UNIVERSITI PUTRA MALAYSIA

PHYSICO-CHEMICAL AND RHEOLOGICAL CHARACTERISATION OF SWEET POTATO FLOURS AND DOUGH

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By

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Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfillment of the Requirements of the Degree of Master of Science

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

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Physico-chemical and rheological characterisation of a new variety of sweet potato flour and dough, the VitAto, known for its high vitamin A contents, were compared with two other commercial sweet potato, the Bukit Naga and Okinawan available in Malaysia. The recoveries of each sweet potato from milling were not significantly different at about 20% but in proximate analysis, the VitAto presented the highest protein, 5.7% and dietary fiber, 14.8% contents with more energy 399.6 kcal/100g produced. The VitAto flour has average particle size of 132.04 μm. The pasting temperature of the VitAto flour was 65°C, with highest setback and trough viscosity values of 530.90 and 197.20 mPa.s, respectively. The flour is classified as easy flowing and stable powders. The rheological properties of sweet potato doughs at different mixing time were studied. In the large deformation extension test, extensibility parameters including dough length at fracture, measured and actual forces acting on dough strips were obtained for calculating the stress-strain data. For the small deformation test, both modulus of elasticity and viscosity (G) were studied.

The extensibility of dough from sweet potato flour increased to its peak at 5 minutes mixing time before decreasing illustrating an optimum mixing time. The variety of VitAto which had a higher protein content of 5.7% has higher values of all the extensibility parameters when compared with the other varieties of sweet potato flours, Bukit Naga and Okinawan. The flow behavior index, *n* of sweet potato dough which were between 1.82 to 2.11 indicated that they were also of strain hardening nature similar to the wheat doughs but at a lower magnitude suggesting suitability in a wide range of application for the snack or confectionary industries. The small deformation tests were not able to identify the optimum mixing time although in general illustrated that sweet potato dough was essentially elastic or recoverable. The Pearson correlations of large and small deformation tests showed that the rheological parameters were positively correlated among themselves in the evaluation of the effect of mixing time to rheological properties of sweet potato dough.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
Sebagai memenuhi keperluan untuk Ijazah Master Sains

FIZIKO-KIMIA DAN PENCIRIAN RHEOLOGI TEPUNG DAN DOH UBI KELEDEK

Oleh

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Fiziko-kimia dan pencirian reologi tepung dan doh ubi keledek baru, VitAto yang dikenalpasti tinggi kandungan vitamin A dibandingkan dengan dua ubi keledek komersial lain yang terdapat di Malaysia, Bukit Naga dan Okinawan. Dengan perolehan setiap ubi keledek dari pengisaran tidak berbeza secara ketara iaitu pada kira-kira 20%, VitAto mempunyai kandungan protein yang lebih tinggi, 5.7 % dan serat, 14.8% serta membekalkan lebih tenaga sebanyak 399.6 kcal/100g di dalam analisis proksimat. Tepung VitAto mempunyai purata saiz partikel sebesar 132.04 μm. Suhu pes tepung VitAto ialah 65^{o}C, dengan nilai halangan dan nilai paluh yang tinggi iaitu masing-masing sebanyak 530.90 dan 197.20 mPa.s. Tepung tersebut adalah dikategorikan sebagai serbuk mengalir mudah dan stabil. Sifat-sifat reologi doh ubi keledek pada masa pengadunan yang berbeza telah dikaji. Dalam ujian ubah bentuk pemanjangan besar, parameter kebolehpanjangan merangkumi kepanjangan doh pada tahap kepatahan, daya ukur dan sebenar yang bertindak pada jalur doh

diperolehi untuk mengira data tegasan-terikan. Bagi ujian ubah bentuk kecil, kedua-dua modulus G kekenyalan dan kelikatan dikaji. Kebolehpanjangan doh tepung keledek yang meningkat sehingga kemuncaknya pada 5 minit masa pengadunan sebelum menurun ini menggambarkan masa pengadunan optimum. VitAto yang mempunyai kandungan protein yang lebih tinggi sebanyak 5.7% mempunyai nilai-nilai paramater kebolehpanjangan yang lebih tinggi apabila dibandingkan dengan tepung ubi keledek lain, Bukit Naga dan Okinawan. Indeks kelakuan aliran, *n* doh ubi keledek di antara 1.82-2.11 menunjukkan bahawa mereka mempunyai pengerasan terikan seperti doh tepung gandum tetapi dengan magnitud rendah menunjukkan kesesuaiannya dalam pelbagai aplikasi untuk makanan ringan atau industri konfeksionari. Ujian ubah bentuk kecil didapati tidak dapat mengenal pasti masa pengadunan optimum walaupun secara umum ia dapat menggambarkan bahawa doh ubi keledek bersifat elastik boleh kembali. Kolerasi Pearson untuk ujian ubah bentuk besar dan kecil menunjukkan parameter reologi secara positif dalam penilaian kesan masa pengadunan kepada sifat-sifat reologi doh ubi keledek.

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I certify that a Thesis Examination Committee has met on 27 January 2014 to conduct the final examination of Abu Bakr Bin Mohd Hanim on his thesis entitled "Physico-chemical and Rheological Characterisation of Sweet Potato Flours and Dough" in accordance with the Universities and University Collages Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

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