CHAPTER I

INTRODUCTION

Cellulose is the main component of higher plant cell walls and one of the most abundant organic compounds on earth. It can be derived from many different sources using a number of techniques that are considered synthetic, and some that might be considered nonsynthetic (natural). It is a linear, insoluble polymer of D-glucose unit joined by glycosidic linkages, and considered a polysaccharide. Cellulose molecules form long chains in polycrystalline fibrous bundles that contain crystalline as well as amorphous regions. It is available in many forms for different functional purposes (OMRI, 2001).

Microcrystalline cellulose (MCC) is a purified, partially depolymerized cellulose that occurs as a white-colored, odorless, tasteless, crystalline powder composed of porous particles. It is commercially available in different particle size grades, which have different properties and applications (Wheatley, 1994).

MCC was commercialized as Avicel® by FMC corporation in 1962, and it was registered in the supplement to the National Formulary, twelfth edition, in 1966. Although Avicel was only the brand-name production of MCC until about 1980, since then, considerable numbers of MCC products have been launched in various countries. In the pharmaceutical industry, MCC has been widely used as an additive for direct compression because of its good flowability and compactability (Suzuki and Nakagami, 1999).

MCC is obtained in industrial scale from wood and cotton cellulose, but obtention from materials such as cereal straw (Jain et al., 1982), water hyacinth (Gaonkar and Kulkarni, 1987), absorbent cotton (Singla et al., 1988), coconut shells (Gaonkar and Kulkarni, 1989), sugar cane bagasse (Padmadisastra and Gonda, 1989; Shah et al., 1993), deciduous wood species (Kotelnikova and Petroparlovsky, 1990), jute (Abdullah, 1991), Crambe abyssinica hull (Gastaldi et al., 1998), soybean husk (Uesu et al., 2000), nata de coco (Yanuar et al., 2003) and kapok (Suttiponparnit et al., 2004) has been studied.

A large amount of agriculture waste from food industries such as fruit peels can be disposed by several techniques. The most effective technique is to reuse this waste by processing it as a new product, fertilizer fuel, household product and construction materials. Chemical and physical properties of this waste have a main role on the user's decision.

Thailand, located in the tropical zone, has many kinds of fruits, Table 1. It produces a huge amount of fruit peels yearly (Khedari et al., 2001).

Since durian is one of a famous fruit in Thailand, which is available in a large quantity especially on its season, a lot of fruit-hulls of durian become waste products. In 1998, Pongsamart et al. have isolated polysaccharide gel (PG) from durian rinds, the PG have potential to be used as pharmaceutical excipients. Their applications such as a tablet binder, tablet disintegrator and gelling agent have been well reported (Pongsamart and Panmaung, 1998; Umprayn, Chanpaparp, and Pongsamart, 1990a,b).

Table 1 Seasons of Thai fruits.

Type/Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Jack fruit *Artocarpus heterophyllus*	—	—	—	—	—	—						
Rambutan *Nephelium lappaceum*						—	—	—	—			
Durian *Durio zibethinus*						—	—	—				
Young coconut *Cocos nucifera*	—	—	—	—	—	—	—	—	—	—	—	—
Pummelo *Citrus grandis osb*								—	—	—	—	
Mangosteen *Garcinia mangostena linn*						—	—	—	—			

However, after the process of PG extraction, about 50% of fiber residue was still remained as waste product. In 2002, Sitthipairojsakul isolated polysaccharide fiber (PF) from this waste by three main steps, alkali hydrolysis and bleaching process, acid hydrolysis and bleaching process, and finalize with washing process. Total yield of 26.62% PF was obtained. The physicochemical properties of PF (pattern of IR, X-ray diffractogram, DSC and TGA) were similar to the commercial MCC (Avicel PH101®) and powdered cellulose (Elcema P100). The study of pharmaceutical application of PF in direct compression tabletting showed satisfactory results of hardness, friability, and disintegration time comparable to tablets prepared from commercial MCC.

In order to use agricultural product efficiently, the present study aim to develop and effectively scale-up the isolation process of MCC from fiber residue of durian fruit-hulls after PG was extracted according to the procedure prior study. The prepared MCC was characterized to determine its physicochemical properties and comfirmed its application as a pharmaceutical excipient in tablets prepared by direct compression in comparison to commercial MCC. In addition, unit cost of the prepared MCC from pilot-scale was calculated and analyzed.

OBJECTIVES

The purpose of this study were to:

1. Develop and scale-up the isolation process of microcrystalline cellulose (MCC) from durian fruit-hull.

2. Determine the physicochemical properties and pharmaceutical properties of prepared MCC in each batch isolation compare to available commercial MCC used in pharmaceutical industries.

3. Analyze and calculate the unit cost of prepared MCC from 3000-g batch isolation.

4. Apply the prepared MCC as a pharmaceutical aid in tablet preparation using direct compression technique.