

## Pyrolytic Decomposition Kinetics of Plastic Wastes

Dr. A. K. Ghoshal

Professor, Department of Chemical Engineering and Head, Centre for Energy  
aloke@iitg.ernet.in

### Abstract

Kinetics study is important in order to understand the degradation mechanism, to know the reaction rate and the reaction parameters. Kinetic modelling is extremely important for the selection, design and operation of the reactors for industrial application. Model-fitting and model-free (isoconversional) methods of analysis are typically used for both non-catalytic and catalytic decomposition kinetics of plastics. Information on the optimum kinetics triplet (activation energy, pre-exponential factor, and reaction order) is obtained by model-fitting method and information on the variation of activation energy with conversion is obtained by model-free method. Selection of inappropriate model and initial guess values of kinetics parameters during evaluation of the optimized kinetics triplet may lead to uncertainty in the estimated kinetics triplet. Standard deviation minimization technique (SDMT) is a promising model-fitting technique for estimation of kinetics triplet. Hybrid genetic algorithm (HGA) has been successful to avoid uncertainty on estimation of kinetics triplet. Model-free analysis approach also narrows down the range of guess values of activation energy for optimization using traditional model-fitting methods. The optimized kinetics triplet obtained by the model-free coupled with local optimization method (LOA) is as good as HGA for estimating the kinetics triplet.

### **Key words:**

Hybrid genetic algorithm (HGA); Kinetics triplet; Model-fitting method; Model-free method; Plastics; Pyrolysis