

A NOVEL FREE-FALL REACTOR FOR (CATALYTIC) PYROLYSIS OF BIOMASS AND PLASTICS

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Pyrolysis of lignocellulosic biomass has been intensely studied in the last decades to obtain biofuels and biobased chemicals. Various pyrolysis devices have been developed for laboratory studies with batch or continuous operation at scales ranging from mg to tenths of g h⁻¹. We here report the design and operation of a novel free fall (catalytic) pyrolysis reactor system and demonstrate that the concept works very well for the (catalytic) pyrolysis of pinewood sawdust. The unit consists of a pre-treatment reactor, a pyrolysis reactor, an *ex-situ* catalytic upgrading reactor, a solid product collection, a three-stage condensation, and a gas-liquid product separation and collection (Figure 1). It allows for rapid testing with semi-continuous biomass feeding (e.g., 50 g h⁻¹), the opportunity to perform reactions at inert (e.g., using N₂) at atmospheric as well as elevated pressure (e.g., 50 bar). Product yields for sawdust pyrolysis at 475 °C and atmospheric pressure gave an optimum pyrolysis oil yield of 62.6 wt.% on biomass intake. All products were analysed extensively by GPC, GC-MS, GCxGC-FID, and elemental analysis. The possibility to use the unit for *ex-situ* catalytic pyrolysis (at 475 °C) was explored using sawdust as the feed and H-ZSM-5 as the catalyst, yielding 9 wt.% phenols and 11 wt.% of aromatics (such as methoxyphenols and dihydroxybenzenes) on biomass intake.

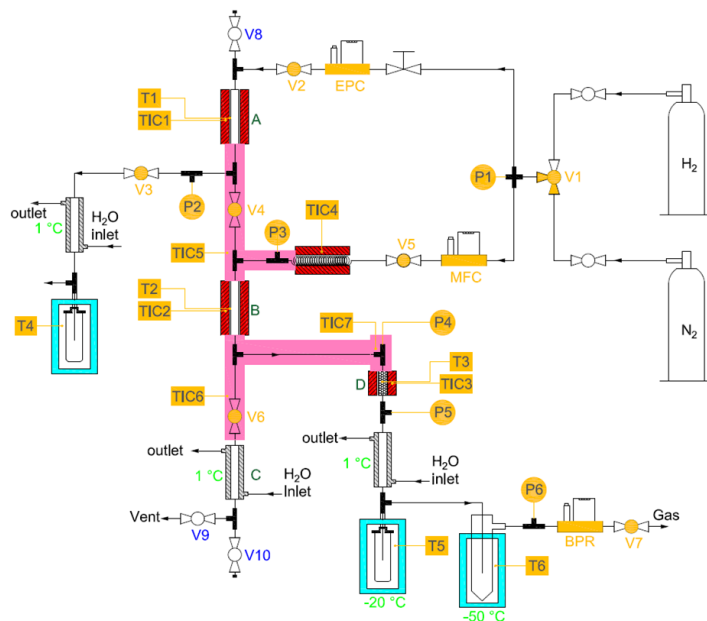


Figure 1 – Schematic representation of the novel reactor concept