CHAPTER V

CONCLUSIONS

1. The addition of virgin HIPS to HIPS scraps can improve the properties of HIPS scraps very slightly. The addition of virgin HIPS leads to a decrease in the melt flow rate, an increase in the Izod impact strength and elongation. The Vicat softening point, the tensile strength at yield and the tensile strength at rupture do not vary much.

2. The recycling/ reprocessing process of HIPS scrap causes some changes in the mechanical properties. Its effect is only minor in the tensile strength at yield, the tensile strength at rupture and the elongation at break. Further recycling and reprocessing results in a detrimental problem of decreasing the impact property. This is due to the increase deterioration induced by the intense shear stress during processing in the injection mold. The greater the number of recycling passes, the lower the Izod impact strength was found.

3. As the number of recycling increases, the melt flow rate of HIPS scraps are gradually increased but the Vicat softening point does not change significantly. The recycling process has also pronounced effect on the reduction of the weight average molecular weight. It is believed that the degradative process was brought about by the heat during processing and chain scission. As a consequence of chain scission, the melt flow rate is inevitably increased.

4. The first pass of post industrial scrap tends to show properties greatly deviated from those of the original virgin material, i.e. the tensile strength at rupture, the elongation at break, the melt flow rate. This is believed to be induced by the titanium dioxide, the initial additive in Scrap B. As it passed through further processing, titanium dioxide was believed to be better dispersed in the materials.

5. Several passes of processing and recycling result in poorer color. An increase in yellowness of recycled HIPS is observed in non-pigmented scraps but the increase is not clear in the pigment-added scrap. This is evidently an important finding on color modification which is one of the most important points for recycling materials.

6. The addition of both SBS block copolymers as an impact modifier is effective in enhancing the Izod impact strength of both scraps. This advantageous effect is believed to be imparted by the butadiene elastic behaviour in the SBS block copolymer. However, the addition of SBS block copolymer has also been found to effect other properties namely :-

6.1 The tensile properties decreases with the SBS block copolymer. The change in the tensile strength at yield is clearly apparent when the amount of SBS block copolymer is applied upto 5%. The elongation at break increases with the increasing concentration of SBS block copolymer. The hardness of the mixture also decreases with the amount of SBS block copolymer due to the softness and toughness imparted by the butadiene content in SBS block copolymer. Increasing the amount of SBS block copolymer means increasing the rubber content in the mixture. The higher the amount of SBS block copolymer, the lower is the hardness.

6.2 The two SBS block copolymer selected for the present study have quite opposite effect on the melt flow rate and the Vicat softening point of the HIPS scraps. While SBS-I tends to increase the flowability of HIPS scraps, the SBS-II shows an opposite effect. The greater the amount of the SBS block copolymer added to the system, the more pronounced the change in the melt flow rate. The increasing amount of SBS-II do not have significant effect on the Vicat softening point of HIPS scraps but the greater amount of the SBS-I added to the system, the more pronounced the decrease in the Vicat softening point.

7. The oil content in SBS-I is believed to aid in decreasing the Vicat softening point and increasing the melt flow rate of SBS-I to a very high value. Hence, the melt flow rate of HIPS scrap is increased. SBS-II has no oil content and the flowability itself was poor. So, SBS-II does not effect in the Vicat softening point and has caused a decrease in the melt flow rate of HIPS scrap.

8. The SEM fractography indicates the compatibility and the miscibility of HIPS with SBS block copolymer. No phase separation can be found in the fractograph. SBS block copolymer was hardly observed on the micrographs.

RECOMMENDATIONS FOR FURTHER STUDIES

The scope and techniques used in the research can be expanded to study on the effect of processing temperature and mixing techniques. In addition, other types of SBS block copolymer can be investigated. Other factors which may effect the recycling properties, such as the particle size of scraps and the possibility of recycled post consumer product are recommended for further study.