

already  
uploaded

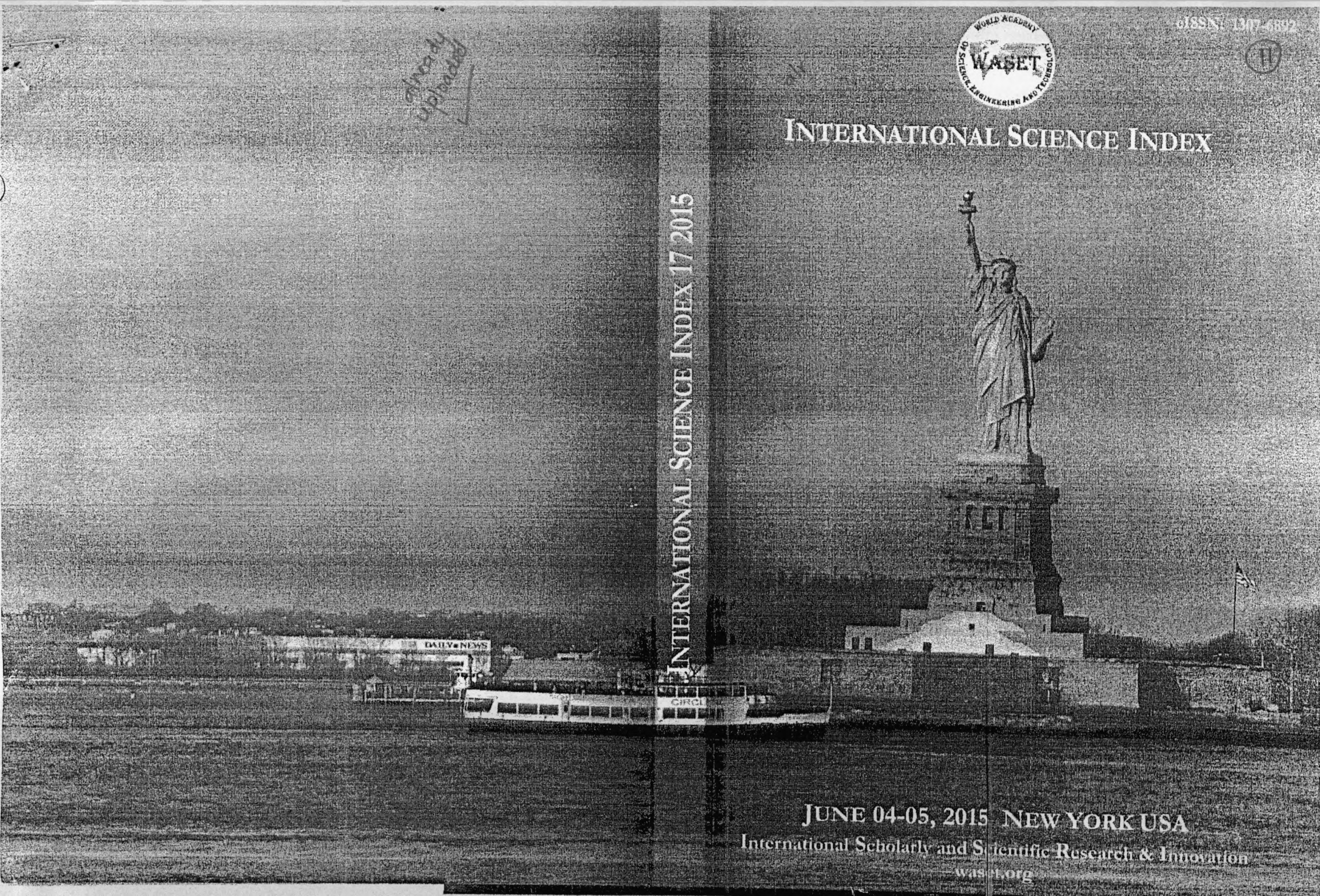


ISSN: 1307-6892



# INTERNATIONAL SCIENCE INDEX

INTERNATIONAL SCIENCE INDEX 17 2015



JUNE 04-05, 2015 NEW YORK USA  
International Scholarly and Scientific Research & Innovation  
waset.org

Article	TABLE OF CONTENTS	Page
36	Use of Indigenous Knowledge System (IKS) by Farmers for Selected Arable Crops Production in Ondo State <i>A. M. Omoore, E. O. Fakoya</i>	180 - 184
37	Spatio-Temporal Variations in Heavy Metal Concentrations in Sediment of Qua Iboe River Estuary, Nigeria <i>Justina I. R. Udotong, Ime R. Udotong, Ojionime U. Eka</i>	185 - 189
38	Oil Sludge Bioremediation Pilot Plant Project, Nigeria <i>Ime R. Udotong, Justina I. R. Udotong, Ojionime U. M. John</i>	190 - 194
39	Assessment of Diagnostic Enzymes as Indices of Heavy Metal Pollution in Tilapia Fish <i>Justina I. R. Udotong, Esien U. Esien</i>	195 - 199
40	Morpho-Anatomical Responses of Leaf Lettuce ( <i>Lactuca sativa</i> L.) Grown with Different Colored Plastic Mulch <i>Edmar N. Franquera, Renato C. Mubesa, Rene Rufael C. Espino, Eudralina P. Seirano, Eduardo P. Panningbatun Jr.</i>	200 - 208
41	Delineation of Oil - Polluted Sites in Ibeno LGA, Nigeria, Using Geophysical Techniques <i>Ime R. Udotong, Justina I. R. Udotong, Ojionime U. M. John</i>	209 - 215
42	Changes in Some Morphological Characters of Dill Under Cadmium Stress <i>A. M. Daneshian Moghaddam, A. H. Hasselzadeh, A. Bandehagh</i>	216 - 218
43	Investigation of the Heavy Metal Pollution of the River Ecosystems in the Lake Sevan Basin, Armenia <i>G. Gevorgyan, S. Khulaverdyan, A. Yuseashina</i>	219 - 219
44	A Comparison of Air Quality in Arid and Temperate Climatic Conditions - A Case Study of Leeds and Makkah <i>Turki M. Hubebulluh, Said Munir, Karl Rokina, Exant A. Moray, Atef M. F. Mohammed, Abdulaziz R. Seraji</i>	220 - 229
45	Time Integrated Measurements of Radon and Thoron Progeny Concentration in Various Dwellings of Bathinda District of Punjab Using Deposition Based Progeny Sensors <i>Kirandeep Kaur, Rohit Mehra, Pargun Bangotra</i>	230 - 238
46	Gas Permeation Behavior of Single and Mixed Gas Components Using an Asymmetric Ceramic Membrane <i>Nyong Claribelle Nwogu, Mohammed Nasir Kajama, Godson Osueke, Edward Gobnu</i>	239 - 239
47	Contributions of Search and Rescue to the World Peace <i>Dursun Kalebay</i>	240 - 252
48	Preservation of Coconut Toddy Sediments as a Leavening Agent for Bakery Products <i>B. R. Madhusan, S. B. Navaratne, I. Wickramasinge</i>	253 - 256
49	Screening of Congenital Heart Diseases with Fetal Phonocardiography <i>F. Kovacs, K. Kaldar, G. Hozszl, A. T. Balogh, T. Zsoltovits, N. Kersner, A. Nagy, Gy. Jeney</i>	257 - 261
50	Bioinformatics and Molecular Biological Characterization of a Hypothetical Protein SAV1226 as a Potential Drug Target for Methicillin/Vancomycin-Staphylococcus aureus Infections <i>Nichole Haug, Kimberly Velk, Tyler McCune, Chun Wu</i>	262 - 266
51	Conformation Prediction of Human Plasmin and Docking on Gold Nanoparticle <i>Wen-Shyong Tsou, Chih-Ching Huang, Chin-Hwo Hu, Ying-Taang Lu, Tui-Wen Pai, Chia-Yin Chiang, Chung-Hao Li, Hong-Jyuan Jian</i>	267 - 270
52	Synchrotron X-Ray Based Investigation of as and Fe Bonding Environment in Collard Green Tissue Samples at Different Growth Stages <i>Sunil Dehipawala, Arghama Sirtumana, Stephan Smith, P. Schneider, G. Tremberger Jr, D. Lieberman, Todd Holden, T. Cheung</i>	271 - 275
53	Synchrotron X-Ray Based Investigation of Fe Environment in Porous Anode of <i>Shewanella oneidensis</i> Microbial Fuel Cell <i>Sunil Dehipawala, Gayathri Amarasuriya, N. Gadhira, G. Tremberger Jr, D. Lieberman, Harry Gafiq, Todd Holden, T. Cheung</i>	276 - 279
54	Raman Spectroscopic of Cardioprotective Mechanism During the Metabolic Inhibition of Heart Cells <i>A. Almomhammed, A. J. Hudson, N. M. Storey</i>	280 - 280
55	Influence of Replacement Used Reference Coordinate System for Georeferencing of the Old Map of Europe <i>Jakub Havlicek, Jiri Cajthaml</i>	281 - 287
56	A Comparative Study of Virus Detection Techniques <i>Sulaiman Al amro, Ali Alkhalifah</i>	288 - 295
57	New Requirements of the Fifth Dimension of War: Planning of Cyber Operation Capabilities <i>Mehmet Karguac</i>	296 - 299
58	On Panel Data Analysis of Factors on Economic Advances in Some African Countries <i>Ayoala Fest J., Kayode Balogun</i>	300 - 304
59	Nano Generalized Topology <i>M. Y. Bakair</i>	305 - 310
60	Challenges with Synchrotron Technology Deployments in Electric Power Grids <i>Emmanuel U. Okeke, Anil Khanal, Ali R. Osareh, Gary L. Lebby</i>	311 - 311

# Preservation of Coconut Toddy Sediments as a Leavening Agent for Bakery Products

B. R. Madushan, S. B. Navaratne, I. Wickramasinghe

**Abstract**—Toddy sediment (TS) was cultured in a PDA medium to determine initial yeast load, and also it was undergone sun, shade, solar, dehumidified cold air (DCA) and hot air oven (at 40°, 50° and 60°C) drying with a view to preserve viability of yeast. Thereafter, this study was conducted according to two factor factorial design in order to determine best preservation method. Therein the dried TS from the best drying method was taken and divided into two portions. One portion was mixed with 3: 7 ratio of TS: rice flour and the mixture was divided in to two again. While one portion was kept under in house condition the other was in a refrigerator. Same procedure was followed to the rest portion of TS too but it was at the same ratio of corn flour. All treatments were vacuum packed in triple laminate pouches and the best preservation method was determined in terms of leavening index (LI). The TS obtained from the best preservation method was used to make foods (bread and hopper) and organoleptic properties of it were evaluated against same of ordinary foods using sensory panel with a five point hedonic scale. Results revealed that yeast load of fresh TS was  $58 \times 10^5$  CFU/g. The best drying method in preserving viability of yeast was DCA because LI of this treatment (96%) is higher than that of other three treatments. Organoleptic properties of foods prepared from best preservation method are as same as ordinary foods according to Duo trio test.

**Keywords**—Biological leavening agent, coconut toddy, fermentation, yeast.

## I. INTRODUCTION

TODDY is a common in various parts of Asia and Africa and goes by various names, such as *Emu* in Nigeria, *Nsamba* in the Congo and *Raa* in Sri Lanka. Toddy is collected as a sap by the tapping of the coconut inflorescence at immature stage [1]. The collected sap will be undergone 8 hours for fermentation into toddy and thereafter it was syphon out from the vat and the sediment is left out as a waste material. Even though the sediment is thrown out as an un-economical product it may contain plenty of vegetative yeast cells and spores.

There are several types of leavening agent available in the market namely biological leavening agents (yeast), chemical leavening agents (bicarbonates). Since toddy sediment contain plenty of yeast cells and spores it can be

F. B. R. Madushan is with the Department of Food Science & Technology, University of Sri Jayewardenepura, Gangodawila, Sri Lanka (corresponding author to provide phone: +94 779-250-280, e-mail: a65568@sci.sjp.ac.lk).

S. S. B. Navaratne is with the Department of Food Science & Technology University of Sri Jayewardenepura, Gangodawila, Sri Lanka (e-mail: ssnava1234@gmail.com).

T. I. Wickramasinghe is with the Department of Food Science & Technology, University of Sri Jayewardenepura, Gangodawila, Sri Lanka (e-mail: inditraw2002@yahoo.com).

used as a biological leavening agents. In biological leavening agents category there are several types for bakery industry available in the market namely cream yeast compressed yeast, active dry yeast and high acidity dry yeast [2]. Commercially yeast (*Saccharomyces cerevisiae*) is mainly produced on grain-mashes or sucrose rich molasses [3]. Yeasts have been used by people since old ages (4000 to 5000 years ago) and nowadays it is being using in vast applications mainly in bakery industry. Consumption of bakery products has been dramatically increased in past years also. Yeast could be aerobic or facultative anaerobic and its carbohydrates, lipids and nitrogen metabolism activities are very helpful for the bakery industry.

Since Sri Lanka is situated in tropical belt of the globe the different types of air born yeast strains are available. Sri Lankan scientists have also reported that there was different types of yeasts and yeast strains available in coconut toddy [4]. Some of these strains are responsible for sugar fermentation. And sediment after fermenting is highly perishable, which (fresh sediment) is used by rural folks for domestic scale food preparation. It has been reported that palmyrah toddy mixed culture has performed better than the baker's yeast [5]. Since coconut toddy sediment is a wasteful by product and possibly good source of yeast spores, scope of this study is to identify yeast load in the sediment, preservation technique and possible utilization of it in food industry.

## II. METHODOLOGY

### A. Collecting Samples

Toddy sediment samples were collected from a large scale coconut tavern in the down south area in Sri Lanka, were put to a sterile container and turned the lid lightly. Then the container was placed in an ice crystal bath for reducing microbial activities and their growth. Thereafter collected samples were transported to the laboratory and kept under refrigeration condition for the subsequent areas of the study.

### B. Determination of Yeast and Mold Count Using Pour Plate Method

Dilution series of fresh toddy sediment and the toddy sediment of the best drying method were prepared up to  $10^6$  dilution using 1g of toddy sediment. Then potato dextrose agar was used for culture yeast and molds. Acidity of the medium was set to approximately 3.5 pH with sterile tartaric acid achieves the inhibition of bacterial growth. Thereafter 1ml of the toddy sediment of each dilution is fed in to each dish and then a thin layer of media is poured. Then dishes were

incubated at the room temperature (29°C) for 48 hours and least CFU (colony forming units) of fresh toddy sediment and toddy sediments of the best drying method were recorded according to [6]. Finally average CFU/g count was taken.

### C. Determination of Leavening Index (LI)

Twenty five grams of wheat flour and 2g of sugar were mixed with 5g of toddy sediment while incorporating adequate amount of water until dough was converted in to suitable consistency. Thereafter a portion of the dough was taken and put in to a measuring cylinder up to 25ml level and it was kept under in-house condition (RH 78% and 29°C).

A layer of paraffin oil was poured onto the top of dough in the measuring cylinder to prevent exposing the dough to the normal atmosphere. Thereafter increased volume of dough was recorded after two and half hours in in-house condition. And leavening index was calculated the using equation given below.

$$LI = \frac{\text{Increment of dough volume}}{\text{Initial dough volume}} \quad (1)$$

### D. Determination of the Best Drying Method

Seven different types of drying methods namely sun drying, shade drying, solar drying, cold dehumidified air drying and hot air oven drying were used to dehydrate the toddy sediment until the moisture content reach to the safe level (6-8%).

In hot air drying at 40°C, 50°C and 60°C temperatures, sensible heating at constant humidity ratio drying process was used. Therein normal atmospheric air was conditioned to get above three temperatures and conditioned air was blown over the wet toddy sediment until it attain to the safe moisture content. In cold dehumidified air drying process, normal atmospheric air was conditioned to get 8°C and RH 10% (approximately) and this cold dry air was used to dehydrate the toddy sediment. In sun drying (at 40°-45°C) the toddy sediment was under protective cubicle and drying was carried out until moisture content reach to the safe level. In the case of shade drying (at 28-30°C), it was done using a specially designed chamber in the laboratory with aeration facility. Solar drying was done using a fabricated prototype solar drier. The normal atmospheric air was blown to the collector (28-30°C) in order to make the cold air hot (70-75°C). The speed of the blowing fan was used to control the 28-30°C temperature of the blowing air. The hot air generated from the collector was blown over the wet toddy sediment until toddy sediment attain safe moisture content. The best drying method was determined in terms of the leavening indexes by comparing values.

### E. Determination of the Best Preservation Method

This experiment was conducted according to two factor factorial experimented design. Therein toddy sediments of best drying method was taken and divided into two portions and one portion was mixed with rice flour at the ratio of 3: 7 (toddy sediment: rice flour) and this portion was again divided in to two equal portions. While one portion was kept under refrigerator condition and the rest was kept in in-house

condition. Same procedure was followed to rest portion but with corn flour. (3: 7; toddy sediment: corn flour)

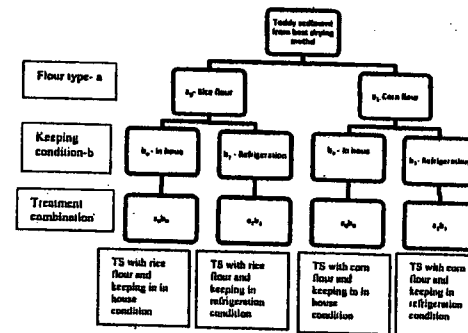


Fig. 1 Design of the experiment

All the treatments were triplicated and vacuum packed using triple laminated pouches. Samples were drawn from each treatment weekly and leavening index was measured in order to determine the best preservation method. The design of the experiment is shown in fig. 1.

### F. Evaluation of Organoleptic Properties of food products

The dried toddy sediment of the best preservation method was taken and two leaven food products (bread and hopper) were made.

Breads were made with a standard bread recipe (without using yeast) according to the prescribed method [7]. Organoleptic properties of prepared breads such as color, crispiness, flavor, odor, texture and overall acceptability were compared against same of ordinary breads according to Duo-trio test method using 30 respondents. The sensory profiles of both treatments with respect to six sensory stimuli were drawn using 5 point hedonic scale along with same number of respondents (30).

Hoppers also were made with a standard bread recipe (without using yeast) according to the prescribed method. Organoleptic properties of prepared hoppers such as crispiness, taste, odor, texture of the edge of the hopper and taste, texture odor color of middle of the hopper and overall acceptability were compared against same of ordinary hoppers according to Duo-trio test method using 30 respondents too. The sensory profiles of both treatments with respect to ten sensory stimuli were drawn using 5 point hedonic scale along with same number of respondents (30).

## III. RESULTS AND DISCUSSION

Initial pH, moisture content, solid content, LI of toddy sediment were measured, which were 3.6, 87.05% 12.95% and 120% respectively. Therefore fresh toddy sediments was somewhat acidic watery. And also it contain live yeast cells

and spores as it has shown a strong value for the leavening index.

**A. Determination of Yeast and Mold Count**

Yeast plate count of fresh toddy sediments and toddy sediments of best drying method were  $58 \times 10^6$  and  $51 \times 10^6$  FU/g. Therefore this count is also indicate presence of live yeast cells and spores in fresh toddy sediments and toddy sediments out of best drying method as well.

**B. Determination of the Best Drying Method in terms of LI**

Leavening index of dried toddy sediments obtained from drying methods namely sun drying (40-45°C), shade drying (28-30°C), solar drying (70-75°C), cold dehumidified air drying (8°C) and hot air oven drying (40°C, 50°C and 60°C) are given in table 1.

TABLE 1  
LEAVENING INDEX OF DRYING METHODS

Drying method	Mean LI % $\bar{x}$	Mean variation $\bar{y} \pm SD$
Sun drying (40-45°C)	0	0
Solar drying (70-75°C)	0	0
Shade drying (28-30°C)	75.33	4.1
Oven drying		
40°C	34.66	3.77
50°C	0	0
60°C	0	0
Cold dehumidified air drying (8°C)	114.05	1.95

The data given in table 1 indicate that the best drying method is cold dehumidified air drying at 8°C because this treatment was capable to preserve viability of yeast cells more than the other 6 drying methods. Because LI is more due to presence of more live yeast cells and spores.

**C. Determination of the Best Method for Preservation of Dried Toddy Sediment**

The best preservation method pertaining to the two factor factorial design was measured in terms of LI weekly for period of 4 weeks and results are given in table 2.

TABLE 2  
LEAVENING INDEX OF TREATMENTS WITH RESPECT TO STORED TIME PERIOD

Mean leavening index % ( $\bar{x}$ ) & mean variation ( $\pm SD$ )	Treatment	Treatment			
		a <sub>0</sub> b <sub>0</sub>	a <sub>1</sub> b <sub>0</sub>	a <sub>0</sub> b <sub>1</sub>	a <sub>1</sub> b <sub>1</sub>
After 1st week	Mean LI variation	101.33	105.33	108	112
		1.88	1.88	0	1.88
After 2nd week	Mean LI variation	92	90.66	101.33	105.33
		0	1.88	1.88	1.88
After 3rd week	Mean LI variation	84	96	93.33	101.33
		3.26	3.26	1.88	1.88
After 4th week	Mean LI variation	79.33	88	89.33	96
		5.73	3.26	1.88	1.88

The data given in table 2 clearly indicate that the best preservation method of toddy sediment is a<sub>1</sub>b<sub>1</sub> (Mixing with corn flour and keeping with refrigerator condition). Reason for this consequence is viability of yeast spores preserved under low temperature storing (8°C). Therefore storing in refrigeration condition is a productive option in preserving of yeast cells in toddy sediments. Moreover, as corn flour is somewhat inert it doesn't have any influence on the viability of yeast cells up to four weeks of period of storage. This conclusion is further evidenced by the mean variation of the best treatment which is  $96 \pm 1.88\%$ .

**D. Evaluation of Organoleptic Properties of Bread**

Organoleptic properties such as color, flavor, odor, texture and overall acceptability of bread prepared from the best preservation method of toddy sediment were compared with the same of ordinary bread. Since both treatments were failed to secure minimum responses (21) to get a significant difference, there is no significant difference between ordinary bread and bread prepared with toddy sediments. To further elaborate this outcome, sensory profiles for the both treatments were drawn which is given in fig. 2.

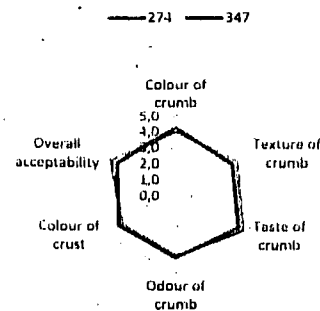


Fig. 2 Sensory evaluation of breads

Sensory profiles also clearly indicated that there was not significant difference between sensory stimuli of both products.

Organoleptic properties such as crispiness, taste, odor, texture of the edge of the hopper and taste, texture odor color of middle of the hopper and overall acceptability of bread prepared from the best preservation method of toddy sediment were compared with the same of ordinary hopper. Since both treatments were failed to secure minimum responses (21) to get a significant difference, there is no significant difference between ordinary bread and bread prepared with toddy sediments. To further elaborate this outcome, sensory profiles for the both treatments were drawn which is given in fig. 3

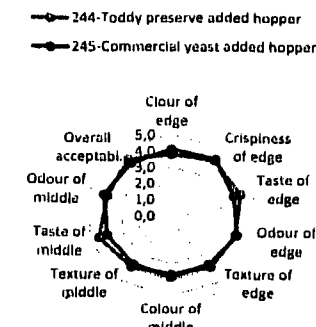


Fig. 3 Sensory evaluation of hoppers

**IV. CONCLUSION**

The best drying method in preserving of toddy sediments was cold dehumidified air drying at 8°C. The best treatment in preserving of toddy sediment is incorporating of corn flour at the ratio of 7:3 and keeping the mixture under refrigeration condition. Bread prepared from the best treatment is as almost same as normal bread in term of sensory stimuli as well as sensory profiles. Therefore toddy sediment is a best source for leavening food products and it can be served in dry form for at least four weeks period.

**ACKNOWLEDGEMENT**

The authors gratefully acknowledge the assistance of the toddy tavern owner and the staff of Paygala, Sri Lanka for supplying toddy sediment and laboratory staff of the Department of Food Science & Technology, University of Sri Jayewardenepura, Sri Lanka.

**REFERENCES**

- Leong, P. (1953). The Nutritive Value of Coconut Toddy. *DJN*, 7(03), p.253.
- McWilliams, Charles S, and Martin S Peterson. *Yeast: Its Characteristics, Growth, and Function in Baked Products*. Washington: Advisory Board on Quartermaster Research and Development, Committee on Foods, Subcommittee on Cereal and Baked Products, National Academy of Sciences-national Research Council, 1957. Print.
- Simpson, Benjamin K. *Food Biochemistry and Food Processing*. 2nd ed. Ames, Iowa: Wiley-Blackwell, 2012. Print.
- Chandraseca, O., Kcerthipala, A. and Walker, G. (2006). Isolation and Characterisation of Sri Lankan Yeast Germplasm and Its Evaluation for Alcohol Production. *Journal of the Institute of Brewing*, 112(4), pp.302-307.
- Balakumar, S. and Arasaratnam, V. (2009). Comparison of Industrial Scale Ethanol Production from a Palmyrah-Based Carbon Source by Commercial Yeast and a Mixed Culture from Palmyrah Toddy. *Journal of the Institute of Brewing*, 115(2), pp.105-110.
- Food Microbiological Examination: Enumeration of Yeasts and Molds*. Ministry of Health of P. R. China, 2012. Print.
- AACC (2000). *Approved Methods of the American Association of Cereal Chemist*, The American Association of Cereal Chemist, Inc., St Paul, MN.