DEHYDROCHLORINATION OF POLYVINYL CHLORIDE IN BASIC IONIC LIQUIDS

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1. Introduction

PVC can be dehydrochlorinated through various methods, such as catalytic dechlorination using metal oxides or composite oxides, mechanochemical dechlorination, and chemical method in an alkaline solution[1]. For dehydrochlorination in an alkaline solution, however, volatile and toxic solvents were adopted using this method. Although the methods of hydrothermal and supercritical dechlorination have been developed to increase the dechlorination efficiency, they have high requirements for the equipments[2]. Therefore, the development of environment-friendly methods for highly efficient dehydrochlorination of PVC is an area of considerable importance.

Poly(ethylene glycol) (PEG) has been used as an environment-friendly reaction medium to enhance the dehydrochlorination of PVC in our previous work [3]. Recently, ionic liquids (ILs), i.e., organic salts that melt at or below 100 ^{o}C, have been used in various reactions due to the advantages such as: easy to operate, less energy demanding, and environmentally friendly due to chemical and thermal stability, low vapor pressure and ease of recycling [4]. It had been reported that the stability of PVC would be reduced when blending with ionic liquids [5]. In this paper, 1-Butyl-3-methylimidazolium Hydroxide ([Bmim]OH), a kind of basic ionic liquids, has been adopted for dechlorination of PVC at atmospheric pressure, which is expected to be a promising environmental friendly reactive solvent for highly efficient dehydrochlorination of PVC.

2. Experimental

PVC (SG-1) was obtained from Xi'an Chemical Co., China. The chlorine content of the PVC is 51.5 %. All other chemical materials were of analytical grade. [Bmim]OH has been prepared according to reference [6].

Dechlorination of PVC was carried out in a 100 ml three-neck flask. In a typical reaction, 5 ml [Bmim]OH and 0.15 g PVC were added into the flask, and then the mixture was reacted

at 100 ◦C for 1 h with stirring. The product as black powder was separated by filtration, and washed with deionized water times, then extracted in a Soxhlet extractor with distilled water for 48 h. The dechlorinated PVC (DPVC) was dried under vacuum at 60 ◦C for 24 h before characterization. The chlorine contents in DPVC were measured by the oxygen–combustion–chlorine selective electrode method.

3. Results and Discussion

The effect of ionic liquids on the dechlorination of PVC has been shown in Fig.1. As can be seen, the dechlorination of PVC at 100 ◦C for 1 h only gives a low dechlorination degree (DD) of 13.53 %, while using ionic liquids, the DD increases. Especially, the basic ionic liquid [Bmim]OH shows the highest dechlorination ability (DD: 24.10%).

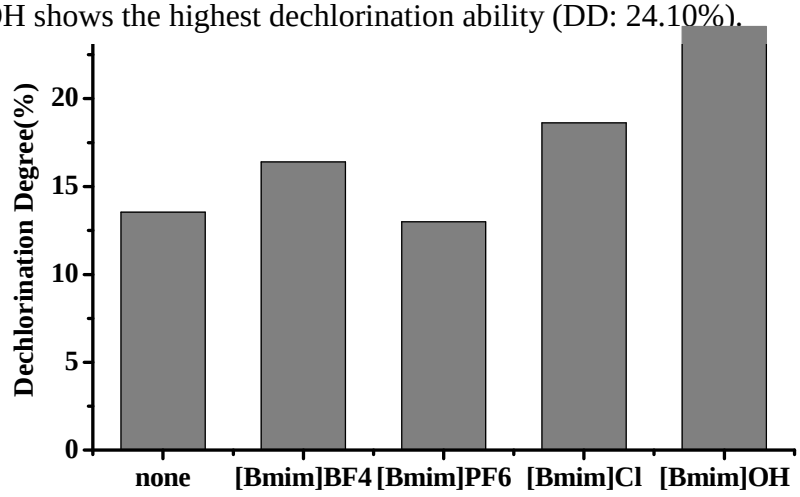

Fig. 1 Effects of ionic liquid on the dechlorination degree of PVC (100 ◦C, 1 h).

Moreover, it can be seen from Fig.2 that the dechlorination degree increases with the increase of reaction time that the dechloriantion degree reaches 55.57% after reaction for 8 h.

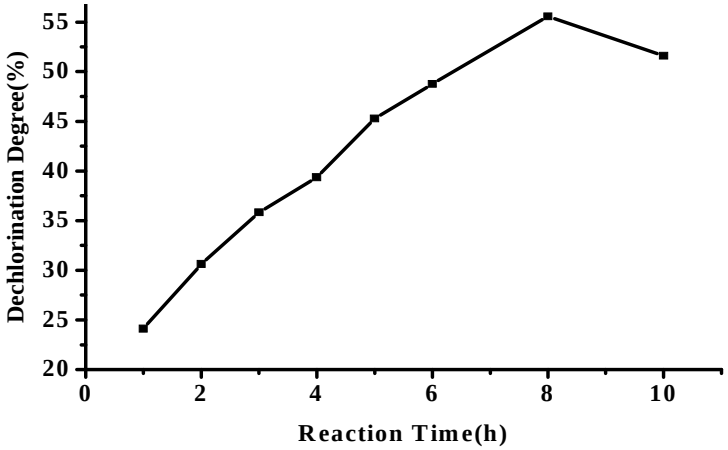

Fig.2 Effects of reaction time on the dechlorination degree of PVC using [Bmim]OH at 100 ◦C.

4. Conclusions

Highly efficient dehydrochlorination of PVC has been achieved under mild reaction conditions using [Bmim]OH as an environment-friendly reaction medium. Especially, no base catalysts have been adopted, which did not generate toxic waste byproducts such as KCl. Preliminary results show that the dechlorination degree increases with the increase of reaction time and the DD reaches 55.57% after reaction for 8 h.

Acknowledgements

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