# CHAPTER V

## CONCLUSIONS

Six common post-consumer plastics wastes namely PET, HDPE, PVC, PP, PS and ABS selected for this study were hydrophobic in nature. PP and HDPE could be separated from mixtures plastics by density separation but the other plastics could not because of their densities and surface energy limitation.

It was possible to separate PET from PVC through selective flotation by using calcium lignosulfonate as a wetting agent and methyl isopropyl carbinol as frothing agent. Similarity, mixture of ABS and PS could also be separated from each other by selective flotation. CaLS can dramatically reduce liquid surface tension. The depressant effects of wetting agent on the plastics were results of the reduced surface tension and adsorption on the plastics surface. The CaLS molecules adsorbed on the plastics surface expose some of their polar groups oriented toward the aqueous phase, hence making the plastics surface hydrophilic. Electrostatic interaction and van-der-Waals force are the main interactions between CaLS and plastics surfaces. According to **Figure 4.18** and **Figure 4.19**, CaLS changed the wettability of plastics in different ratio, which confirmed the selective adsorption on plastics surface of CaLS.

However, the separation of ABS/PS required, ethyl alcohol, for modifying density of medium. The depressing effect of CaLS on plastics was attributed mainly to its adsorption on plastics surface. The CaLS molecules absorbed on plastics surface probably exposed the polar groups adjusted towards the liquid phase, hence making the plastics surface hydrophilic. Other very important parameter was conditioning time of the plastics mixture. Longer conditioning time made all plastics too hydrophilic, which was not desire. Because successful plastics separation by selective flotation technique necessitated made each plastics to hydrophilic state but another maintained in a hydrophobic state. Therefore, hydrophobic plastics floated to the surface of the medium but hydrophilic plastics remained in the bottom of the flotation column.

Meanwhile, higher flotation column reduced the bond between plastics surface and air bubbles. This means that hydrophobic plastics; should be floated to top of the column, could not attach the air bubble through the surface of the medium solution and fall down to the bottom. Hence, hydrophobic plastics still contaminated with hydrophilic plastics.

In **Figure 5.1**, the purposed flow chart in this study is presented. The summaries of the experiment were shown below:

i) PP and HDPE were first separated from the plastics m ixtures by 50 %v/v LMS.

ii) While, PET, PVC, ABS and PS still mixed together. PET and PVC were separated from ABS and PS by 20 %w/v DMS.

iii) Mixture of PET and PVC was separated individually by 500 mg/l CaLS at pH 11, conditioning time 3 minutes, 0.1 %w/v $CaCl_2$ and 0.02 ml of MIBC.

iv) Furthermore, PS was separated from ABS by 200 mg/l CaLS at pH 7 conditioning time 4 minutes and 0.1 %w/v $CaCl_2$. These results of sink-float method and selective flotation separation were also summarised in **Figure 5.1**.

Clean, pure plastics, which was separated from the mixed post-consume plastics wastes were the suitable raw materials to recycling plastics. Thus, all plastics wastes must be separated prior to recycling. In general, there are many types of plastics that used in many applications in daily life so just six plastics separation method in this work is n ot enough. Furthermore, there are other wetting agents that can be used to separate plastics wastes. So in the future work, CaLS and types of plastics should be change to the others for covering the all plastics wastes.

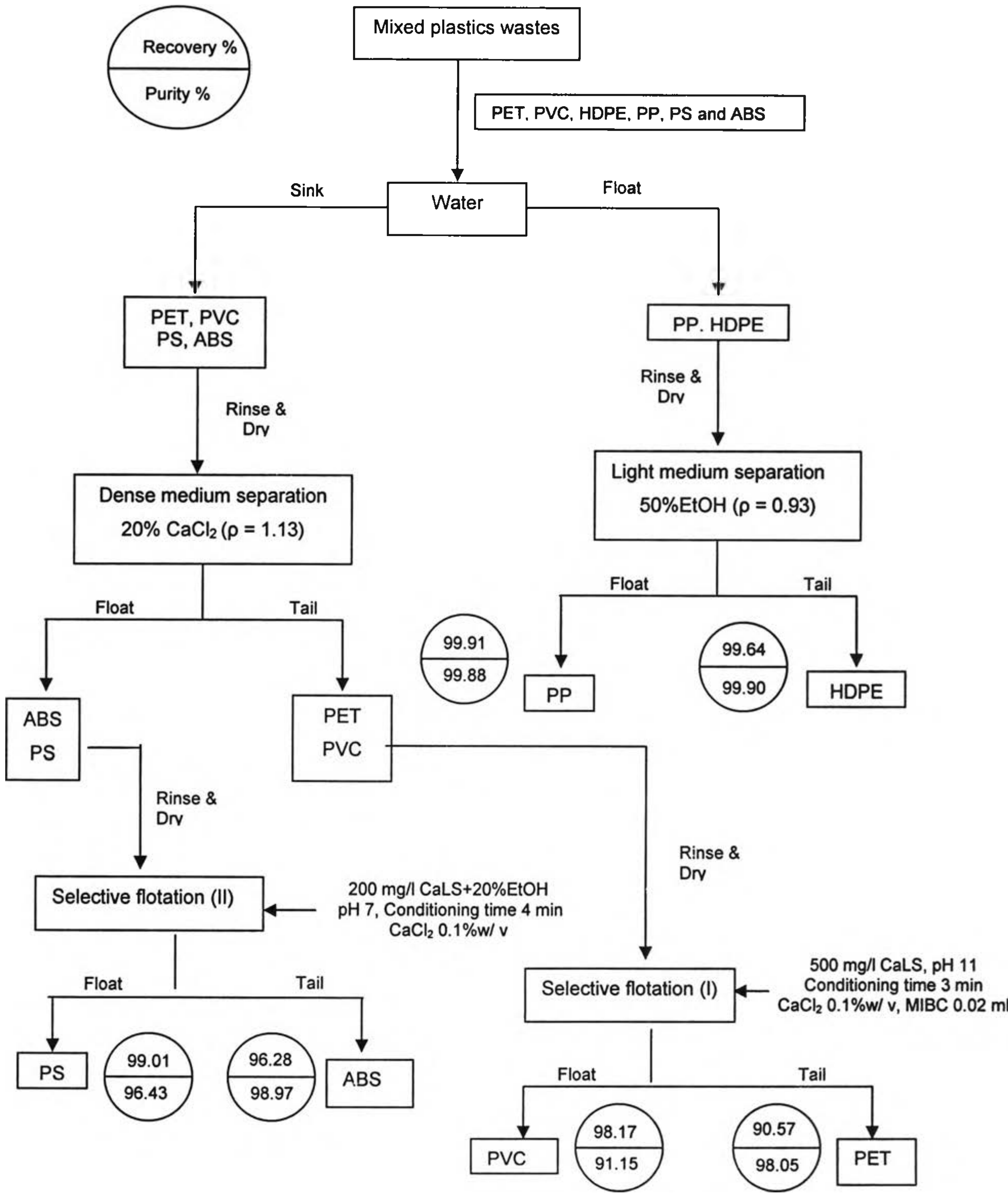


**Figure 5.1** Proposed flow chart for separation of plastics from mixtures by combination of sink-float method and selective flotation technique