

CHAPTER V

CONCLUSIONS

5.1 Preparation of Natural Rubber Sheet

Natural rubber sheet can be prepared by electrodeposition method. The application of a potential difference between the two electrodes causes the negatively - charged rubber particles to move toward the anode. The natural rubber sheet prepared by this process can be grown to various thickness and weight on the working electrode (anode) of the cell using different current rates which can be controlled by various potential application (voltage). The thickness can also be controlled by varying the period of time during which a current is applied across the cell. As the thickness of the natural rubber sheet increases, the surface of the natural rubber sheet becomes nodules.

It is observed that, the thickness of NR sheet products formed depends on

- i) the potential application (voltage) between two electrodes in the coagulation of natural rubber latex;
- ii) the time during which a current is applied across the cell.

5.2 Preparation of Conductive Natural Rubber

5.2.1 Preparation of Conductive NR Sheet by Electrochemical Method

The preparation of CNR sheet was performed by electrochemical process, a porous medium of NR sheet was first obtained by concentrated electrodeposition method at 4 volts applied across the electrochemical cell for 4 minute coagulation time. This NR sheet is later employed as host for conducting PPy composition by addition of 0.05 M of pyrrole monomer to the electrochemical cell.

It can be concluded that, the conductivity of the prepared CNR sheet depends on concentration of LiClO_4 and oxidation potential of the solution as well as reaction voltage, reaction time, reaction temperature and atmosphere (in nitrogen gas). The most suitable conditions is using reaction medium of 2.00 M LiClO_4 in methanol at 25°C with nitrogen gas flow for 6 hr and applying a voltage of 4 volt to a palladium (Pd) working electrode. The CNR sheet obtained shows conductivity as high as 7.9×10^{-3} S/cm. The electrical conductivity of this CNR sheet is expected to be strongly dependent on the following three factors :

- 1) the penetration of pyrrole solution (pyrrole monomer and electrolyte) into the pores of NR sheet to generate a PPy network;

2) the suitable reaction condition for electrochemical polymerization to generate a PPy network on NR sheet;

3) the other effect such as the decrease stability of the conductivity of CNR when the time passes by (time - decay), acid or base treatment and moisture. These polymers should thus be kept in desiccator in order to impede the charge decay.

5.2.2 Preparation of CNR disc by Chemical Dissolution Method

Powder PPy can be synthesized by chemical oxidation reaction in 2.5 M FeCl₃ in methanol at 0°C for 20 minute [26]. After that it was employed in the blending with coagulated NR sheet by chemical solution method at various pyrrole contents (by weight percent). Finally, it was formed into CNR disc. It is evident CNR sheet can be prepared electrochemically better than chemically. The physical appearance and conductivity of CNR depend upon the preparation route employed. The chemical solution route leads to CNR disc, while the electrochemical route provides free - standing CNR sheet. The electrochemically prepared CNR sheets generally possesses higher conductivities and mechanical strengths than those prepared via the chemical dissolution method. The use of the electrochemical synthesis is, however, limited by size, shape, and nature of the electrode involved as well as the difficulty in preparing thick sheets.

5.3 Suggestions

From the observation, it is suggested that, the properties of CNR can be improved through electrochemical synthesis in order to obtained highest conductivity so that it may substitute for conductors or semiconductors in a wide variety of electrical and electronic devices. Potential advantages of conductive or semiconductive polymer lie in their light weight less brittle and ease of manufacturing can be accomplished. It should be further studied in the following aspects;

- 1) effect of a surface active pyrrole on the conductivity of natural rubber composites by different processing method;
- 2) effect of nature of different liquids (solvent) leads to the efficiently of the adsorption on the pores of all the specimen (NR sheet);
- 3) modification of surface of the pores of the host polymer (NR sheet) by using electrodes of various size and types.

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