CHAPTER VIII
CONCLUSIONS AND RECOMMEDATIONS FOR FUTURE WORK

Metal alkoxides synthesized by the OOPS process were successfully used as precursors for synthesizing extremely high surface area MCM-41, Ti-MCM-41, Mo-MCM-41 and $Bi_{12}TiO_{20}$. MCM-41 structure is formed only in a narrow range of ion concentration and a wide range of temperature. The higher the temperature used, the larger the pore size obtained. At the mixing temperature of 100°C, high quality MCM-41 is observed. Surfactant concentration affects the BET surface area while no effect on pore size was observed. The surface area and the pore volume of MCM-41 obtained are as high as 2400 m^2/g and 1.72 cc/g, respectively. High surface area, precise structure and large pore volume make this material useful in catalysis area since higher surface area will allow higher catalyst concentration to be present. From that reason, titanium and molybdenum glycolate precursors were successfully used to prepare the Ti-MCM-41 and Mo-MCM-41 catalyst with high content of metal incorporated. The BET surface area of prepared catalysts was very high. For Ti-MCM-41, the Ti incorporation is mainly in the form of isolated Ti species when Ti loading is not more than 10% as probed by DRUV. The Ti incorporated in the framework is as high as 35% while still absence the extra-framework. For molybdenum loaded MCM-41, the highly dispersion of molybdenum onto MCM-41 supports has been successfully prepared. The structure of hexagonal array still retained even 10 mol% of Mo or ≈0.265 g/g of MoO_3/SiO_2 loaded. The surface areas of the supports are very high (> 1600 m^2/g) which open the opportunity to incorporate high content of metal on the surface. High contents of metals in Ti-MCM-41 and Mo-MCM-41 catalysts are found to be effective catalysts for the peroxidative bromination test. As expected, the activity of catalyst that presence higher concentration of isolated metal species gave higher catalyst activity. In chapter VII involved the synthesis of ceramic catalyst from metal alkoxide precursor. $Bi_{12}TiO_{20}$, having the sillenite structure and successfully synthesized by co-precipitation. The best pH for preparation of pure phase sillenite structure is 3-6. This catalyst shows much higher rate of photocatalytic activity for photodegradation reaction of 4-nitrophenol (4-NP), as compared to TiO_2 and Bi_2O_3. Photodegradation of 44 ppm of 4-NP is essentially complete in less than 30 min.

Recommendations for future work

1. Functionalized pore wall of MCM-41 with covalent binding of active species, su ch as, an organic amine for using as basic catalyst, is an interesting technique since it could obtain a very stable material while maintaining the meso-structure.

2. Synthesis of controllable particle size MCM-41 should be further studied since macro-structure is an important factor in catalyst process.

3. Other types of catalysts need to be further studied for using in other catalyst processes, such as, hydrotreating process.