CHAPTER V

CONCLUSIONS

In this study, the modification molecular structure of DBS to form fibril morphology was investigated. The effect of four sorbitol derivatives as a nucleating agent for iPP and their effect on morphology and mechanical properties were also studied. The results obtained from this work can be concluded as follow:

1. The chemical structure of sorbitol derivatives (i.e. *o*-Cl-DBS, *m*-Cl-DBS, *p*-Cl-DBS, and *p*-Br-DBS) were characterized by FT-IR and ^{1}H-NMR spectroscopy. The result of both techniques can be confirmed that all of derivatives are the products from reaction of D-sorbitol and aromatic benzaldehyde.

2. SEM and TEM micrographs of gel extracted from organic solvent reveal the fibril network of chloro and bromo substitutes which their diameters can be observed in the range of 7-216 nm and length higher than 9 μm.

3. The effect of sorbitol derivatives on the crystallization of iPP were studied using different scanning calorimeter technique (DSC). It was found that addition of 0.5 % wt of *p*-Cl-DBS increase the crystallization temperature of iPP to 18 °C compared to neat iPP. No further increase in the crystallization temperature when the amount of additive reach 0.5 wt% for *para* chloro derivatives. The *para* chloro substitution was the most effective of all the studied derivatives to nucleate iPP. DSC studies also showed that derivatives did not change the melting temperature of iPP. The addition of 0.5 % wt of *p*-Cl-DBS increased the degree of crystallinity of iPP 12% for compressed sample. On the other hand, the additions of *p*-Cl-DBS more or less are not effective on the degree of crystallinity of iPP fiber.

4. Optical micrograph of iPP dispersed with 0.1% wt of all sorbitol derivatives showed smaller spherulite size than that of neat iPP. At high concentration (0.5 % wt) of sorbitol derivatives, the addition of *p*-Br-DBS reveal the very dramatic decrease in spherulite sizes of iPP compared to *p*-Cl-DBS, *o*-Cl-DBS, and *m*-Cl-DBS. Therefore, these materials are able to use as a nucleating agent for iPP.

5. The high level of preferred orientation of iPP lamellar is clearly seen when the samples were dispersed with small amount of sorbitol derivatives under high screw speed and temperature where the fibril still exist in the polymer melt. The SEM micrographs of cross section of as-spun iPP fiber were indicated the location of sorbitol derivatives fibrils which aligned within iPP melt.

6. The effect of sorbitol derivatives on mechanical properties of as-spun and drawn iPP fiber were studied by using tensile tester. For as-spun fiber, the effect of amount, substitution position, and type of sorbitol derivatives on mechanical properties of iPP fiber reveal that the elastic modulus of neat iPP can be increased up to 46 % when 1% wt of p-Cl-DBS added. For drawn iPP fiber, the tensile strength and elastic modulus of both amount of sorbitol derivatives (0.5 and 1 % wt) fiber increase when draw ratio increased. While the percentage of elongation of fiber decrease when draw ratio increased. The sorbitol derivatives have no effect on mechanical properties for drawn fiber.