

Chemical engineering



**ASSIGN
BUSTER**

RAW MATERIAL

The Dwarf Cavendish banana (or simply Cavendish banana), is a banana cultivar originally from Vietnam and China. It is one of the most commonly planted banana varieties from the Cavendish group, and is the leading fruit grown in the Philippines. Its prospect in the domestic and foreign markets is promising as demands for fresh and processed products are increasing. According to the National Industry Cluster Capacity Enhancement Project of the Department of Trade and Industry, “ The Philippines’ production area of banana ranked as the third largest in the world at 415, 000 hectares in 2004 or about 8. 5% of the total world area. It ranked second to India which has 680, 000 hectares. The country’s production area from 1990 to 2004 was increasing at a rate of 2. 2% per year¹.” Cavendish banana also comprises 50 % of the 2. 21 million metric tons of banana production in the Philippines from October to December of 2012, as declared by the Bureau of Agricultural Statistics².

Banana peels are commonly known to be used in compost pits and as fertilizers. Others use it as pain relievers for burns and scratches, for wart removal and splinters removal according to a website called apartmenttherapy. com³.

PRODUCT

Pectin for use in food is defined as a polymer containing galacturonic acid units (at least 65%). The acid groups may either be free, combined as a methyl ester, or as sodium, potassium, calcium or ammonium salts, and in some pectins amide groups may also be present.

It is produced commercially as a white to light brown powder, mainly extracted from citrus fruits, and is used in food as a gelling agent particularly in jams and jellies. It is also used in fillings, medicines, sweets, as a stabilizer in fruit juices and milk drinks, and as a source of dietary fiber. According to a study entitled "Characterization of Pectin from Different Fruit Wastes" by Apsara Madhav and P. B. Pushpalatha in 2002, banana peel contains approximately 7 - 8% of pectin as compared to the usual raw material which are apple pomace, containing 1 - 1.5% and, citrus peels containing, 30%, and mango peels containing 7 - 8% of pectin⁵. This study suggests that banana peel can be utilized as a source of pectin.

PROCESS

There are different ways of extracting pectin. The most common is by acid hydrolysis. This research proposes to use another way of extracting pectin from banana peel which is by ammonium oxalate-extraction. According to a study by Nazaruddin, R., Noor Baiti, A. A., Foo, S. C., Tan, Y. N. and Ayob, M. K. entitled, "Comparative chemical characteristics of hydrochloric acid- and ammonium oxalate-extracted pectin from roselle (*Hibiscus sabdariffa* L.) calyces", "Remarkably, pectin was successfully extracted from roselle calyces using HCl and ammonium oxalate. Ammonium oxalate appeared to be the most effective extractant in solubilizing and releasing pectin from roselle calyx compared to HCl." ⁶

This process of extracting pectin in this research, using also ammonium oxalate as the solvent, will be patterned to another study entitled "Environmentally friendly preparation of pectins from agricultural byproducts

and their structural/rheological characterization” by Bocki Min, Jongbin Lim, Sanghoon Ko, Kwang-Geun Lee, Sung Ho Lee, and Suyong Lee in 2011. 7

“ Pectins were extracted from the apple pomace powder in two different ways (chemical and combined physical/enzymatic methods). In the conventional chemical method (Koubala et al., 2008; Rha et al., 2011), apple pomace powder was treated four times with ethanol (85%) for 70 °C for 20 min and filtered with miracloth (Merck KGaA, Darmstadt. Germany). The residue (10 g) was then mixed with oxalic acid/ammonium oxalate (0. 25%, pH 4. 6, 400 mL), which was maintained at 85 °C for 1 h. The mixture was filtered with miracloth and the filtrate was mixed with three volumes of ethanol (96%). After centrifugation at 14, 500 x g for 10 min, the precipitates were washed with 70% and then 96% ethanol, followed by oven-drying (50 °C).”