The catalytic pyrolysis of lignin to benzene, toluene and xylene

Zhaolin Fu, Yuanzheng Ge, Youna Shan, Yuanmei Song

[1]Sino-Danish Center for Education and Research, Beijing, China
[2]DTU Chemical Engineering, Technical University of Denmark

INTRODUCTION

With the depletion of the fossil resources, more and more attention has been paid to the development and utilization of biomass. As a kind of nature renewable resources, lignin consists of large amounts of aromatic compounds. It has become a research focus in producing chemicals such as benzene, toluene and xylene (BTX) from lignin through catalytic pyrolysis.

THEORY

Lignin is a complex and cross linked polymer of phenolic monomers through the C-O-C and C-C bond and primarily comprised of: conifer alcohol, coumaryl alcohol, sinapyl alcohol. Formation of BTX through catalytic cracking of lignin proceeds through lignin depolymerization followed by the dehydration, decarboxylation and decarbonylation process. Gases co-produces in this process such as CH_4, CO, H_2O and H_2.

METHODS

The process for production of BTX from lignin is briefly described below. Lignin comes from the residue after ethanol fermentation. Five kinds of catalysts and the lignin particles with diameter smaller than 50μm are performing catalytically pyrolysed in the fixed-bed quartz reactor. The pyrolysis products are analyzed by Gas Chromatogram Mass Spectrum. The equipment is shown in Fig 1.

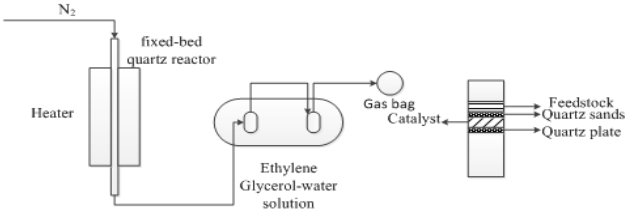

Fig 1 the Experimental Schematic Diagram

The N_2 flows into the reactor as the reaction atmosphere and carry out the product which will get cooled by a two-step condensing. The liquid product finally gets collected in the bottom of the bottles.

RESULT

From the appearance and the test results of the products, the lignin can produce bio-oil. The five catalysts have different performance in producing the BTX. The catalytic pyrolysis of lignin by ZSM-5 catalyst is a promising alternative to produce BTX.