

## CHAPTER V

### CONCLUSIONS AND RECOMMENDATIONS

#### 5.1 Conclusions

Iron-SBA-15, titanium-SBA-15, and bimetallic 0.01Fe-0.01Ti-SBA-15 were successfully synthesized via the sol gel process at room temperature using silatrane, ferric chloride, and titanium isopropoxide as silica, iron, and titanium sources, respectively, non-ionic surfactant Pluronic 123 as a structure-directing agent in highly acidic condition. SAXS and FE-SEM results showed that all samples still maintained 2D hexagonal mesoporous structure. N<sub>2</sub> adsorption-desorption results showed type (IV) isotherm with H1 hysteresis loop, exhibiting uniform pore as well as high surface area (631–763 m<sup>2</sup>/g), large pore volume (0.621–0.971 cc/g), and pore size (3.93–5.21.nm). The results from DR-UV confirmed the metal incorporation with no extraframework. The highest phenol conversion at 37.96% with 100% selectivity of benzoquinone was obtained when using 1:1 molar ratio of phenol/H<sub>2</sub>O<sub>2</sub> and 30 mg of 0.01Fe-0.01Ti-SBA-15 at 30 °C for 20 min. Metal leaching is not observed. However, the catalyst can not be regenerated due to the less hydrothermal stability.

#### 5.2 Recommendations

According to the results of this work, it is recommended to use these catalysts in other applications or other catalytic reactions so as to obtain a better appropriate reaction. Moreover, other types of metals should be incorporated into SBA-15 framework and studied other applications that are suitable for its properties.