

Research Article

## Direct Synthesis of Highly Crystalline ZSM-5 from Indonesian Kaolin

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### Abstract

Direct synthesis of ZSM-5 from Indonesian kaolin without calcination for the formation of metakaolin was done through the addition of an alkaline solution (sodium fluoride and sodium hydroxide) and the fusion using sodium hydroxide. Crystallization was conducted through hydrothermal method at 80 °C for four days. XRD diffractogram and FTIR spectra showed that the addition of sodium fluoride solution in the ratio Si/Al = 100 could produce highly crystalline ZSM-5, whereas the use of a sodium hydroxide solution and fusion process did not produce the crystalline ZSM-5. Copyright © 2017 BCREC Group. All rights reserved.

**Keywords:** Kaolin; Sodium fluoride; Synthesis of ZSM-5; crystalline ZSM-5

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### 1. Introduction

ZSM-5 are widely applied as a catalysts in a variety of industrial processes and environmental protection [1,2]. Generally, the ZSM-5 are synthesized with mole ratio of Si/Al over 5 and using TPA<sup>+</sup> cation as structure directing agent (SDA) [3]. Zhu *et al.* [4] have synthesized ZSM-5 by adding tetraethylorthosilicate (TEOS) as silica source and aluminum isopropoxide as an alumina source. Some researches use natural material as silica and alumina sources for examples rectorite [5,6], rice husk ash [7,8], kaolin [9,10], and diatomaceous earth [11]. The use of natural materials as silica and alumina

source in synthesis of zeolite is more advantageous than the commercial chemical because it is more economical.

Kaolin has been used as silica and alumina sources in synthesis of ZSM-5 through calcination of kaolin to be metakaolin in an attempt to activate of kaolin [9,10,12]. Liu *et al.* [12] synthesized ZSM-5 from metakaolin by adding silica and alumina, Pan *et al.* [9] used dealuminated metakaolin, and Hartati *et al.* [10] used metakaolin by addition of silica. In this research, a novel method of ZSM-5 synthesis was proposed directly without pretreatment such as calcination or the formation of metakaolin. Silica of TEOS was added to complete the mole ratio of Si/Al in the formation of ZSM-5.

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