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Syngas From Polypropylene Gasification in a Fluidized Bed

Authors : Sergio Rapagnà, Alessandro Antonio Papa, Armando Vitale, Andre Di Carlo

Abstract : In recent years the world population has enormously increased the use of plastic products for their living needs, in particular for transporting and storing consumer goods such as food and beverage. Plastics are widely used in the automotive industry, in construction of electronic equipment, clothing and home furnishings. Over the last 70 years, the annual production of plastic products has increased from 2 million tons to 460 million tons. About 20% of the last quantity is mismanaged as waste. The consequence of this mismanagement is the release of plastic waste into the terrestrial and marine environments which represents a danger to human health and the ecosystem. Recycling all plastics is difficult because they are often made with mixtures of polymers that are incompatible with each other and contain different additives. The products obtained are always of lower quality and after two/three recycling cycles they must be eliminated either by thermal treatment to produce heat or disposed of in landfill. An alternative to these current solutions is to obtain a mixture of gases rich in H_2, CO and CO_2 suitable for being profitably used for the production of chemicals with consequent savings fossil sources. Obtaining a hydrogen-rich syngas can be achieved by gasification process using the fluidized bed reactor, in presence of steam as the fluidization medium. The fluidized bed reactor allows the gasification process of plastics to be carried out at a constant temperature and allows the use of different plastics with different compositions and different grain sizes. Furthermore, during the gasification process the use of steam increase the gasification of char produced by the first pyrolysis/devolatilization process of the plastic particles. The bed inventory can be made with particles having catalytic properties such as olivine, capable to catalyse the steam reforming reactions of heavy hydrocarbons normally called tars, with a consequent increase in the quantity of gases produced. The plant is composed of a fluidized bed reactor made of AISI 310 steel, having an internal diameter of 0.1 m, containing 3 kg of olivine particles as a bed inventory. The reactor is externally heated by an oven up to 1000 °C. The hot producer gases that exit the reactor, after being cooled, are quantified using a mass flow meter. Gas analyzers are present to measure instantly the volumetric composition of H_2, CO, CO_2, CH_4 and NH_3. At the conference, the results obtained from the continuous gasification of polypropylene (PP) particles in a steam atmosphere at temperatures of 840-860 °C will be presented.

Keywords : gasification, fluidized bed, hydrogen, olivine, polypropyle
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