
DEVELOPMENT OF SOLID ACID CATALYSTS FOR THE CONVERSION OF WASTE PLASTICS INTO VALUABLE FUEL RANGE HYDROCARBONS

V. Rekha and N. Lingaiah*

Catalysis Laboratory, I&PC Division, Indian Institute of Chemical Technology, Hyderabad-500007, India

Email: nakkalingaiah@iict.res.in

*Corresponding author. Tel.: +91 40 2719 1722; fax: +91 40 2716 0921

Abstract

The catalytic degradation of waste plastics is carried for the production of potentially valuable hydrocarbons. Alumina-silica based mixed oxide catalysts were prepared and studied for the conversion of waste plastic into fuel oil. The results suggest that the catalysts are highly efficient compared to commercial catalysts. The catalyst is cheap, easy to prepare and reproducible in large quantities.

Keywords: Waste plastics; alumina-Silica catalyst; degradation; fuel oil.

1. Introduction

In recent years the use of plastics increased dramatically and at the same time more waste plastics coming out with widespread applications of plastics. As the most of these waste plastics are non-degradable under natural conditions, it becomes a serious environmental problem. It is necessary to attend this problem of environment and at the same time it is important to utilize the precious carbon source. There are different method in treating the waste plastics such as land filling, incineration, and thermal cracking. Generally thermal cracking can be carried with the aid of a catalyst to get the refined useful products. Numerous papers present the application of various acidic catalysts, such as silica-alumina, zeolites (HY, HZSM-5, mordenite) or other metal oxides [1-4]. The present study related to the development of alumina-silica based catalysts for the conversion of waste plastics collected from municipality.

2. Experimental

Alumina-silica based mixed oxides catalysts were prepared by using physical mixing method. The catalysts were calcinated in air from 400 - 900°C. The catalysts were characterized by BET surface area, X-ray diffraction and temperature programmed desorption of ammonia. The catalysts were evaluated for the conversion of waste plastic into fuel range hydrocarbons.

3. Results and Discussion

The catalytic activities of alumina-silica based catalysts were evaluated for the conversion of waste plastic into fuel range hydrocarbons and the results are presented in Table 1. The activity is explained based on the physico-chemical properties of the catalysts. The results suggest that the catalysts are highly active for the complete conversion of waste plastics with 12-16 min of reaction time. The overall efficiency of the system in conversion of plastics is above 90%. The activity of the catalysts is related to its controlled acidic properties. The results were discussed based on the surface and structural features of the catalysts.

Table 1. Activity profile during catalytic degradation of waste plastics

Quantity of Plastic (g)	Catalyst amount (%)	Reaction Temperature (°C)	Total output time (min)	Quantity of oil (ml)	Density of oil (g/ml)	Efficiency of the system (%)
500	0.2	530	12	450	0.78	90
500	0.5	529	11	475	0.78	95
500	1	532	13	460	0.76	92
500	1.5	530	16	425	0.78	85

4. Conclusions

Alumina-silica based mixed oxide catalysts are active for the conversion of waste plastic into fuels. The catalysts are efficiently converting plastics into oil with very small amount of catalyst. Preparations of these catalysts are relatively easy, reproducible and also cheap.

References

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