

CHAPTER V

CONCLUSION

Fe-SBA-15 material with iron incorporated in the SBA-15 framework structure can be prepared by direct synthesis method. To obtain the SBA-15 structure, the gel mixture, which is composed of iron source (iron(III) nitrate or iron(II) chloride), silica source (tetraethylorthosilicate, TEOS), triblock copolymer template ($\text{PEO}_{20}\text{PPO}_{70}\text{PEO}_{20}$), and hydrochloric solution, must be aged at 40 °C with continuously stirring for 24 h and then kept in the static condition at 100 °C for 48 h. The formation of ferrisilicate complexes by pre-mixing of iron source and silica source in acid solution is a key to incorporate iron into silicate framework.

The factors affecting the morphology, iron content, and crystallinity of Fe-SBA-15 material are pH of gel, type of iron source, and the amount of iron in gel. The amount of iron in Fe-SBA-15 material strongly depends on the pH of gel. From the elemental analysis, the iron content is increased with increasing the pH of gel. Moreover, the pH of gel also affects the crystallinity and morphology of the material. The low pH provides high crystallinity and the rope-like morphology. It is found that iron, at a particularly high amount, disrupts the arrangement of crystal. The higher the amount of iron in gel, the higher the disorder of structure. There is no significant effect of using different iron source because Fe^{2+} is converted to Fe^{3+} during crystallization process. Therefore the optimal condition for synthesis of Fe-SBA-15 is as follows: the gel pH of 2.0 or 2.5, the Si/Fe ratio of 90, and Fe^{2+} and Fe^{3+} as iron source with the aging step and pre-mixing of iron source and silica source.