Synthesis of microporous organic polymers based on chloride – derivatives as structural unit

Huong T.T. Tong,*[1] Tuan N. Tran,[1] Hung V. Do,[2] Loc C. Bui[1]

[1] Hanoi University of Mining and Geology, Hanoi, Vietnam

[2] Vietnam Institute of Industrial Chemistry, Hanoi, Vietnam

Email: tongthithanhhuong@humg.edu.vn.

Abstract: Microporous organic polymers are currently an important class of porous polymers that have been studied extensively. These polymers have advantages of good chemical and physical stability. The high surface area is a salient feature in comparison with traditional porous materials. Due to the predominant characteristics, they have attracted attention in a number of technological applications. In this paper, we present how these organic polymers were synthesized from aromatic compound of 4,4-Bis (chloromethyl)-1,1 Biphenyl 95% (BCMBP) in dichloroethane (DCE) or BCMBP and Dichloro-p-xylene (DCX), and their characteristics. Properties of these polymers and co-polymer were characterized by FT-IR, SEM, TGA, and BET methods. Polymer synthesized show high BET specific surface areas. S_{BET} are high from 1598.36 m^2/g to 1761.34 m^2/g and average pore width from 51.8 - 43.8 Å. These polymers are also stable at around 300 – 350 ^oC.

Keywords: Microporous Organic Polymers, BCMBP, Friedel-Craft alkylation.

1. INTRODUCTION

Microporous solids always are important materials that have been interested. Microporous organic polymers are important class, which are networks constructed from small organic building blocks. The materials exhibit a large surface areas, small pore sizes and low density. These characteristics let the microporous organic polymers have attracted attention due to their potential use in applications such as catalysis (Li B., 2012), chemical separations (Luo Y, 2012), gas storage (Chen Q., 2012), electrical energy storage (Venkata K.R., 2014). During last decades, microporous organic polymers have been developed in to different groups, such as: hypercross-linked polymers (HCPs), polymers of instrinsic microporosity (PIMs), covalent organic frameworks (COFs) and conjugated microporous polymers (CMPs) (Feng X., 2012). The design and synthesis of novel building blocks has been recognized as one of the most important driving forces for the great advance in microporous organic polymers. Thus, numerous microporous polymer based adsorbents have been developed, mainly using approaches of Friedel-Crafts alkylation, palladium catalyzed Suzuki-Miyaura reactions, Sonogashira-Hagihara and Buchwald-Hartwig cross-coupling reactions, Nickel catalyzed Ullmann coupling reactions, and oxidative coupling polymerization (Robert D., 2012). Nevertheless, it still remains a great challenge to synthesize microporous organic polymers with rational design at molecular level by using cost-effective and simple pathways for the polymerization. The hypercross-linked polymers are often synthesized from aryl halides and aromatic hydrocarbons mixture (Robert D., 2012). However, this report shows the synthesis of microporous organic polymer network directly synthesized from 4,4-Bis (chlorometyl)-1,1 Biphenyl (BCMBP) in DCE solvent under Friedel-Crafts alkylation promoted by iron (III) chloride.

2. MATERIALS AND METHODS

2.1. Materials

All chemical reagents were commercially available. 4,4-Bis (chlorometyl)-1,1 Biphenyl 95 % (BCMBP) was purchased from Aldrich. Dichloro-p-xylene (DCX) 98% and dichloroethane (DCE) 99 % were obtained from AK Scientific Inc. Iron (III) chloride 98 % and methanol 99 % were obtained from P.R.China.