

# PYROLYSIS OF PLASTICS WASTES: PRODUCT, REACTORS AND POLLUTION CONTROL

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**ABSTRACT:** About 40 % of plastic products end their lifespan in 1-2 years and become wastes, therefore dealing with the plastics wastes is a common task worldwide. From 1950 to 2015, according to statistics, around 8.3 billion tons of plastics products had been produced, of which 2.5 billion tons of them are still in service while 4.9 billion tons of them were abandoned as waste plastics going to landfills or dumping sites [1]. In China the generation of plastics wastes is about 33 million tons annually, the effective measures for dealing with waste plastics are urgently demanded [2]. In 27 European union countries, 25 million tons of consumed plastics wastes are generated annually. And this number is 150 million tons worldwide [3]. Waste plastics account for 13 % of MSW in USA [3] and 13.5 % in 20 big cities in China [4]. From 2019 the “Zero waste city” plan and municipal solid waste segregation started in China, but when the waste plastics have been segregated as “recyclable wastes”, there is none proper destination for them. Incineration treatment of waste plastics is wasting resources as plastics are made from petroleum. For example, 2.3 tons of petroleum is consumed when producing 1 ton of PP. Recycle oil and chemicals from plastics wastes through pyrolysis can be an economic and convenient solution. Oil from plastics is a good substitute for petroleum to refinery plant. The profit can be 1500-3000 Yuan RMB dependent on product quality. Also, pyrolysis achieves high levels of pollution control compared to incineration. In this review, sometime important issues about recycling oil from plastics including products, reactors and pollution control were discussed.

## 1. PRODUCTS

The pyrolysis products include oil, gas and char for plastics wastes, while oil is chosen as target product because its transportation convenience and high energy density. However, even for the same kind of plastic waste, the oil product would have different components when the reaction parameters such as temperature, heating rate and residence time at high temperature zone change. In fact, the products quality is related to both plastics categories, impurities contents and reactor types in addition to operation parameters. In this review the products from different reactors are compared, and the influence of impurities has been investigated.

## 2. PYROLYSIS REACTOR

Reliable, high quality pyrolysis reactor (PR) is essential for the successful operation of plastics waste pyrolysis plant. The type of PR is also closely related to the efficiency of energy utilization and quality of

products, which is directly related to economic benefits. The reported waste PR include fixed bed PR, rotary kiln PR, fluidized bed PR, etc. [3]. For obtaining higher quality of products and achieving higher capacity, a molten-falling film type reactor has been introduced and its operation performance was discussed.

### 3. POLLUTION CONTROL

Pollution is mainly caused by harmful elements contained in the raw materials. For example, to avoid corrosion of the facilities and contamination of products, PVC is usually strictly controlled. In this work we introduced a new method to remove Cl from PVC before pyrolysis so that Cl contamination can be avoided. The pollution caused by the impurities is also discussed.

### 4. CONCLUSIONS

Waste plastics pyrolysis for oil recycling is reviewed in this paper especially in the aspects of product quality, reactor type and pollution control. The products are closely related to plastic category, reactor type, and impurities the plastics wastes contained when the operation parameters are the same. The proper design of the reactor is important for raising quality of the product and capacity of the plant. Finally, the Cl removal and organic impurities separation are required for the technology reliability.

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