Kinetic Study of Gelatin Waste and Its Pyrolysis Products

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Abstract

With urbanization, the spectrum of waste generated has also grown. Few of the widely practiced methods of solid waste disposal are direct landfill, storage in surface impoundments, physical/chemical stabilization and direct incineration. The problem associated with landfill and incineration techniques are that they emit harmful gases that are detrimental to the environment. In India large amounts of waste go into landfills. This is because of economic considerations as landfills are inexpensive. The Indian scenario of waste collection operates at a efficiency of around 70% and the disposal method is unscientific in most of the rural areas. Due to the inexpensive nature of landfills and unscientific methods adopted in India the impact on environmental would be unfavorable. Incineration has its share of problems in that they release carbon dioxide, carbon monoxide, poly aromatic hydrocarbons, particulate matter and other harmful gases. Waste to energy is the concept now picking up in all developing countries. Many workers have worked on municipal solid waste and ways to dispose them safely and also to have obtained value added products from it. On the industrial front, industries have tried to reduce waste and recover valuable products from waste. The work, which we have undertaken, is industrial disposal issue. Gelatin waste that comes out in the form of netting waste during the manufacture of capsules in pharmaceutical industries is disposed of without any value addition, by way of incineration. This study aims in recovering energy from the waste gelatin.

Pyrolysis is the process of anaerobic thermal conversion of biomass to bio-fuels. In the present study, Gelatin waste obtained as industrial waste is subjected to thermogravimetric analysis in nitrogen atmosphere between 573 – 973 K. From the data obtained, the effective activation energy and pre-exponential factors are calculated. The kinetic parameters are used to calculate the mass loss rate in a pyrolyzer based on their measured temperature histories. A kinetic scheme that involves two parallel reactions and a third reaction for secondary interactions of volatile products and char is used. The effect of heat transfer resistance is included in the model. The calculated mass loss rates are compared to the results obtained from TGA studies and found to be satisfactory.

Keywords: Waste to Energy; Pyrolysis; Gelatin; Activation Energy; Pre-exponential Factor; bio-fuels.