Organic Template Free Synthesis of ZSM-5 from Calcinated Indonesian Kaolin

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Abstract. A pure ZSM-5 has been synthesized from calcinated kaolin without organic template. The synthesized samples were characterized using X-ray diffraction (XRD), Fourier Transform Infrared (FTIR) spectroscopy, nitrogen adsorption/desorption technique, and Transmission Electron Microscopy (TEM). The results showed that microporous ZSM-5 obtained by silica adding through three-step crystallization at 100-120-150 °C for 24 h respectively.

INTRODUCTION

ZSM-5 zeolite generally synthesized using commercial chemicals as silica and alumina sources. Tetraethylorthosilicates (TEOS) was the most chemical used as silica source [1, 2]. Other materials also used as silica sources like ludox [2], water glass [3], and SiO₂ hydrogel [4]. As alumina source, some researchers used of aluminum isopropoxide (AIP) [5] aluminum sulphate (Al₂(SO₄).18H₂O) [3] sodium aluminates (NaAlO₂) [5], and other chemicals contained aluminum.

On the other hand, ZSM-5 could be synthesized using natural materials as starting materials, such as rectorite [6], rice husk ash [7], and kaolin [8,9]. The utilization of natural materials as a precursor in zeolite synthesis is more advantageous than chemicals because it is more economical.

ZSM-5 was typically synthesized using organic template as MFI structure directing agents, like tetrapropylammonium bromide, TPABr [6] or tetrapropylammonium hydroxide, TPAOH [5]. The synthesis method without MFI structure directing agents have been successfully developed and conducted [9], however it still required surfactant cethyltrimethylammonium bromide (CTAB) as mesophase agent. In the previous research, we have been successfully prepared the high crystallinity of ZSM-5 from Indonesian kaolin through treatment with the addition of sodium fluoride [10].