Chapter VI

Conclusions

6.1 Conclusions

6.1.1 Effects of the kneading conditions on the dispersion of pigments

The various factors affecting the dispersibility of organic pigments (carbon black and quinacridone violet) in HDPE upon using the continuous twin-screw kneader may be concluded as follows:

1. As regards the kneading temperature effect, a higher temperature enhanced the dispersibility of either pigment because of decreasing melt viscosity of the polymer.

2. The higher the rotational speed of the twin-screws, the higher the degree of dispersion of either pigment. This may be attributed to the increase in the intensity of the shear stresses.

3. Regarding the effect of the feed rate of the HDPE-pigment mixture, a higher feed rate led to slight decrease in the dispersibility because the retention time in the kneader was reduced.

4. A premixed time of 10 minutes, was enough to satisfy the pre-distribution of pigment in HDPE powder. Thus, further increase in the premixed time had insignificant effect on the dispersibility.

5. Interms of dispersibility and tensile properties, the present carbon black is a better (more preferable) additive than quinacridene violet.

6. Thermal degradation and scission of the polymer chains contributed a net deterioration in the tensile properties despite the positive effect of more uniform dispersion at the highest temperature and rotational speed.

6.1.2 Effects of kneading conditions on the tensile properties

1. As the kneading temperature increased, the strain at break and the work done decreased while the 0.2% offset yield stress and the modulus of elasticcity were enhanced. This may be attributed to the thermal degradation of the kneaded polymer by high-temperature oxidation.

2. Regarding the rotational speed, it was found that the strain at break and the work done decreased as the rotaional speed increased. In contrast, the 0.2% offset yield stress and the modulus of elasticity increased. This effect may be attributest to more scission of polymer chains by the increased shear rate.

3. The effect of feed rate on the tensile properties was not clear-cut. It may be concluded that the feed rate had insignificant effect.

4. The tensile properties was independent of the premixed time in this study. This may be because the shortest premixed time of 10 minutes used in the present work already provided sufficient pre-mixing.

6.2 Recommendation for further study

As the next step of study, the flow rate of the mixture through the kneader should directly be controlled by ensuring that the screw channel is full of the melt mixture. Moreover, there could be other factors to investigate, such as the arrangement of the screw paddles, the ratio of pigment to polymer and so on. The kneaded samples should be tested to investigate the effect of dispersibility on other mechanical properties of the compounded polymer such as the impact strength, compression and so on.