

## CHAPTER V

### CONCLUSION AND SUGGESTION

#### 5.1 Conclusion

The collection of volatile components that may cause mal-odor from natural rubber was carried out using the headspace technique. The volatile samples were then subjected to analysis by Gas Chromatography (GC) and Gas Chromatography / Mass Spectrometry (GC/MS).

Three types of rubber sample based on the process of production were used; cup lumps, ribbed smoke sheet grade 1-5 and block rubber (such as STR5L, STR5, STR10, STR20 and deproteinized rubber). 51 components that cause mal-odor from natural rubber were found. The identities of some components have been established by comparison of their retention time and mass spectra data with those standard substances or reference library. They included aliphatic compounds, volatile fatty acid (VFA) and aromatic compounds. The major cause of mal-odor in cup lumps (giving the strongest bad smell) were volatile fatty acid such as acetic acid, propionic acid, isobutyric acid, butyric acid, isovaleric acid and valeric acid, benzylhydrazine, ethylamine. They were also discovered in all samples with varied quantity. Unlike other samples, aromatic compounds were found as the major cause of mal-odor from the smoke rubber samples.

The odor-reducing substances were used carbon black, chitosan, benzalkonium chloride, sodium dodecyl sulphate(SDS), cyclodextrin and zeolite13x. These substances were mixed with rubber sample (STR20 and Smoke5) in the ratio of 1.5 and 5.0 phr by two-roll mill. According to GC analyses and olfactometry testing, the efficient odor-reducing substances were carbon black, chitosan, and zeolite13X.

The mechanical properties such as stress-strain, stress at 300% modulus, hardness and specific gravity of vulcanized rubber after being mixed with the odor-reducing substances were tested. Chitosan, carbon black and zeolite 13x were found to act as good reinforcing fillers. Hence, they can improve hardness and stiffness of rubber. While SDS increased the strain value but reduced the hardness of rubber.

## 5.2 Suggestion

This part of data suggested that it is quite feasible to incorporate some substances that can reduce mal-odor effectively without causing adverse effect on mechanical properties. From the practical standpoint, it is necessary to consider the price as well as applications.

In order to absolutely verify the components that cause mal-odor, which have very low polarity and small size, it is necessary to use an appropriate column for characterization by GC, GC/MS.

For the practical purpose, further detail studies on a few aspects involving odor-reducing substance should be carried out, for example, the effect of the substance quantity on odor reduction efficiency. Incorporation of odor-reducing substance into natural rubber latex is also another experiment that should be attempted due to the fact that it should be best to eliminate the source of odor from the beginning of process.