POTENTIAL OF *Amorphophallus hewittii* FOR GLUCOMANNAN PRODUCTION

Norida Hanim[1], A., M. Jiwan[1]* and R.K. Franklin[1]

INTRODUCTION

Glucomannan is present in corms of several Araceae (Aroid) genus (e.g. in *Amorphophallus konjac*) and other plant families such as Amaryllidaceae (e.g. in *Narcissus tazetta*), Orchidaceae (e.g. in *Blettilla striata*), Liliaceae, Iridaceae and Agavaceae (McCleary and Kennedy, 2004). The fresh corms are a good source of complex carbohydrates and easily digestible starch which contains an average of 18% dry matter, of which 55 to 60% is glucomannan (Ragharan, 2007; Sikorski, 2007). The corms of these species have hard and horny endosperms with thick walls. Before drying or further processing corms of *A. hewittii* needs to be peeled, sliced and repeatedly washed to remove toxic and irritating calcium oxalate crystals (Frohne and Pfa'nder, 2005). In order to produce flour, the slices need to be dehydrated, heated and ground to enable glucomannan to be extracted (Nollet, 2004). Postharvest factors such as storage duration, temperature and processing of corms affect glucomannan availability (Praquin and Miche, 1971). However, glucomannan availability in *Amorphophallus* corms varies with species. Evaporation through high drying temperature causes loss of moisture that leads to shrinkage, damage of tissues and cells of corm resulting in a reduction of glucomannan availability. It is believed that suitable *Amorphophallus* species for glucomannan production have great potential to be identified. Glucomannan are the acetylated polysaccharides, predominantly hemicelluloses and heteropolymers, comprising β-1, 4 linked D-glucose and D-mannose (Bender, 2005; Bender and Bender, 2006) residues in proportions ranging from 2.5 to 4.0:1 (Cui, 2005).

Glucomannan extracts from *Amorphophallus* spp. (e.g. *A. albus*, *A. campanulatus*, *A. konjac*, *A. muelleri*, *A. oncophyllus*, *A. paeoniifolius*, and *A. variabilis*) have been approved as an ingredient for human consumption by the Food and Drug Administration (FDA) in the United Stated of America (US) in early 1997, with a tentative E425 agreement number in the modification of the 92/2/CE European Authorised Food Additives list (Eliasson, 2006). Glucomannan flour from *A. konjac* is a health product (e.g. for capsules) widely used in temperate Asian countries (China and Japan), mountainous regions of Thailand and Indonesia, in India, Africa and the United States of America. Many uses are reported in traditional medicine such as in the treatment of hypoglycaemia (low blood sugar) and hyperglycaemia (high blood sugar), high blood pressure, high cholesterol (obesity) and digestion problems, dysentery, earache, cholera, respiratory problems, cancer, heart disease, osteoporosis, chronic stomach disease and to cure rheumatic pains (Duke *et al.*, 2002; Biliaderis and Izydorczyk, 2007; Sikorski, 2007). In Sarawak, nine species of *Amorphophallus* have been identified with certain species being recorded as consumable by certain ethnic groups (Ipor *et al.*, 2004). These species have the possibility of containing a certain amount of glucomannan as in other species like *A. konjac*, *A. muelleri*, *A. paeoniifolius* and *A. variabilis*.

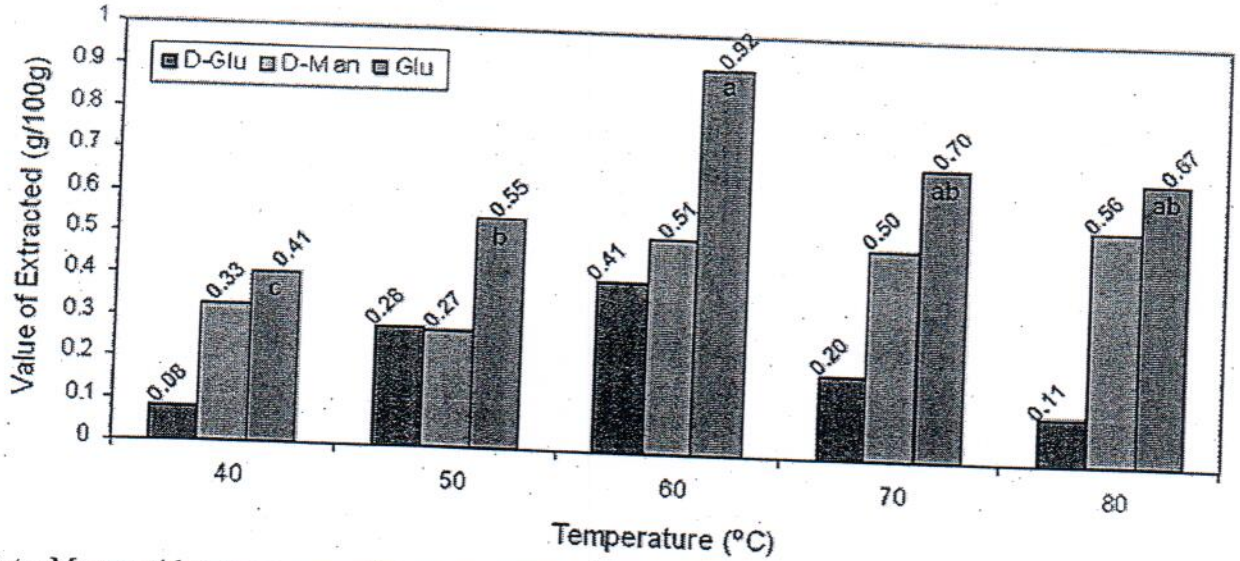
[1] Department of Crop Science, Faculty of Agriculture and Food Science, Universiti Putra Malaysia Bintulu Sarawak Campus, 97008 Bintulu, Sarawak, Malaysia (*E-mail: *mjiwan@btu.upm.edu.my*)

MATERIALS AND METHODS

Corms of *Amorphophallus hewittii* of various sizes and age were randomly harvested from a limestone area in Bau, Sarawak. The corms were stored under ambient conditions for one day before being sliced and oven-dried. The outer layer of the corms were removed before washing them with distilled water, slicing into 2 mm thickness and soaking in 20 ppm salt solution to reduce the concentration of oxalate crystals, prevent browning (caused by oxidation) and preserve the apparent freshness of slices. All samples were repeatedly washed with distilled water and drained. One hundred grams (wet weight) of sliced sample were oven-dried at 40, 50, 60, 70 and 80°C for 24 hours. The dried samples were ground to produce 250 µm mesh size flour for further glucomannan determination (Biliaderis and Izydorczyk, 2007). Glucomannan determination was done using the Glucomannan Megazyme Assay Kit and the methods followed McCleary and Kennedy, (2004).

RESULTS AND DISCUSSION

The study found that drying temperature had a significant effect on the availability of glucomannan in the flour. Drying at a temperature of 60°C was found to yield a good amount of detectable glucomannan in the flour comparing to other temperatures (*Figure 1*). The highest amount of detectable glucomannan was 0.92 g/100 g (dry/wet) or 33.90% of the flour with 10.4% moisture content. Compared to commercial *A. konjac* flour which has an average of 18% dry matter, the glucomannan content was 55 to 60% (Biliaderis and Izydorczyk, 2007).



Note: Means with same superscript are not significantly different at P ≤0.05 using DMRT.

Figure 1. Glucomannan availability in corms at different drying temperatures

Increasing drying temperature to between 70 and 80°C inhibited carbohydrate transformation in the dried flours (Birch and Green, 1973; Ikuzo and Edilberto, 1984). Apart from drying temperature, other factors might influence the quantity of glucomannan availability within the corms, such as age of the corm, time of harvesting, storage period and conditions (Cauvein, 2003; Biliaderis and Izydorczyk, 2007). These preliminary studies suggest that the species has potential to be exploited for supplementing the production of glucomannan.

CONCLUSION

From this study, glucomannan was found in the ground flour from *A. hewittii* dried corm slices. The highest availability of glucomannan (33.9% flour) was derived from samples oven-dried at 60°C. This indicates that the plant has the potential to be further exploited for the production of glucomannan for the food industry in this country. Further studies to determine the association of post-harvest factors with the availability of glucomannan in the corms need to be done.

REFERENCES

Bender, D.A. (2005). Dictionary of food and nutrition. A hand, non-technical guide on all aspects of diet and health, 2nd ed. New York: Oxford University Press

Bender, D.A. and Bender, A.E. (2006). Bender's dictionary of nutrition and food technology. Boca Raton: CRC Press

Biliaderis, C.G. and Izydorczyk, M.S. (2007). Functional food carbohydrates: functional foods and nutraceuticals. Boca Raton: CRC Press

Birch, G.G. and Green, L.F. (1973). Molecular structure and function of carbohydrate. London: Applied Science Publishers Ltd.

Cauvein, S.P. (2003). Bread making, improving quality, the chemistry and biochemistry of wheat. Boca Raton: CRC Press

Cui, S.W. (2005). Food carbohydrates chemistry, physical properties and applications. Boca Raton: CRC Press

Duke, J.A., Bogenschutz-Godwin, M.J., deCellier, J. and Duke, P.K. (2002). Handbook of medicinal herbs, 2nd ed. London: CRC Press

Eliasson, A. (2006). Carbohydrates in food. Boca Raton: CRC Taylor & Francis Group

Frohne, D., and Pfa'nder, H.J. (2005). Poisonous plants: a handbook for doctors, pharmacists, toxicologists, biologists and veterinarians. London: Manson Publishing Ltd.

Ikuzo, U. and Edilberto, D.R. (1984). Tropical root crops: postharvest physiology and processing. Tokyo: Japan Scientific Societies Press & Tokyo Press

Ipor, I.B., Tawan, C.S., Abai, J., Meekiong, K., Simon, A. and Boyce, P.C. (2004) Preliminary observations on the diversity of *Amorphophallus* (Araceae:Thomsonieae) in Sarawak. Kuching: Universiti Malaysia Sarawak

McCleary, B.V., and Kennedy, A. (2004). Megazyme Glucomannan Assay Procedure. Available at http://www.megazymeinternationalireland.com (Retrieved on 2 October 2008)

Nollet, L.M.L. (2004). Handbook of food analysis: revised and expanded physical characterization and nutrient analysis, 2nd ed. New York: Marcel Dekker

Praquin, J.Y. and Miche, J.C. (1971). Study on the factors affecting storage of edible aroids. *Biochemical Journal* **82:** 19-25

Ragharan, S. (2007). Handbook of spices, seasonings, and flavorings: emerging flour contributors, 2nd ed. Boca Raton: CRC Press Taylor & Francis Group

Sikorski, Z.E. (2007). Chemical and functional properties of food components. Boca Raton: CRC Press.