



University of Idaho

College of Natural Resources

Mixed plastic waste deconstruction & reconstruction

Armando McDonald

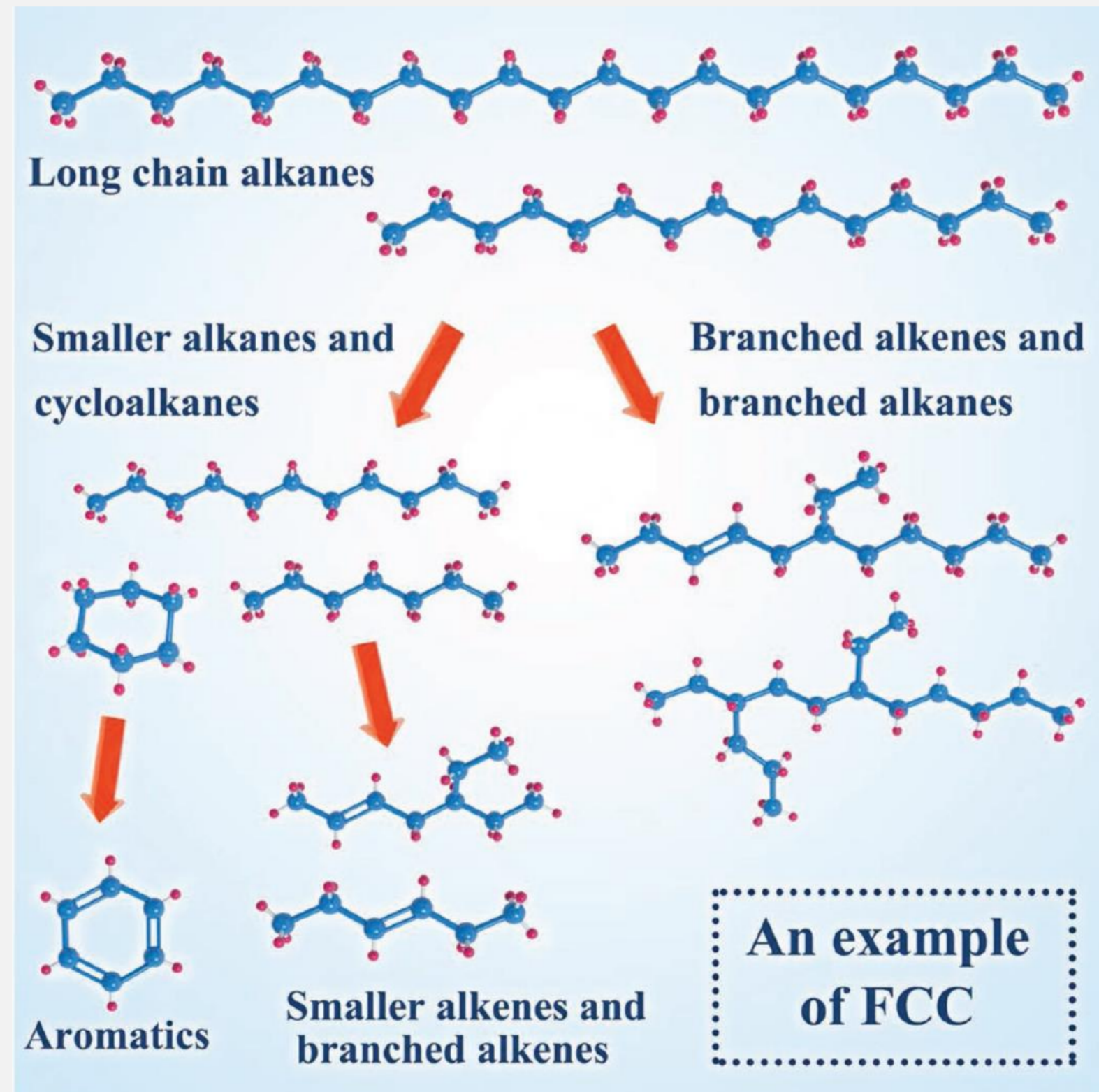
MIXED PLASTIC DECONSTRUCTION



Complex mixture of PE, PP, nylon, PET, etc, and options for deconstruction:

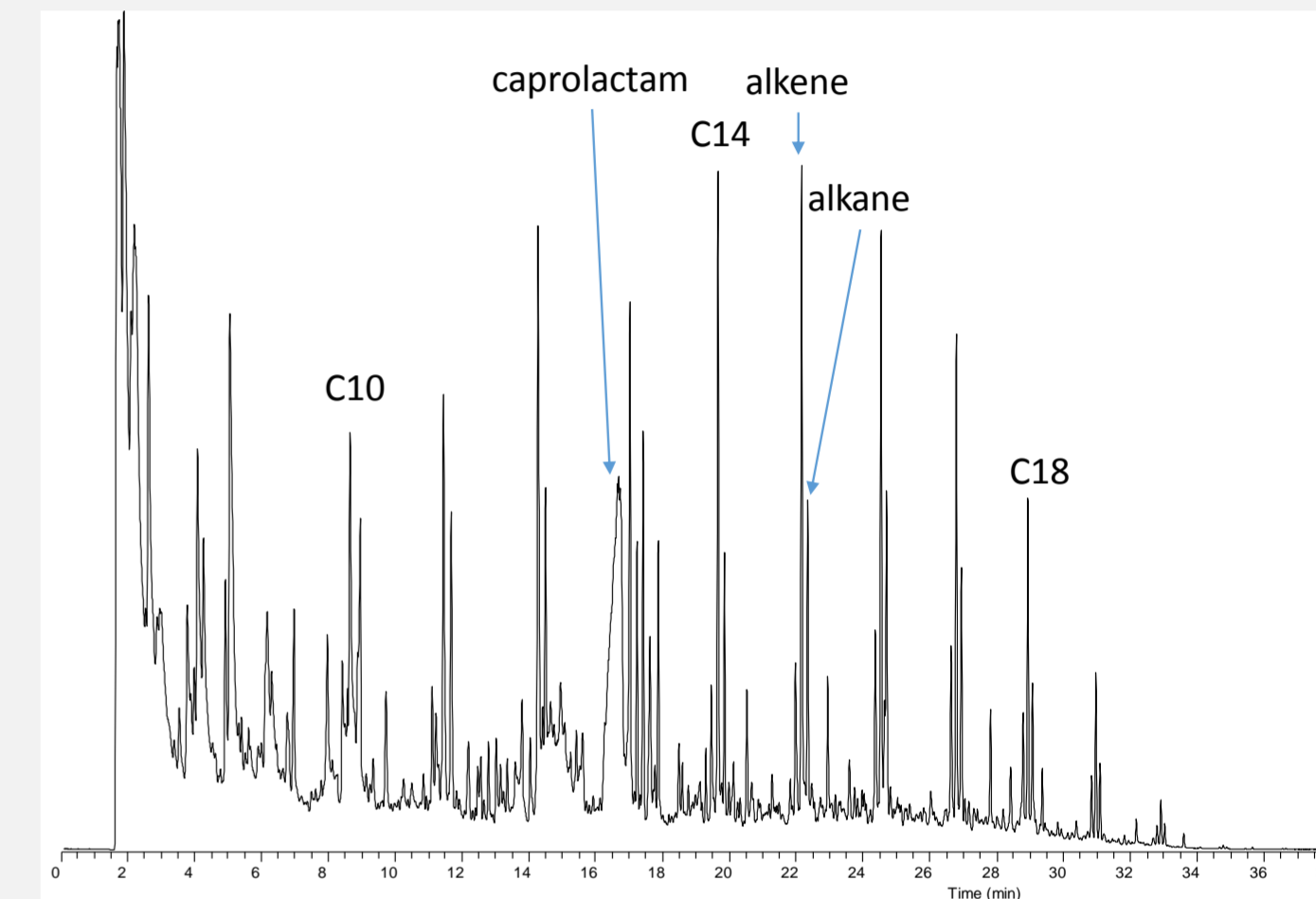
- **Thermochemical**
 - Low cost
- **Catalytic thermochemical**
 - Cost of catalyst & regeneration

Product profile depends on process & operating conditions

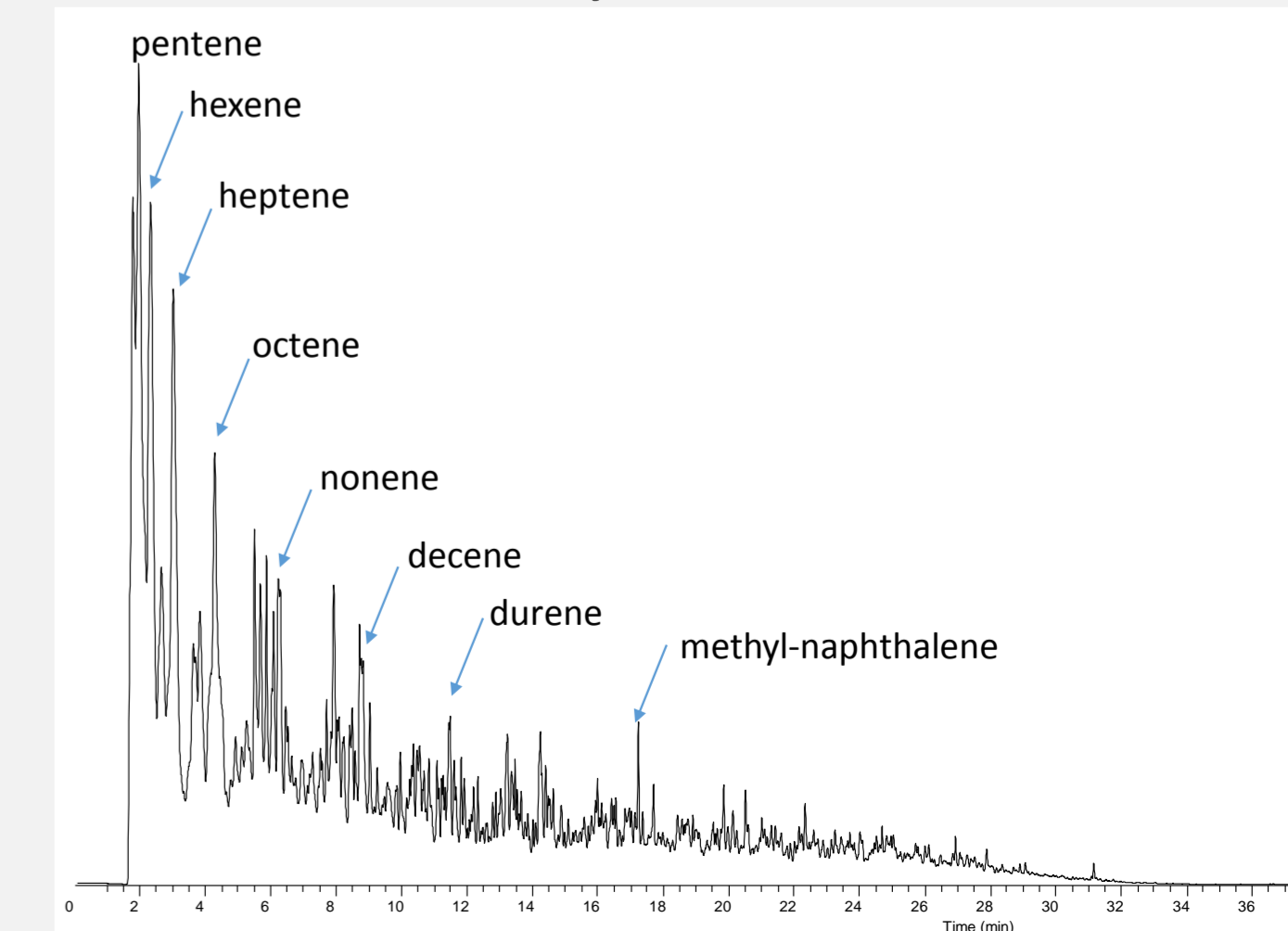


Adv. Mater. 2017, 1701139

Mixed plastic waste at 500°C



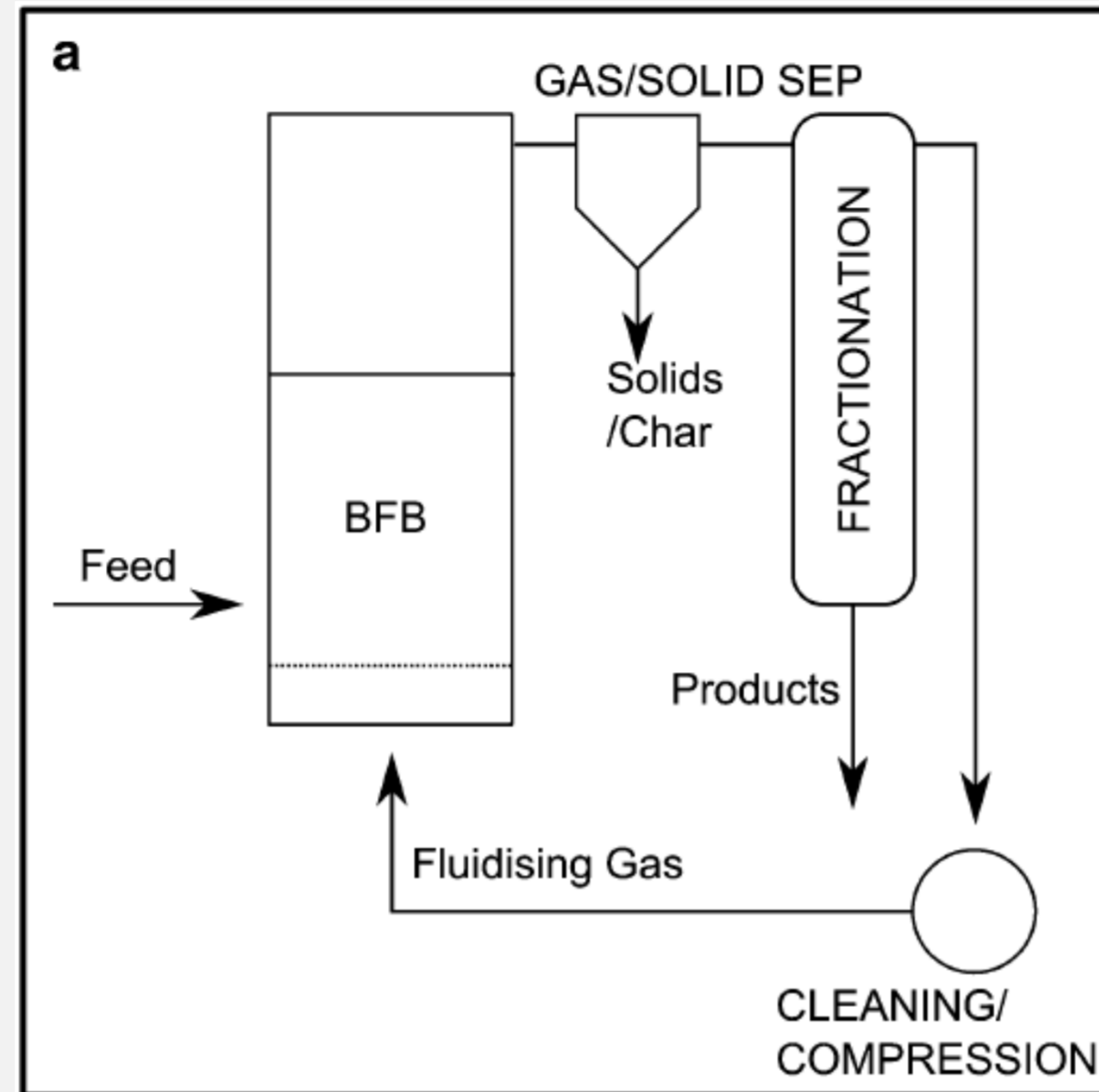
+ Zeolite-Y catalyst



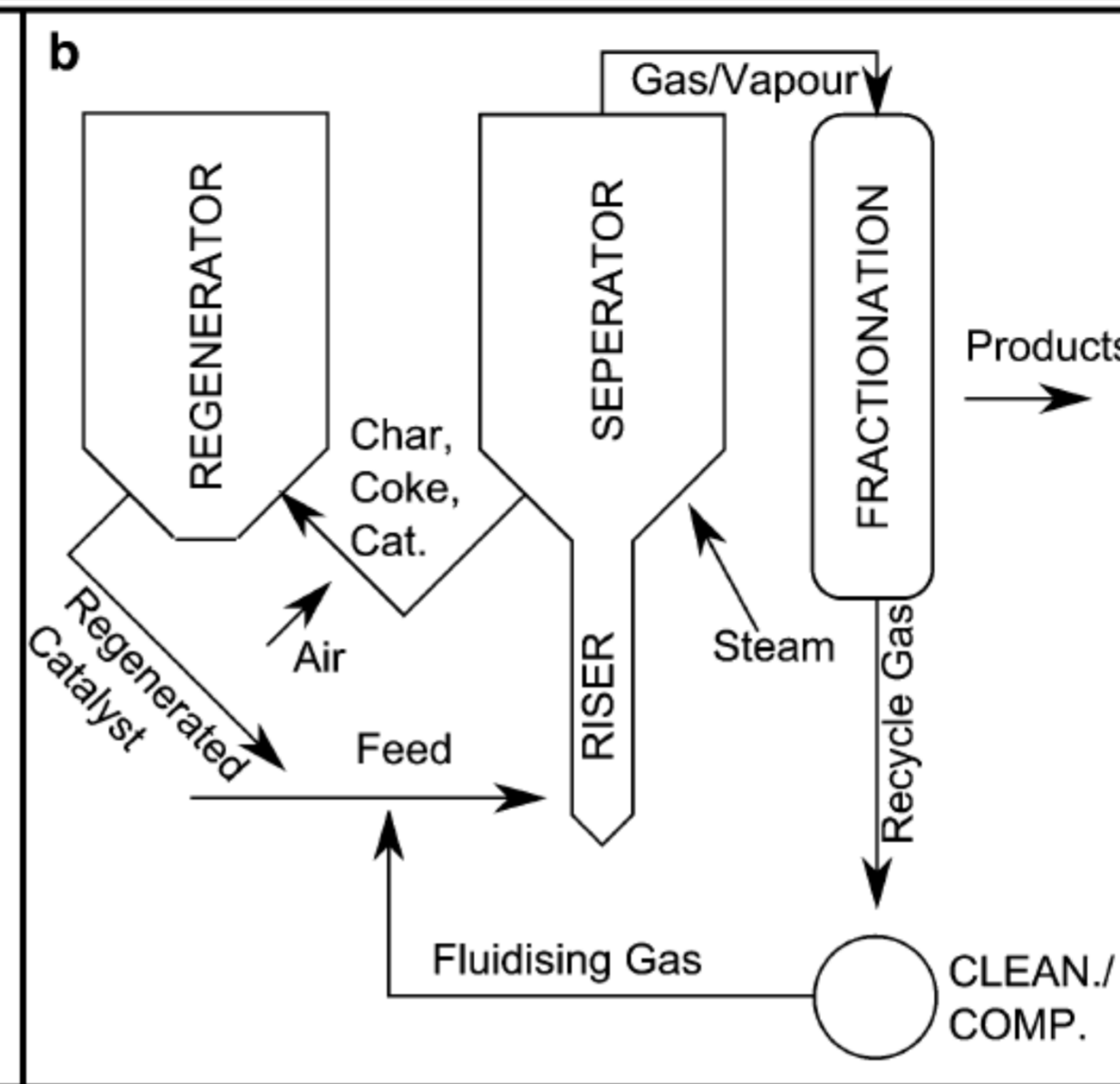
DECONSTRUCTION



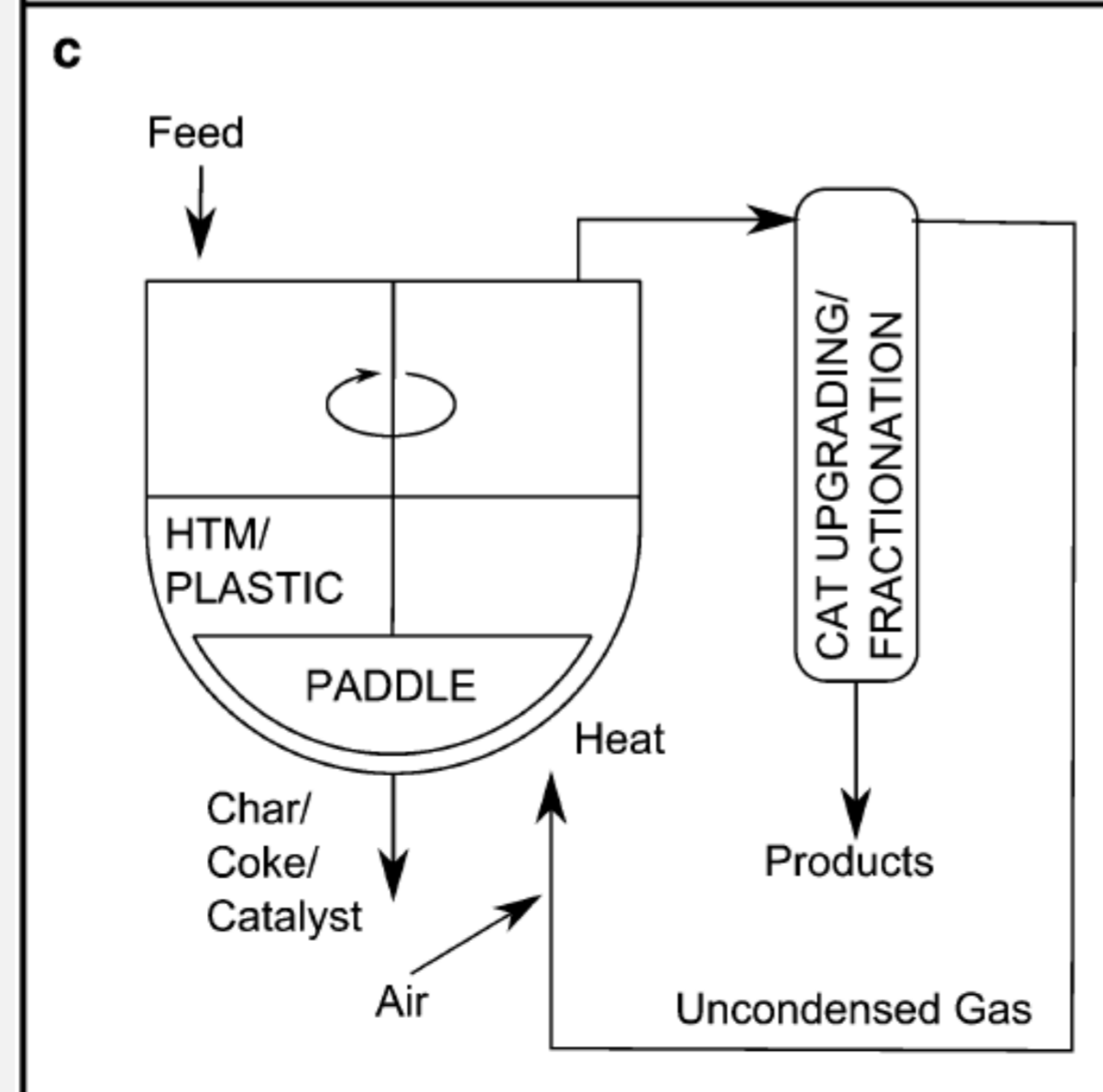
Bubbling
fluidized bed



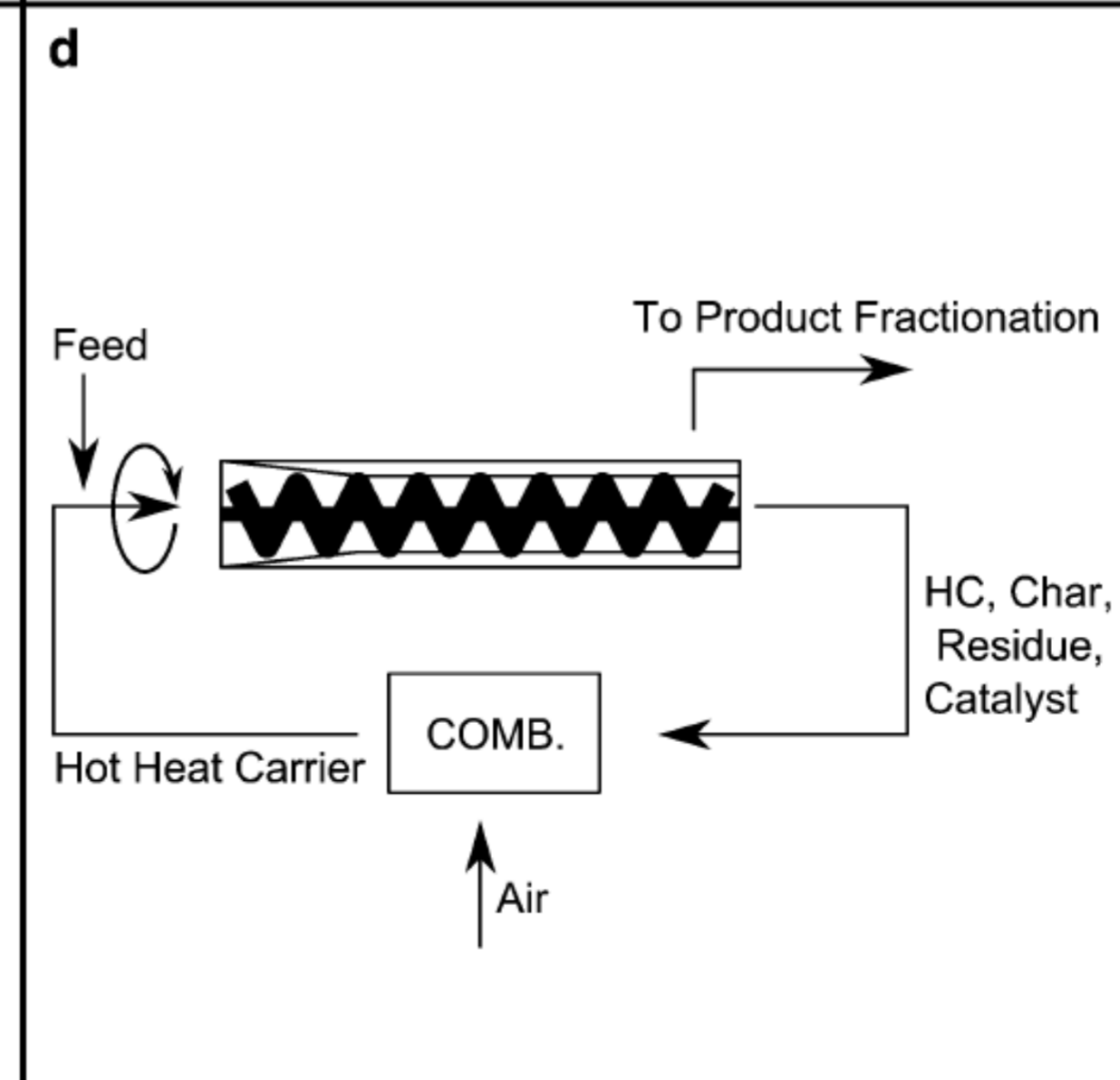
Fluid catalytic
cracker



Stirred tank
reactor



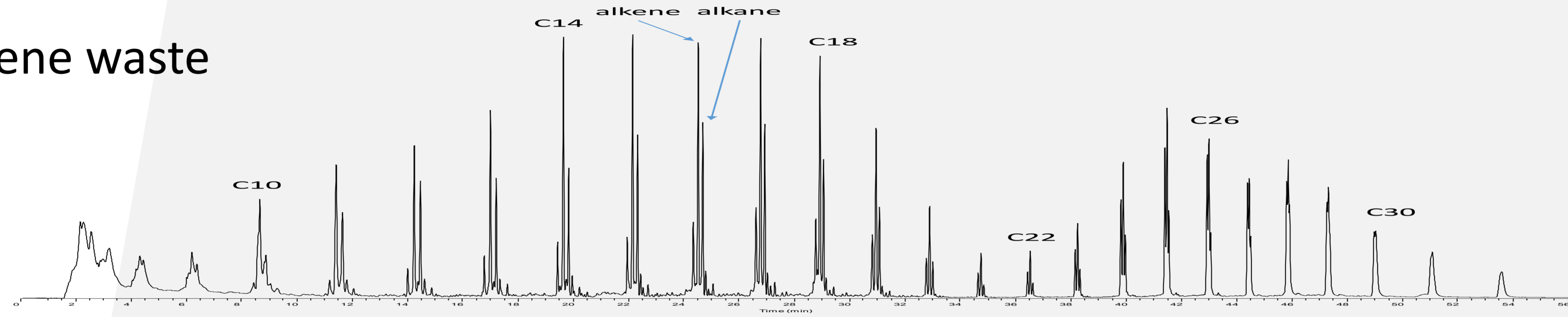
Auger
reactor



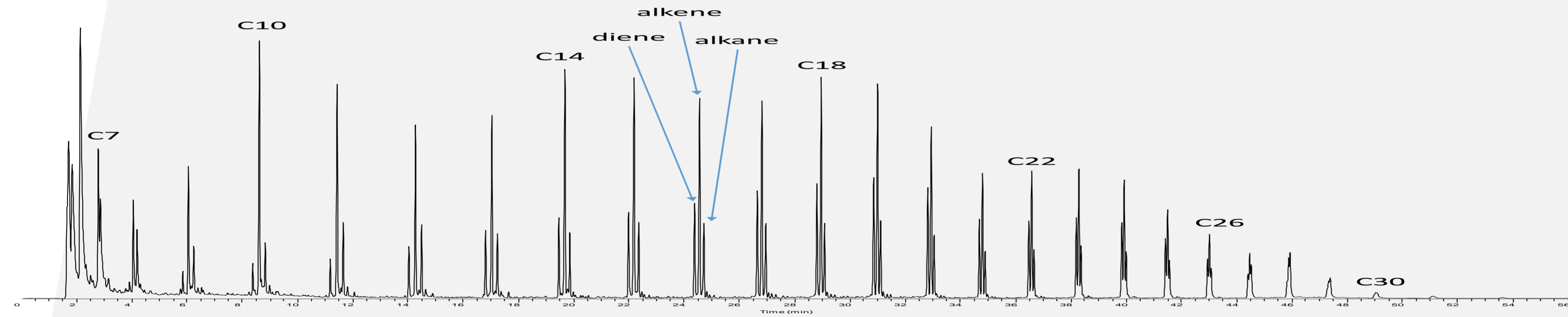
MIXED PLASTIC DECONSTRUCTION



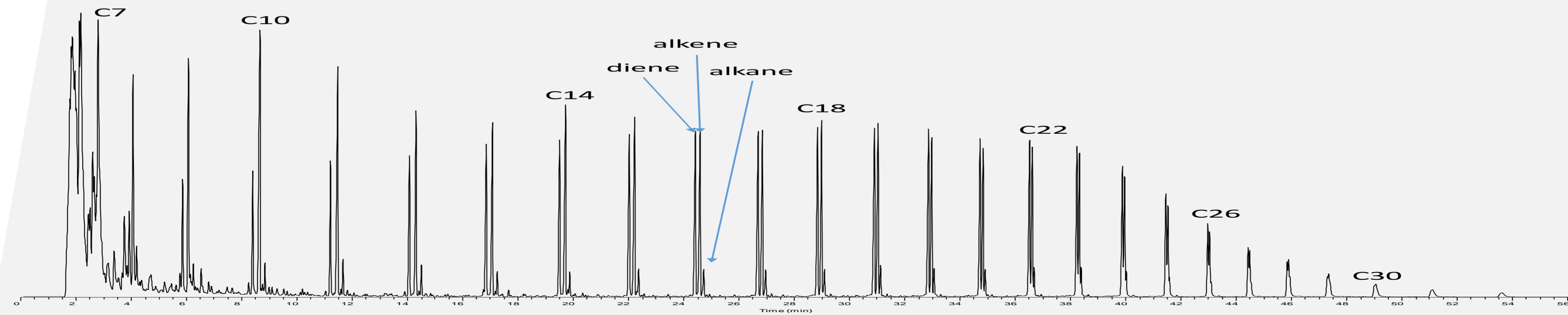
Polyethylene waste



500°C



600°C



700°C

MIXED PLASTIC DECONSTRUCTION



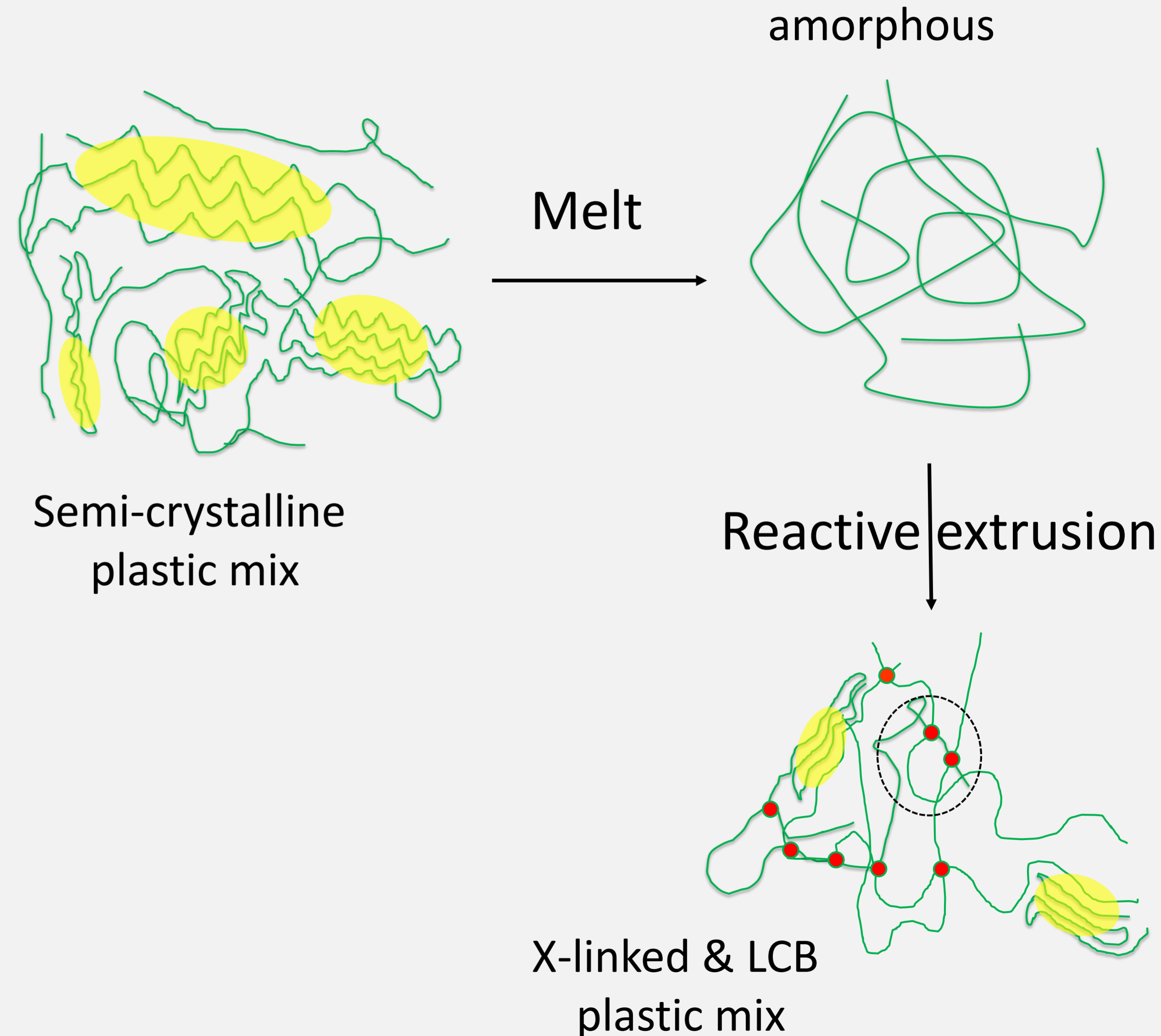
- **Mixed plastic feedstocks will contain multiple components**
 - paper, adhesives, etc
- **Thermochemical process is generally robust**
- **Need to fractionally condense the products to obtain different product classes, e.g. gases, liquids, waxes, etc.**
- **Industrial processes can (i) separate gases & (ii) clean up fractions**
- **Separated fractions can be used to create different products**

RECONSTRUCTION



Some options based on product profile:

- Mixed plastics used in composites
- Long/short-chain branching / x-linking of mixed plastic by reactive extrusion
- Polymerization of deconstructed mixed plastic olefin/diene oligomers such as free-radical coupling reactions

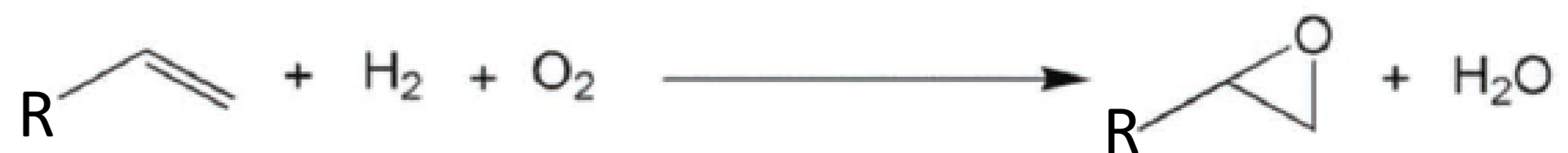
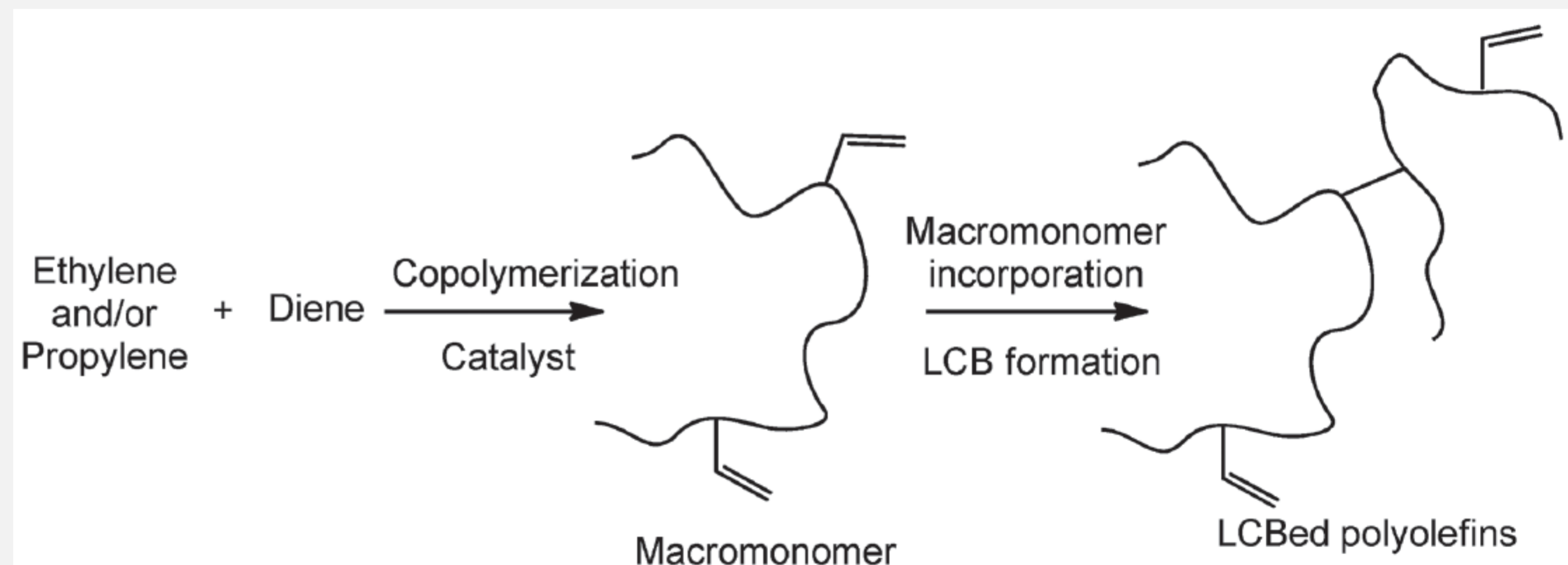
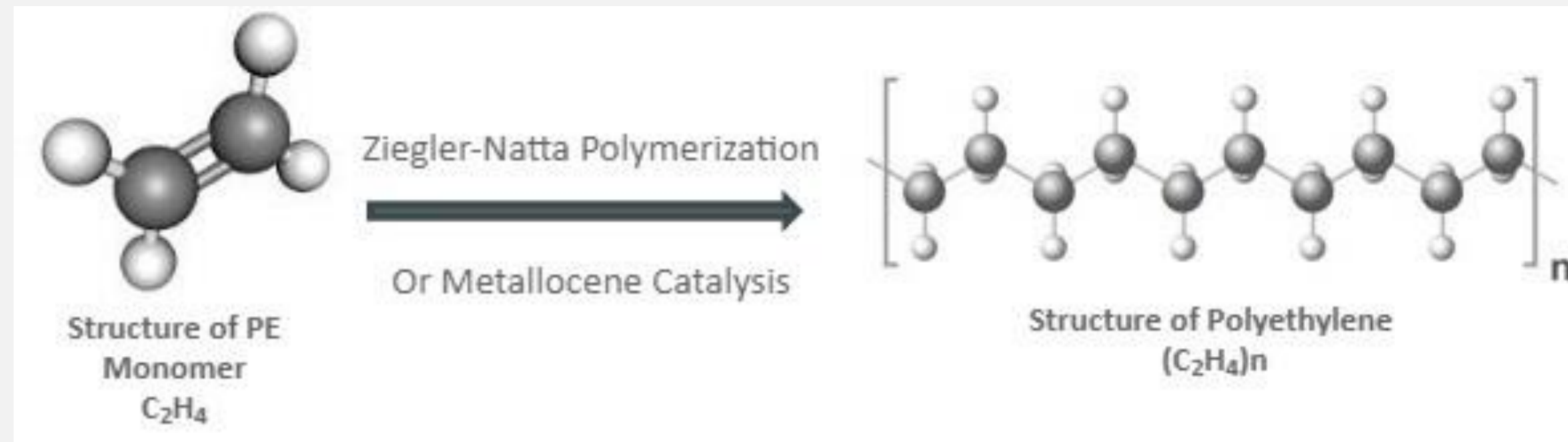


RECONSTRUCTION



Some options based on product profile:

- Metalocene / Ziegler-Natta coupling reactions of C_2 - C_4 deconstructed products to form plastics
- Producing polymers from deconstructed olefin/diene oligomers via epoxy intermediates





QUESTIONS ?