CHAPTER V

CONCLUSIONS

The following conclusions can be drawn from this study:

1. Microcrystalline cellulose (MCC) from durian fruit hulls was successively produced and scale-up according to the basic principles obtained from previous studies of Sitthipairojsakul (2002). The amounts of starting raw fibers used in this study were 30, 300 and 3000 g. The equipment and process appropriate for the production of MCC from 30, 300 and 3000 g of raw materials were considered to be different in size but geometrically similar. Similarity factors used as scale-up criterion include time and temperature for the digestion of raw fibers, mixer velocity and after-treatment end point detection concerning pH and residual chloride ion. Percent yield of MCC obtained from 30, 300 and 3000 g of raw fiber were 29.5, 32.9 and 27.4 %, respectively.

2. The physicochemical properties of prepared MCC were characterized using scanning electron microscopy, laser diffraction particle size analyzer, infrared spectrophotometry, powder X-ray diffractometry, differential scanning calorimetry and thermogravimetry in comparison to commercial MCC (Avicel PH101®). The results showed that MCC isolated from agricultural waste, both from laboratory-scale (30-g batch isolation) and pilot-scale (300-g and 3000-g batch isolation) of durian fruit-hulls, were similar to of commercial MCC. Prepared MCC also complied with the pharmaceutical requirement which includes identification, pH, loss on drying, residue on ignition and water soluble substance under methods described in the USP26/NFXXI.

3. Application of MCC from durian fruit-hulls 3000-g batch isolation as an excipient in preparation of tablet was tested by direct compression method. The properties of tablets including weight, thickness, hardness, friability and disintegration time were evaluated. The weight, thickness, hardness and friability of tablets made from prepared MCC at a compression force of 500 lb/in^2 showed similar results to tablets made from commercial MCC (Avicel PH101®). But disintegration time of tablets made from prepared MCC was longer than commercial MCC, which did not comply to the previous study of Sitthipairojsakul (2002) but within acceptable limit.

4. The unit cost of MCC prepared from durian fruit-hulls 3000-g batch isolation was 2,963 baht per kilogram, which was considered to be higher than of commercial MCC (Avicel PH101®) used in Thai pharmaceutical industry due to process, equipment and facility limitations. However, isolation in the industrial scale with proper optimization process may reduce the unit cost which should be comparable to Avicel PH101®.

Recommendations for future work:

1. After the last washing process, spray drier may be used for drying the solid fiber (suspension) instead of hot air oven, to obtain high porosity microcrystallite aggregates. The MCC product prepared from this drying method may improve the disintegration property tablets are evaluated.

2. The following suggestions may be used to reduce the MCC production cost:

- Before starting the project, equipments should be compared among various vendors that they can actually functioned and give desirable product quality. The lower cost of equipments with satisfactory function will result in lower depreciation cost when calculated.

- MCC should be produced via the same equipment set with the maximum capacity. This will help reduce the depreciation cost because the equipment depreciation cost in this study was calculated based on 8 working hours per day. However, if all equipment were used to produce MCC 16 hours per day, the depreciation cost will decreased by 50%.

- Supporting tools or equipment should be specially designed to reduce labor and increase productivity of the MCC isolation.

- There were many reagents used in the MCC isolation process such as low-concentration sodium hydroxide and hydrochloric acid solution. Currently, these materials are neutralized and then discarded. The future work could assess the feasibility of purifying and increasing the concentration of the diluted waste to make it reusable, which may help reduce the direct material cost.