

2nd World Congress on Petrochemistry and Chemical Engineering

October 27-29, 2014 Embassy Suites Las Vegas, USA

CFD and process simulations of air gasification of plastic wastes in a conical spouted bed gasifier

Abdallah S Berrouk The Petroleum Institute, UAE

Introduction: Apart from coaland biomass gasification, the gasification of plastic wastewhichis commonly deemed asone category of municipal solid waste(MSW), isnot only a promising techniqueto produce syngas because of high content of hydrogen and carbon element but low content of oxygen in plastics which should give rise to high-quality syngas with high heat value, but also an alternate and economicalway for effective treatment of non-decomposable solid waste. The main objective of thisinvestigation is to study numerically air gasification of a plastics feedstock that consists of 100% polyethylene (PE) in a newly designed conical spouted bed reactor. The investigation was carried out using a CFD-based Equivalent Reactor Network (ERN) model developed by the authors in Aspen Plus simulator.

Numerical Methodology: The construction procedure of CFD-based ERN model consists of three steps:

- 1. A computational fluid dynamics (CFD) model is run that accounts only for the hydrodynamics of the conical spouted bed gasifier. Herein, an Euler-Euler two fluid model, closed using the kinetic theory of granular flow, was used to model the hydrodynamics of the gas-solid flow in the gasifier.
- 2. An auto-zoning algorithm is applied to the CFD-generated flow field to create an ensemble of connected zones or compartments.
- 3. Each zone or compartment is considered as an ideal chemical reactor according to the predominant flow pattern in it. Herein, the spouted bed gasifier was zoned into five connected zones and represented by corresponding chemical reactor chosen from Aspen Plus unit database. Detailed homogenous and heterogeneous kineticsof gasification reactions were nested into Aspen Plus in the form of FORTRAN modules.

With the establishedCFD-based ERNmodelfor the spouted bed gasifier, the effects of gasification temperature and equivalence ratio (ER) on air gasification of polyethylene in the conical spouted bed gasifierwerequantified after model validation through compared with available experimental data.

aberrouk@pi.ac.ae