

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The following conclusions emerge from this study:

1. The addition of 0.4 wt% sulfur as sulfur compounds affects hydrodenitrogenation of quinoline on commercial nickel-molybdenum/alumina catalyst. The quantities of quinoline, 1,2,3,4-tetrahydroquinoline and decahydroquinoline are decreased while the quantities of 5,6,7,8-tetrahydroquinoline, o-propylaniline, propylcyclohexane and propylbenzene are increased. The change in catalyst activity is reversible.

2. The effects of sulfur compounds on hydrodenitrogenation of quinoline depend on the feature of sulfur compounds and can be stated as follows:

2.1 Comparison of structure of sulfur compounds, straight chain sulfur compound (ethyl sulfide) and cyclic sulfur compound (thiophene), shows that straight chain sulfur compound has stronger effect (as described in 1.) than cyclic sulfur compound due to its mechanism of hydrodesulfurization and resonance effect.

2.2 Comparison of number of sulfur atom, methyl sulfide (1 sulfur atom) and methyl disulfide (2 sulfur atoms), shows that methyl disulfide has stronger effect (as described in 1.) than methyl sulfide due to its higher electron density inside molecule.

2.3 Comparison of number of carbon atom is divided into two groups:

The first group consists of methyl disulfide (2 carbon atoms) and carbon disulfide (1 carbon atom). Methyl disulfide ($\text{CH}_3\text{-S-S-CH}_3$) has stronger effect (as described in 1.) than carbon disulfide (S=C=S) due to its

lower bond energy.

The second group consists of methyl sulfide (2 carbon atoms) and ethyl sulfide (4 carbon atoms). Ethyl sulfide has less effect than (as described in 1.) methyl sulfide due to its hindrance effect.

5.2 Recommendations

1. The quantities of sulfur compounds should be varied in order to study effects of the concentration of sulfur compounds.

2. The same set of experiment should be studied with other types of sulfur compound and hydrodenitrogenation catalyst.

3. The more different of feature of sulfur compounds should be studied. For instance, the effects of structures which consist of equal sulfur atoms but different carbon atoms should study between methyl disulfide and butyl disulfide.

4. Effects of other additives on hydrodenitrogenation of quinoline, such as aromatic hydrocarbons and oxygen compounds, should be studied.

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