PALM SAP-BASED SUGAR AND ITS POTENCY AS CHOCOLATE SWEETENER

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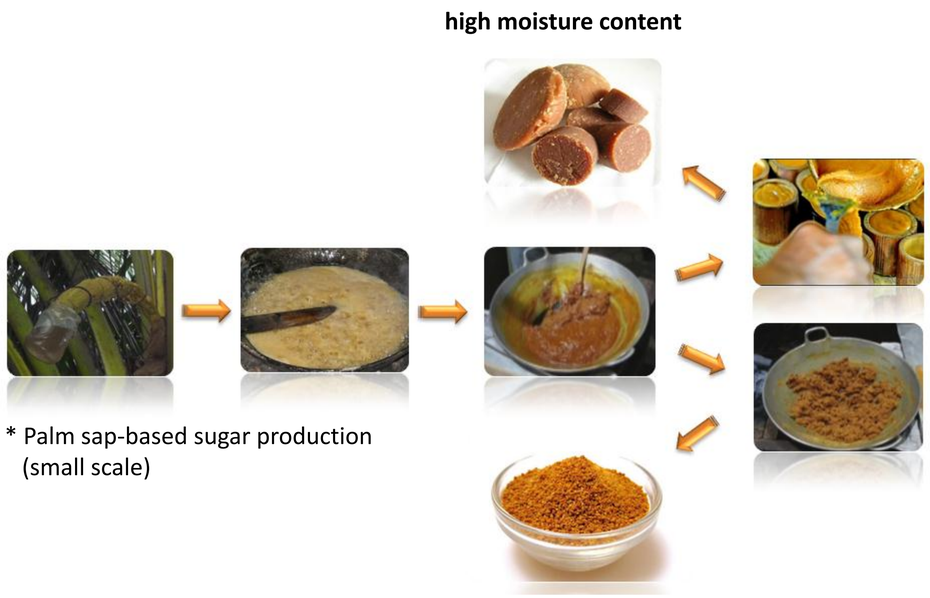
INTRODUCTION

The most common sugar used in the production of chocolate is sucrose. However, the demand for healthier sweeteners in chocolate, and foods in general, is increasing.

Palm sap based sugar is claimed to be a healthy alternative because it does contain not only minerals and vitamins but also exhibits a low glycemic index (GI). The production of this sugar is achieved by boiling sap, collected from palm tree flowers, under agitation until supersaturation, whereby crystals are formed.

The variability within the palm sap-based sugars can be explained by the fact that they are traditionally produced by farmers applying distinct processing techniques/conditions.



* Palm sap-based sugar production (small scale)

Sucrose, the most common sugar used in chocolate, is considered as an inert ingredient, contributing ''only'' to sweetness. However, the usage of palm sap-based sugar, might affect the quality attributes of chocolate to some extent, such as colour, hardness, melting point of sugar in chocolate, flow behaviour of molten chocolate, fineness, and aroma profile of chocolate.

Palm sap-based sugar

Sucrose

The main objective was to study the quality attributes of palm sap-based sugar and investigate its potency as chocolate sweetener.

CHARACTERIZATION

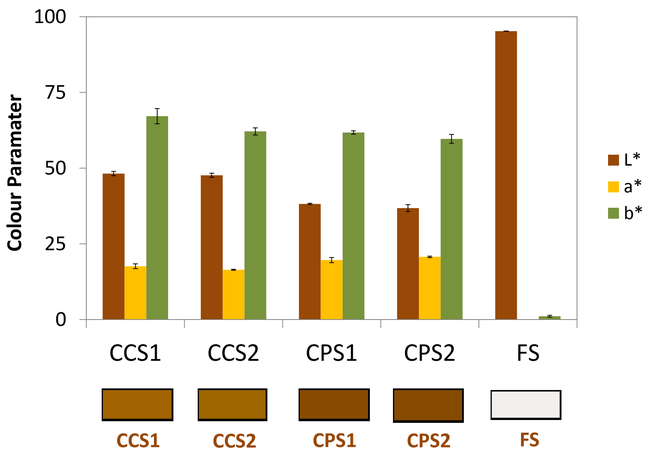
- **Thermal analysis (Differential Scanning Calorimetry)**
  Measured with Q1000 differential scanning calorimeter (DSC) equipped with a refrigerated cooling system (TA Instruments, New Castle, USA).
- **Particle Size Distribution (Laser Diffraction)**
  Measured with malvern Mastersizer (Malvern Instruments Ltd., Worcestershire) equipped with 300 F and 1000 F lens.
- **Sugar composition (Gas Chromatography)**
  Measured with Gas Chromatography (GC)
- **Microscopy (Scanning Electron Microscopy)**
  The surface topography of the sugar was visualized using a JSM-7100 F TTLS LV TFEG-SEM (Scanning Electric Microscopy) (Jeol Europe, Zaventem, Belgium)
- **Moisture content**
  Measured by means of Karl-Fisher titration method, performed using the 719 Titrino apparatus (Metrohm, Switzerland).
- **Colour**
  Measured with a colorimeter (Minolta Model CM-2500D Spectrophotometer, Tokyo, Japan).
- **Crude protein**
  Measured with Kjeldahl method.
- **Density**
  Measured with pycnometer method.

RESULTS

Sugar samples

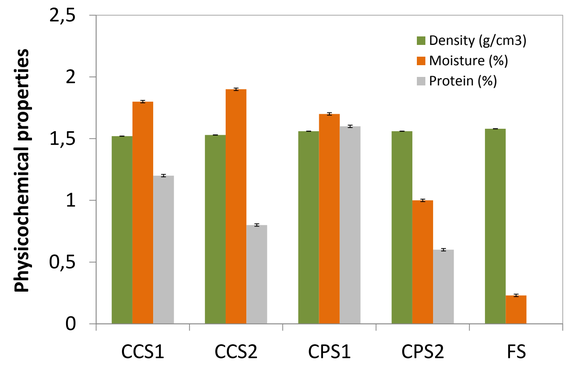
Palm sap-based sugar :
CCS 1 : Coarse coconut sugar 1; CCS 2 : Coarse coconut sugar 2
CPS 1 : Coarse palm sugar 1; CPS 2 : Coarse palm sugar 2
Reference :
FS : Fine sucrose

Colour



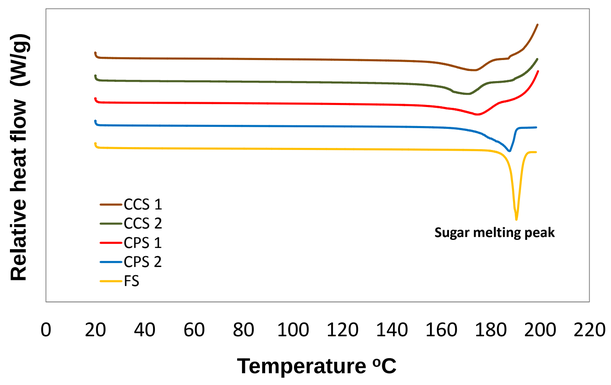
Palm sap-based sugar exhibited darker colour than that of sucrose, due to Maillard reaction during sugars production

Density, moisture and protein content



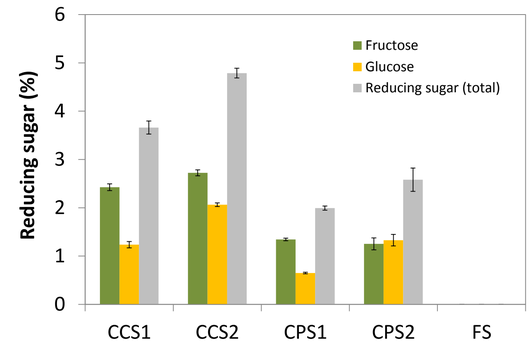
Palm sap-based sugar exhibited somewhat higher density and moisture content, might affect particle-particle interactions in chocolate, resulting in a higher viscosity and hardness of chocolate. The presence of protein might induce additional Maillard reaction during chocolate production

Melting Profile



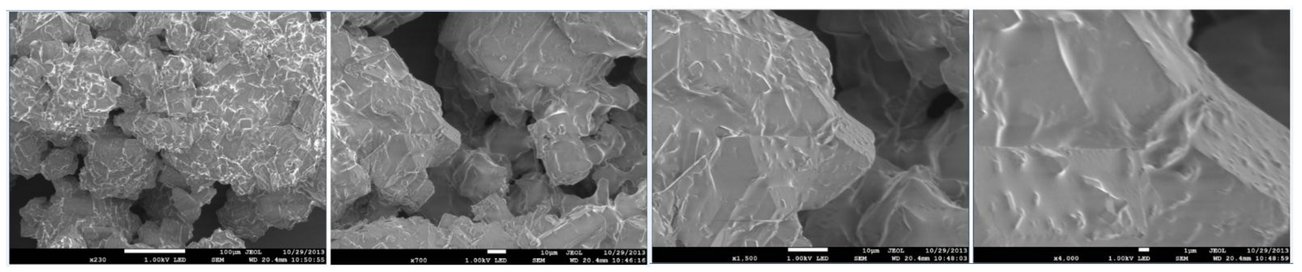
Distinct sugar melting peak was observed, indicative for the differences in sugar composition and solid state (amorphous state/crystalline state)

Sugar composition



Palm-sap based sugars contain fructose and glucose (reducing sugar) in contrast to fine sucrose, might induce additional maillard reaction during chocolate production contributing to the development of a distinct chocolate aroma

Microscopy



Particles surface of palm sap-based sugar were coated with amorphous sugar and/or moisture

Particle Size Distribution

Sugars	Distribution Percentiles (µm)			Derived Diameter (µm)	
	D(90)	D(50)	D(10)	D(4,3)	D(3,2)
CCS1	1181 ± 70	423 ± 45	122 ± 4	549 ± 40	206 ± 7
CCS2	1250 ± 88	556 ± 56	166 ± 15	640 ± 45	267 ± 26
CPS1	900 ± 10	443 ± 17	165 ± 0	497 ± 42	235 ± 2
CPS2	925 ± 75	452 ± 33	141 ± 15	497 ± 38	216 ± 23
FS	279 ± 0	86 ± 1	13 ± 0	120 ± 0	27 ± 0

Palm sap-based sugar exhibited bigger particles than that of sucrose. The variability within the palm sap-based sugar can be explained by the fact that they are traditionally produced by farmers applying distinct processing techniques/conditions

CONCLUSIONS

- Substitution of sucrose in chocolate with palm sap-based sugar has great potential for development of dark chocolate products with a distinctive flavour/aroma.
- Low particle density and high moisture content of palm sap-based sugar might influence colour, hardness and viscosity of chocolate.
- The presence of amorphous state in palm sap-based sugar and relatively high moisture content might induce particle agglomeration in chocolate.

ACKNOWLEDGMENT

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