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Pyrolysis Of Plastics In A Reactive Gas-Solid Vortex Reactor (RGSVR)

Aim

Quantification of pyrolysis products of plastics (PS, PE, PP) in RGSVR

Justification

Modern-day lifestyle has led to gradual demand for the consumption of plastics. With a nearly twenty-fold surge in plastic products for the past half-century, it is expected to consume 40% of all crude oil by the mid of this century. Such indiscriminate usage of plastics has brought challenges due to vast plastic solid wastes (PSW). However, it has also led to growing concern about the recycling of such products. Prior studies have indicated that pyrolysis emerges as a promising alternative to the chemical recycling of plastics (Fig. 1). Specifically, high volatile matter ($> 86.83\%$) and low ash content ($<2\%$) of conventional plastics offer an attractive route to produce liquid oil.

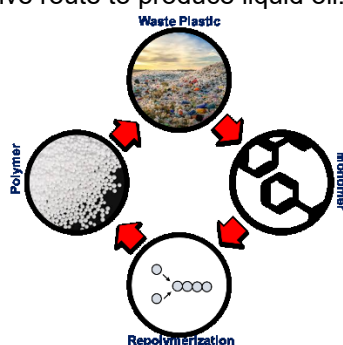


Fig. 1 A typical recycling protocol of PSW

However, as PSW are mostly a plethora of plastics, it is pertinent to optimize and design systems for each of them. As Polystyrene (PS) is a major demand driver, a preliminary study of its pyrolysis was carried out arguably for the first time in a reactive gas-solid vortex reactor (Fig. 2).

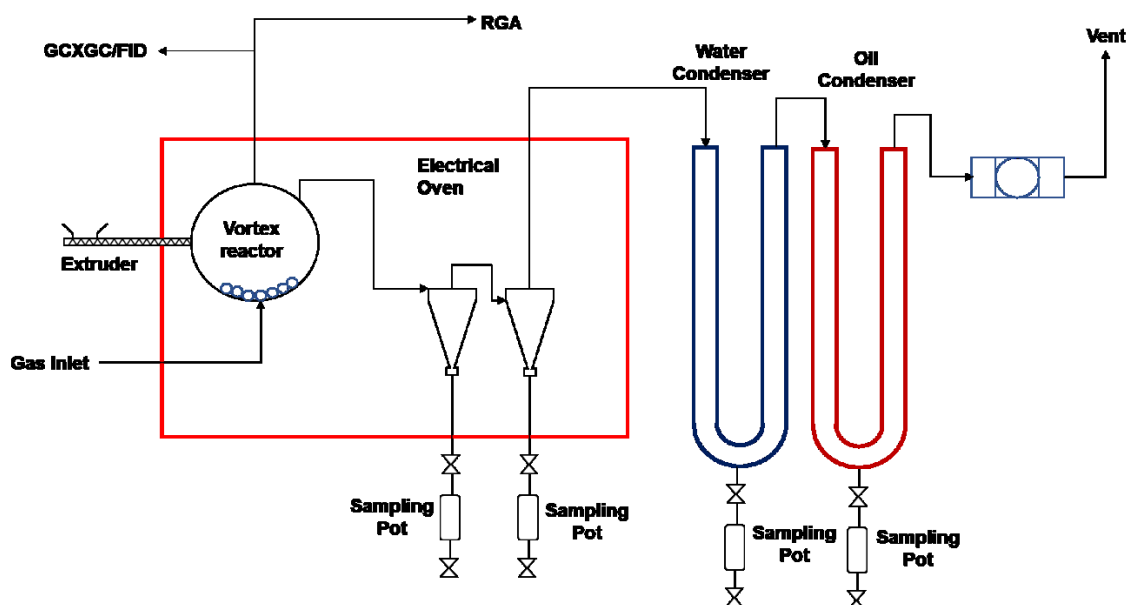


Fig. 2 Schematic layout of plastic pyrolysis in RGSVR

Typically, pyrolysis of polystyrene is known to propagate through initiation, transfer, decomposition, and termination. It may involve random as well as end-chain scissions. Irrespective of temperature, PS products are mostly liquid monomers (~80%). It was reported that liquid styrene production is maximised at about ~450- 500 °C. Nonetheless, it is now proposed to study the pyrolysis of plastics like polyethylene (PE) and polypropylene (PP).

In an RGSVR, gas at a very high velocity is injected tangentially through a specially designed vane ring with slots. Several past studies have established that such a flow pattern ensures high slip velocities, which are conducive to heat and mass transfer. For these attributes, the application of RGSVR for plastic pyrolysis is being sought to be studied.

Program

- Literature study on the background of GSVR and OCM processes.
- To investigate the influence of temperature on the pyrolysis of plastics in RGSVR

Relevant literature

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