Recycling and Valorization of Carbon- based Solid Waste

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INTRODUCTION AND MOTIVATION:

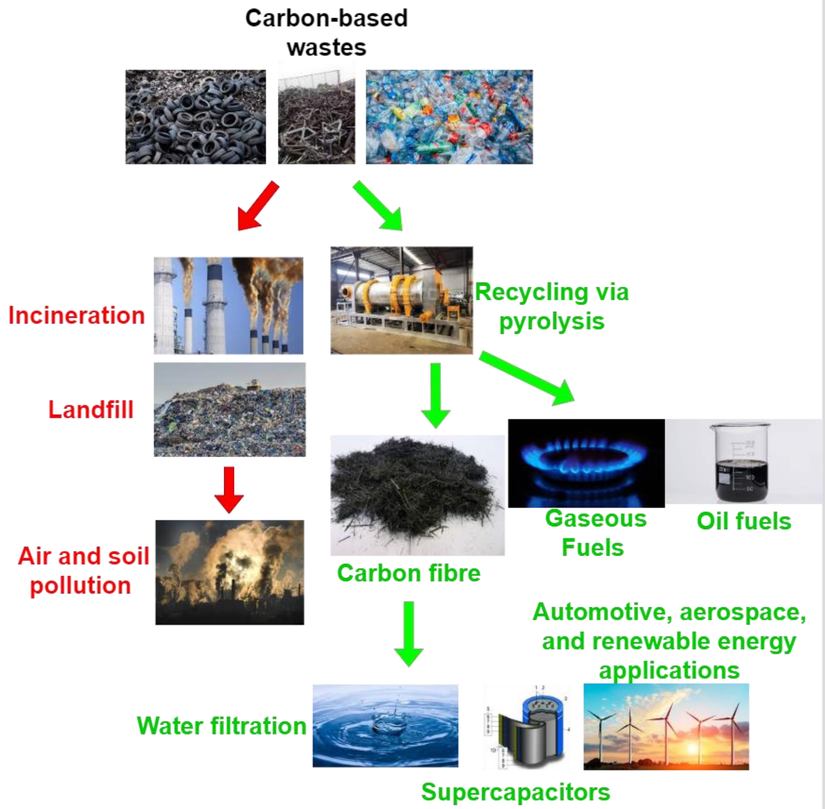


Fig 1. A comparison of a recycling approach to a typical landfill or incineration approach.

- **Carbon-based** waste includes carbon reinforced plastics (CRP), rubber, plastic and food waste.
- Breakdown of US waste:
  - Carbon reinforced plastics: **68,000 tons.**(1)
  - Rubber: **9.1 million tons.**(2)
  - Plastics: **35.4 million tons.**(2)
  - Food: **40.6 million tons.**(2)
- Approximately 50% of each of the above waste types is landfilled, and **less than 15% is recycled**.(2)
  - Leads to soil, groundwater pollution, and air pollution.
  - Damages ecosystems and **adversely impacts human health**.
- Via resource recovery, these solid wastes can be safely managed and **converted into valuable products** as new outputs.

REASEARCH GOALS:

Design and optimization of the carbon-based solid waste valorization process via **self-sustainable pyrolysis**.

METHODS:

- Process can be modified for use with other carbon-based waste.
- Vapor and oil products are recovered to **fuel the heating processes**.

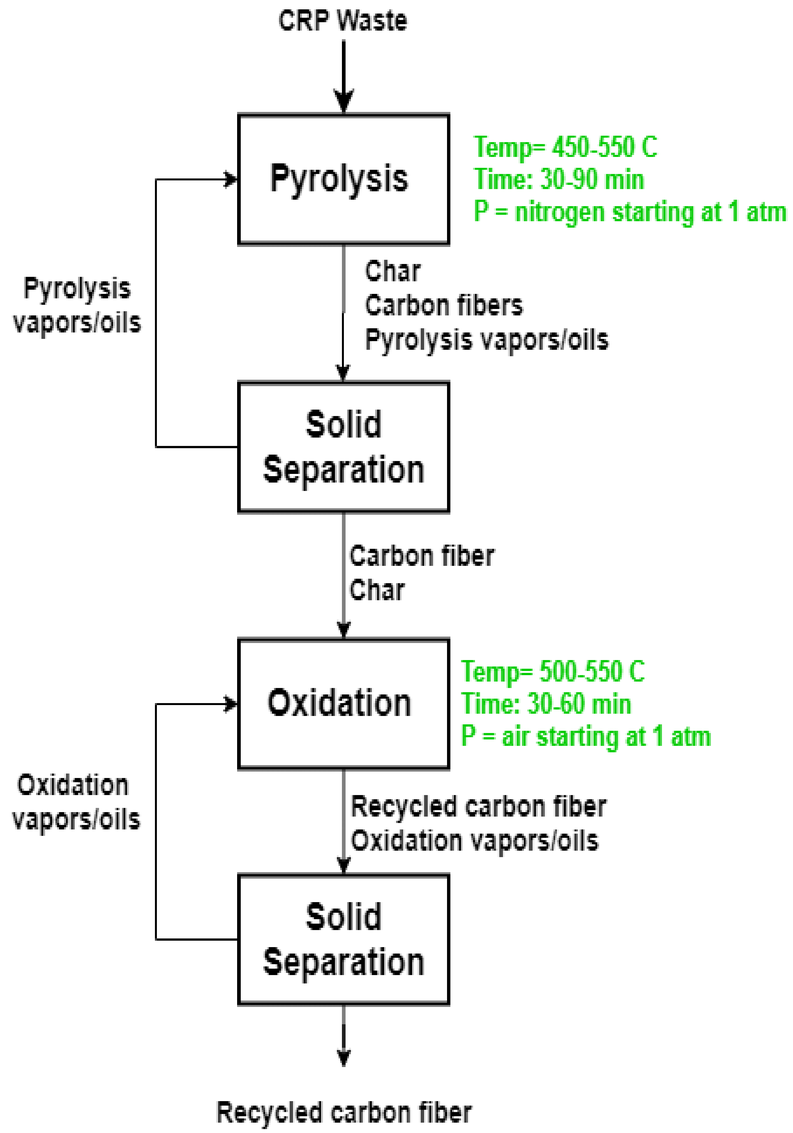
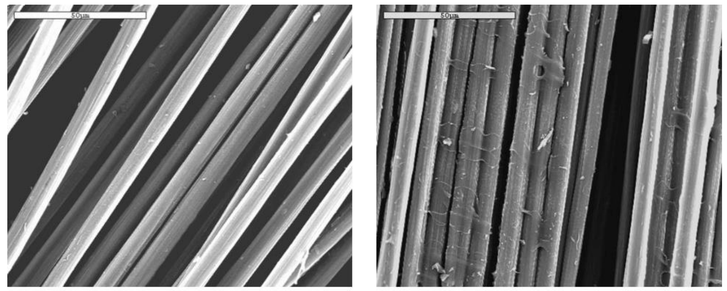


Fig 2. An overview of the carbon-based solid waste recycling and valorization process using a pyrolysis reactor.

EXPECTED RESULTS AND CHALLENGES

- The recycling and valorization process would be **self-sustainable** and would have a minimal environmental footprint.
- The **mechanical properties** of the recovered fibers will not change significantly.
- Challenges include fiber realignment and ensuring the removal of toxins from gas and oil products.



(a) Clean recycled fibres. (b) Recycled fibres with char residue.

Fig 3. A comparison between the recycled fibers with (a) and without (b) an oxidation process. (3)

FUTURE WORK:

- Lab-scale testing and optimization of the recycling process and best operational parameters.
- Conversion of the bench scale to large scale waste valorization process.
- Fabrication of porous electrodes for **water treatment**.
- Fiber alignment and resale into **aerospace, automotive, and energy markets.**

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