Physicochemical Characteristics of Starch of Commercial Cassava Varieties Grown in Thailand

O. Boonseng [1], J. Hansethasuk [1], U. Chantamanee [1] and A. Summataya [2]

[1] Rayong Field Crops Research Center, Sukhumvit Road, Hauypong, Muang, Rayong. 21150. Thailand. Opasboonseng@yahoo.com
[2] Nakhon Ratchasima Field Crops Research Center, Ladbuakoa, Sikhiu, Nakhon Ratchasima. 30340. Thailand.

Abstract

Cassava starch samples extracted from the roots of several commercial varieties grown in Thailand, i.e. Rayong 5, Rayong 90, Kasetsart 50 and Rayong 72, were evaluated in terms of physicochemical properties using Brabender Amylograph (BU). These roots were obtained from cassava planted both in the early and late rainy season, on Hauypong soil series at Rayong Field Crops Research Center, and harvested monthly intervals from 6 to 24 months after planting. The analyses indicate that the starch samples (at 5 % starch) of Rayong 5 had low pasting temperatures and high peak viscosity through growth stage in both early and late rainy season planting.

Cassava starch obtained by planting on different soil series in Nakhon Ratchasina region had the highest viscosity on Chokchai soil series followed by Stuk, Warin, Yasothon, Surin, and Korat soil series, respectively.

Introduction

Cassava (Manihot esculenta Crantz) is the third most important crop in Thailand. About 18 to 20 million tons of cassava root are produced each year from 1.15 million hectares of planting area. About 40 percents of the total cassava root production is used as raw material for production of cassava chips and pellets. The remaining 60 percents is utilized for production of cassava starch, which is either exported or domestically consumed in various industries, such as in various food products, monosodium glutamate, sweetener, textile industry, plywood, paper, high water absorbing polymer, cyclodextrin and bio-degradable products. A new promising uses of cassava roots includes the production of ethanol used as a petroleum substitute, that of cassava starch to partially replace wheat flour in bakery and various snack products, which are needed some informations about physicochemical properties. The extensive utilization of cassava starch as food and industrial raw material is depended on its functional properties which are influenced by environmental factors (Asaoka et al, 1991). Physicochemical properties of extracted starch are also affected by the age of harvested roots and environmental growth conditions (Moorthy and Ramanujam, 1986).

In this study, the physicochemical properties of cassava starch, i.e. pasting temperature, peak viscosity, final viscosity, breakdown and setback, is being carried out in order to obtain basic information to be used in cassava processing for value addition.

Methods

1. Changes in physicochemical properties of cassava starch grown in different planting seasons

The four commercial varieties of cassava, i.e. high yield varieties (Rayong 5 and Rayong 72) and high starch content varieties (Kasetsart 50 and Rayong 90), were planted under rainfed condition in both early (May) and late (October) rainy season of 2001, on Hauypong soil series at Rayong Field Crops Research Center in the Eastern part of Thailand, using a split plot design in RCB. Cassava starch samples were extracted from the roots monthly intervals from 6 to 24 months after planting. The samples of 5 percents starch were evaluated in terms of pasting temperature, peak viscosity, final viscosity, breakdown and setback using a Brabender Amylograph (BU).

2. Physicochemical properties of cassava starch grown on different soils

The four varieties of cassava, i.e. Rayong 5, Rayong 90, Kasetsart 50 and Rayong 50, were planted under rainfed condition in the early rainy season of 2001, on Chokchai, Stuk, Warin, Sikhiu, Yasothon, Surin, and Korat soil series around the planting area in Nakhon Ratchasima province, Northeast of Thailand, using a split plot design in RCB. Cassava starch samples were extracted from the roots at 6 and 8 months after planting. The samples of 6 percents starch were evaluated in terms of pasting temperature, peak viscosity, final viscosity, breakdown and setback using a Rapid Visco Analyzer (RVA)

Results and Discussions

1. Changes in physicochemical properties of cassava starch grown in different planting seasons

The analyses indicate that the starch samples of Rayong 5 had low pasting temperatures and high peak viscosity through growth stage in both early and late rainy season planting. The cassava starch of early rainy season planting gave in lower pasting temperature and higher peak viscosity than that of late rainy season planting (Figure 1 and 2) . The final viscosity and setback is low for Rayong 72 in both early and late rainy season (Figure 3 and 5). The breakdown is high for Rayong 5 in both early and late rainy season (Figure 4).

Figure 1 Pasting temperature of starch of commercial cassava varieties grown both in the early and late rainy season at different harvesting dates

Figure 2 Peak viscosity of starch of commercial varieties grown both in the early and late Rainy season at different harvesting dates

Figure 3 Final viscosity of starch of commercial cassava varieties grown both in the early and late rainy season at different harvesting dates.

Figure 4 Breakdown of starch of commercial cassava varieties grown both in early and late rainy season at different harvesting dates.

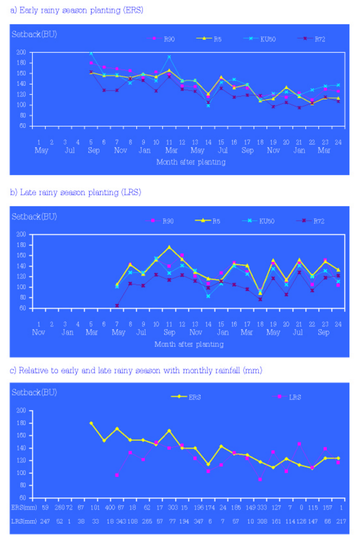

Figure 5 Setback of starch of commercial cassava varieties grown both in early and late rainy season at different harvesting dates.

2. Physicochemical properties of cassava starch grown on different soils

Cassava starch obtained by planting on different soil series in the planting area had the highest viscosity on Chokchai soil series followed by Stuk, Warin, Yasothon, Surin, and Korat soil series, respectively. Rayong 5 provided the lowest pasting temperature and highest peak viscosity. Harvesting at 8 MAP resulted in lower pasting temperature and higher peak viscosity than 6 MAP (Table 1).

Table 1 Effects of soils, varieties and harvesting dates on physicochemical properties of cassava starch

Treatment	Pasting	Viscosity (RVA)		Value (RVA)	
	Temperature (°C)	Peak	Final	Breakdown	Setback
Soil series factors					
1. Stuk	66.26	437	222	317	102
2. Warin	67.21	435	243	309	117
3. Korat	66.88	371	200	252	81
4. Chokchai	68.02	491	233	344	86
5. Surin	69.60	400	212	260	72
6. Yasothon	67.97	418	226	286	94
7. Sikhiu	67.97	427	254	260	87
Varieties factors					
1. Rayong 5	65.45	429	230	292	93
2. Rayong 72	67.92	383	211	260	88
3. Rayong 90	68.13	413	231	270	88
4. Kasetsart 50	68.88	428	233	293	93
Harvesting date factors					
1. 6 MAP	69.89	405	218	267	80
2. 8 MAP	66.52	427	237	293	103
Average	68.21	416	228	284	91

Note Breakdown = Peak viscosity - Trough viscosity Setback = Final viscosity - Trough viscosity Soil texture : Loamy sand (Warin and Korat) ; Clay loam (Chokchai and Surin) Sandy clay loam (Stuk and Yasothon) ; Sandy loam (Sikhiu)

Conclusions

1. Rayong 5 is the best variety for starch production due to its high starch viscosity and low gelatinization properties through growth stage.
2. Cassava starch had the highest viscosity on Chokchai soil series followed by Stuk, Warin, Yasothon, Surin, and Korat soil series, respectively.

Refferences

Asaoka M., J.M.V. Blanshard and J.E. Richard. 1991. Seasonal effects on the physicochemical properties of starch from cultivars of cassava. Starch/Starke 43 : 455-459.

Moorthy S.N. and T. Ramanujam T. 1986. Variation in properties of starch in cassava varieties in relation to age of the crop. Starch/Starke 38 : 58-61.

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