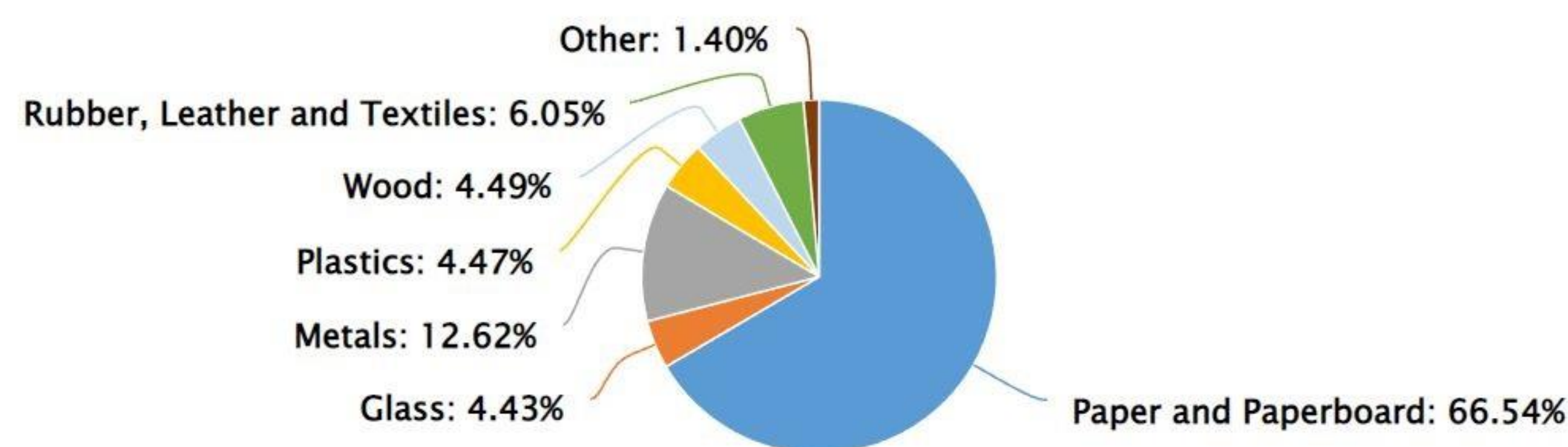


Fig 2: "Total Municipal solid waste recycled by material 2018" EPA.gov, December 3, 2022

Low pressure Hydrothermal Processing of Polystyrene

- Polystyrene was chosen due to its low rates of recycling and chemical makeup of Carbons and Hydrogens
- Methods of Hydrothermal processing at low pressures (LPHTP) were tested and compared to traditional methods of Hydrothermal processing (SWL) for yields of BTEX compounds

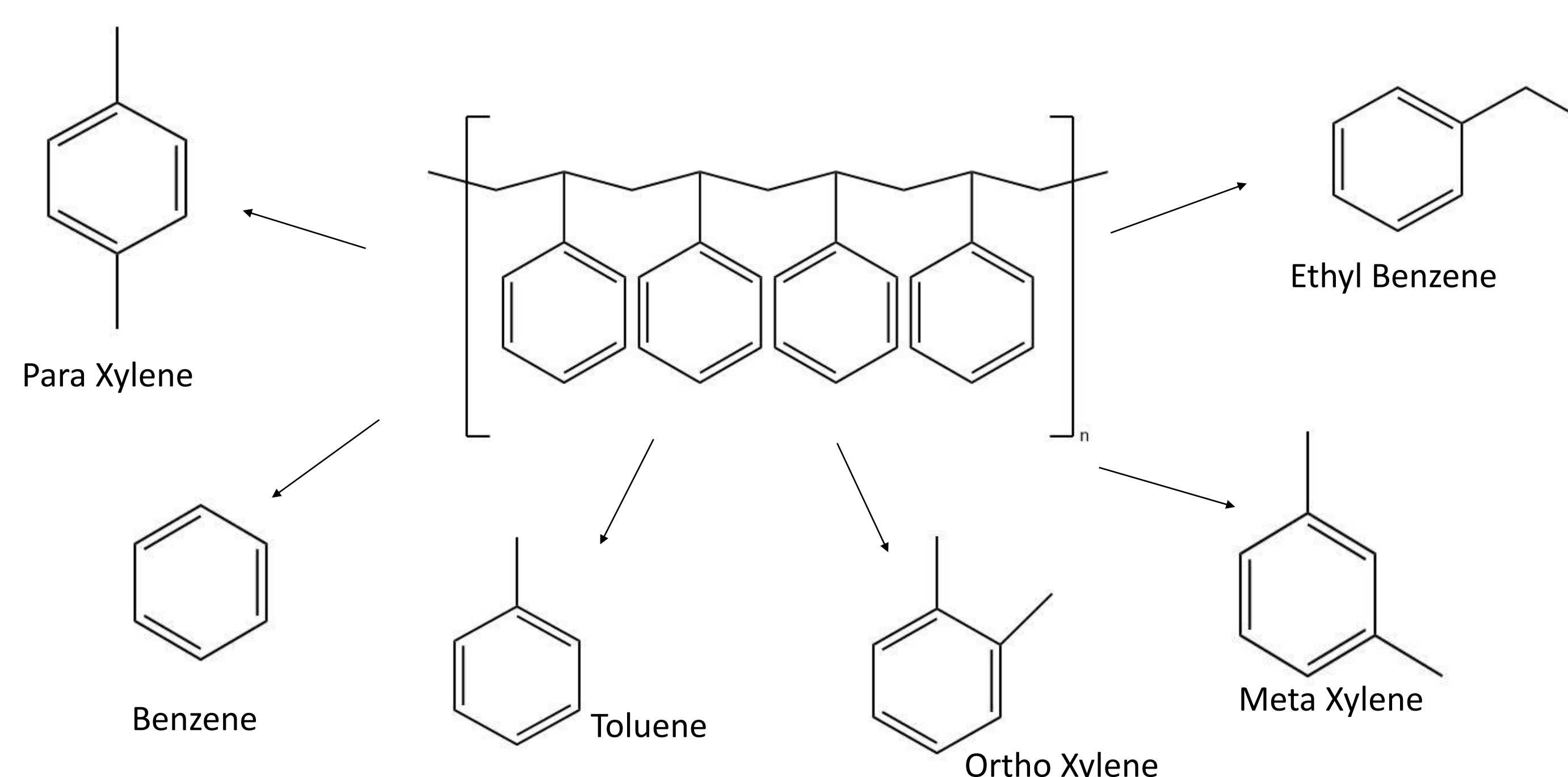


Fig 3: BTEX compounds from polystyrene

- Multiple samples of PS were reacted at varying temperatures of 350 °C, 400 °C, 425 °C, 450 °C, 475 °C, 490 °C for 0-60 minutes
- BTEX compounds were quantified using Gas chromatography mass spectrometry coupled with a Flame ionization detector

Results

- Increase in weight % of Benzene and Toluene were reported for reactions occurring at higher temperatures as shown.
- Highest yield of Ethyl Benzene was noticed at 450 °C for 45 minutes at 35.96%.
- Highest yield for Xylenes from LPHTP were reported at 450 °C for 30 minutes at 4.10%

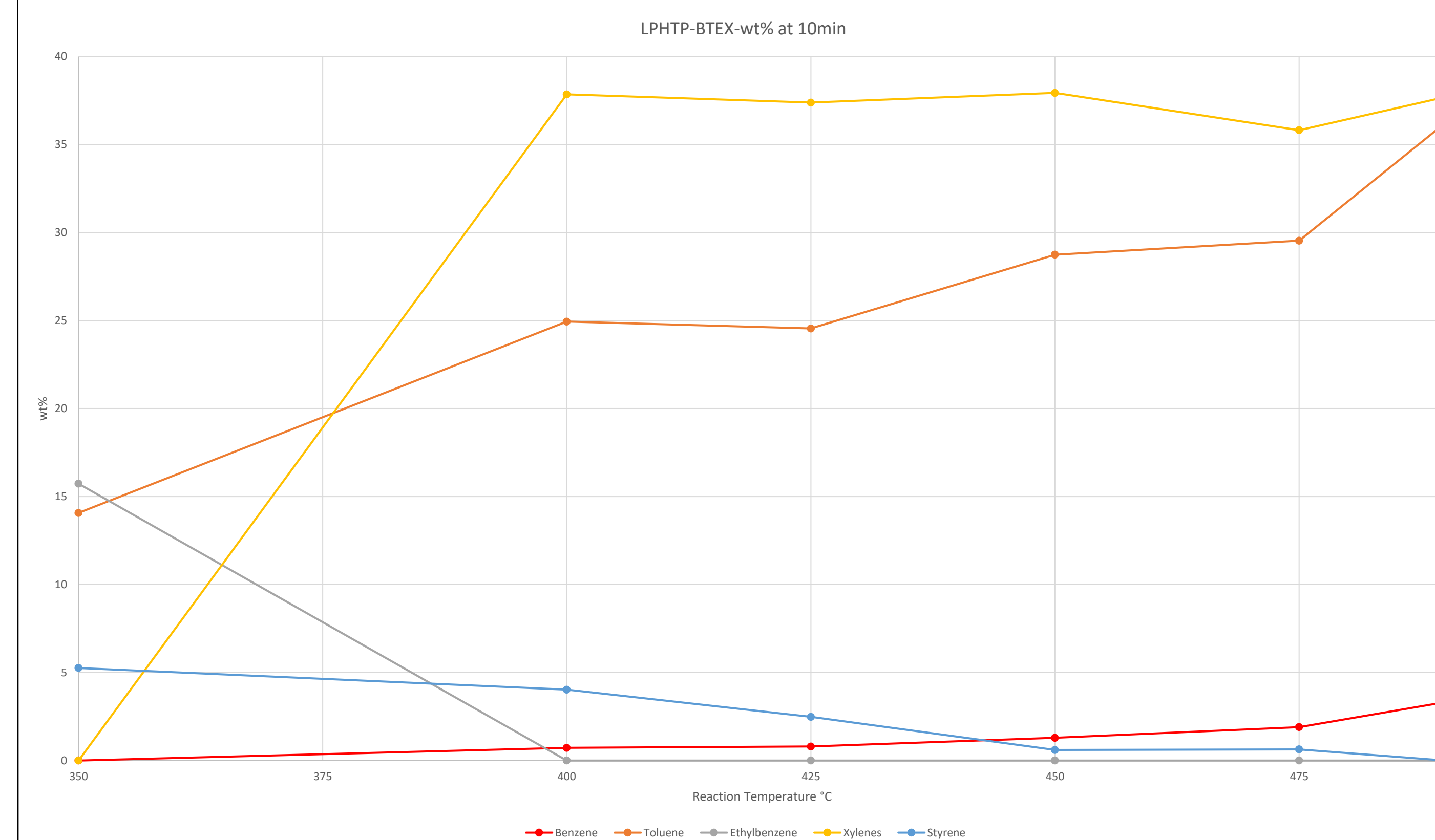
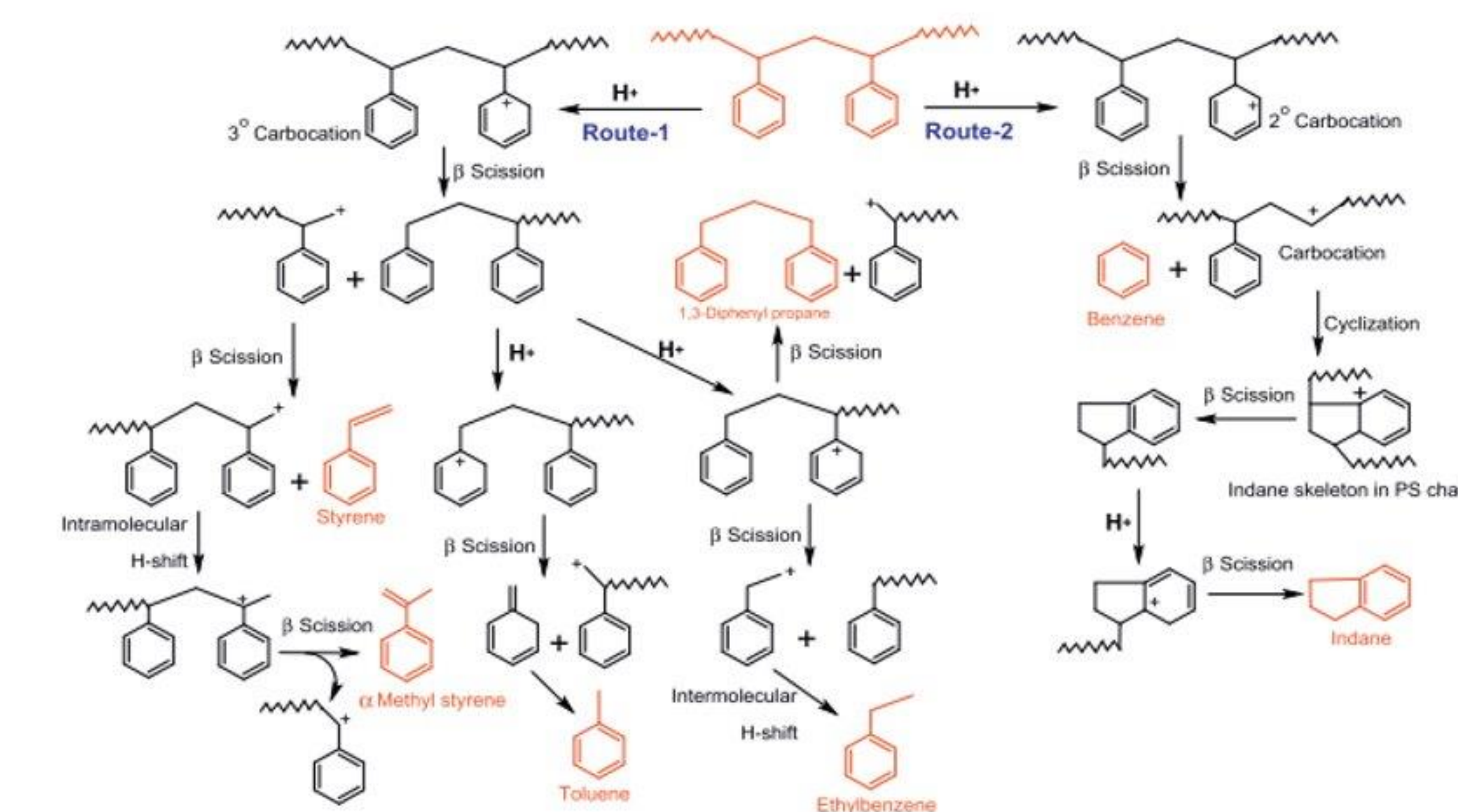


Fig 4: Temperature vs weight percent for BTEX compounds of polystyrene

Future Work

- Determination of reaction pathways for PS under LPHTP



Scheme 1. Mechanism and reaction pathways involved in the formation of major products during catalytic fast pyrolysis of PS. Fig 5: PS catalytic fast pyrolysis mechanism (Ojha et al., 2015)