

**Identification and characterization of  
physico-chemical properties of Kithul  
(*Caryota urens*) flour for widening its  
applications in food industry**

by

**J A A C Wijesinghe**



**Ph.D.**

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**J A A C Wijesinghe**

**Thesis submitted to the University of Sri Jayewardenepura for  
the award of the Degree of Doctor of Philosophy in Food Science  
on 2015.**

## DECLARATION

The work described in this thesis was carried out by me at the Department of Food Science and Technology, Faculty of Applied Sciences, University of Sri Jayewardenepura under the supervision of Dr.Indira Wicramasinghe, Senior Lecturer, Department of Food Science and Technology, Faculty of Applied Sciences, University of Sri Jayewardenepura and Dr K.H Saranandha ,Head /Food Research Unit, Gannoruwa, and a report on this has not been submitted in whole or in part to any university or any other institution for another degree.

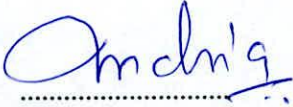
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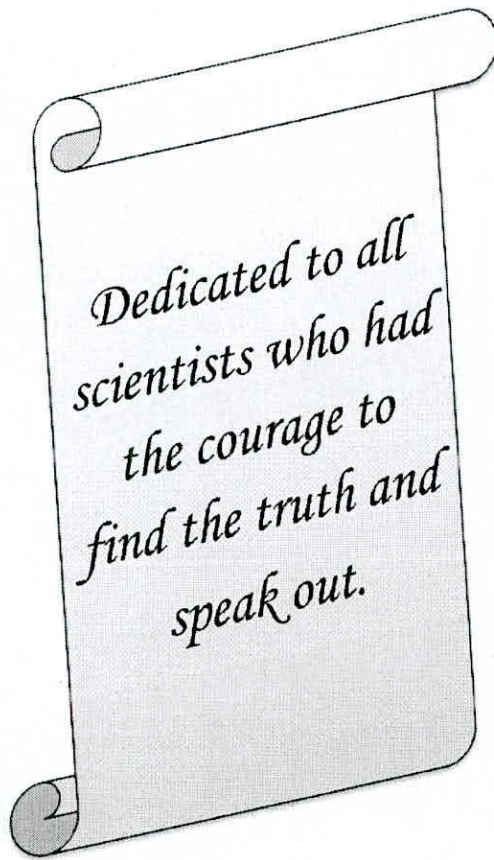
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*Dedicated to all  
scientists who had  
the courage to  
find the truth and  
speak out.*

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## LIST OF ABBREVIATIONS

ANOVA – Analysis of variance

DSC- Differential Scanning Colourimetry

FTIR - Fourier transform infrared

HMT – Heat – moisture treatment

PG – pre-gelatinized

SP – Swelling Power

AC – Acidified

DX – Dextrinized

ANN-Annealing

T<sub>P</sub> -gelatinization temperature

T<sub>g</sub>- glass transition temperature

ΔH-Gelatinization Enthalpy

ΔE- Colour Difference

PDA -Potato dextrose agar

NA- Not applicable

AOAC-Official methods of Analysis of Association of Official Analytical Chemists

Ca -Calcium

K- Potassium

Na- Sodium

Fe- Iron

Zn- Zinc

Mg- Magnesium

**Identification and characterization of physico-chemical properties of Kithul (*Caryota urens*) Flour for widening its applications in Food Industry**

**J A A C Wijesinghe**

**ABSTRACT**

A study was carried out to determine the possible applications of Kithul flour in food industry. The characterization of Kithul flour was based on area wise comparison and different physical stages as tapped and non-tapped which were helped to find out the suitable modification method and the use of same composite flour for bulk industrial requirements. Suitable modified flour treatment was used as a stabilizer of new drinking yoghurt formulation.

There were significant difference of Kithul flour from five different Kithul growing districts with respect to proximate and colour attributes with respect to  $L^*$ ,  $a^*$ ,  $b^*$  and colour difference ( $\Delta E$ ). Although there were no any significant changes in granular morphology of Kithul flour which will be a positive point for using same composite flour from different growing areas in food production. The most common shape of granules in Kithul flour was oval and mean value of the starch granular length and width were  $45.6 \pm 19.1$  and  $26.4 \pm 9.9$   $\mu\text{m}$ , respectively. Shelf life of the raw Kithul flour was approximately two years and room temperature was ideal as the storing temperature.  $L^*$  (Lightness) and  $+a^*$  (redness) has improved while  $+b^*$  (yellowness) has decreased with the time.

Physico-chemical properties among tapped and non-tapped Kithul flour were not showed any significant difference ( $P < 0.05$ ). Nevertheless in quantity wise there could be differences

among the tapped and non-tapped Kithul trees align with the allocated time to re-accumulate after cessation of the Tapping. It will provide a perfect answer for use of tapped trees for flour production which could be helped to empower the Kithul industry by protecting both tapping industry as well as flour industry. Based on the X ray diffraction pattern observed for native and modified Kithul flour has clearly shown that the Kithul flour is an A- type starch.

Three modifications as pre-gelatinized (PG-I and PG-II), acid thinned (AC) and dextrinized (DX) were subjected to native Kithul flour .By taking account to all findings as differential scanning thermogram and viscosity variations this physical treatment, PG-II (prepared on 75°C moisture-heat treatment) is the most suitable and reliable than other treatments for food application. Specially it is appropriate use as a thickener or a stabilizer and a water retention agent for yoghurt production according to this study. Developed drinking yoghurt with modified Kithul (*Caryota urens*) flour (PG-II) as stabilizer was given the better results by reducing Syneresis, giving appropriate viscosity and ranking higher score for all sensory attributes except colour. Shelf life was up to 7 days with low level of preservative as 242 ppm of Potassium sorbate, at 4 °C.

Finally ,mechanical process was developed (with grinder ,sifter and dryer) for flour preparation by Kithul bark in hygienic and effective manner .Further ,it could be introduced as a low cost operation with better recovery yield of flour at a time effective manner which gain more profit both for manufacturer and customer. Improvement on the processing system may take time to be accomplished which leads Kithul flour production as one of the most important industries in Sri Lanka.