

**KOMODITAS: KELAPA**  
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**PLANT PHYSIOLOGY- GROWTH AND DEVELOPMENT (3 Jdl)**

Moumita Chakraborty, Anitha Karun, Adinpunya Mitra, Accumulation of phenylpropanoid derivatives in chitosan-induced cell suspension culture of *Cocos nucifera*,

*Journal of Plant Physiology*, Volume 166, Issue 1, 1 January 2009, Pages 63-71, ISSN 0176-1617, DOI: 10.1016/j.jplph.2008.02.004.

(<http://www.sciencedirect.com/science/article/B7GJ7-4SD1KH6-3/2/2a7d24d7a18b511e07cee793cf4b5360>)

**Abstract: Summary**

Chitosan-induced elicitation responses of dark-incubated *Cocos nucifera* (coconut) endosperm cell suspension cultures led to the rapid formation of phenylpropanoid derivatives, which essentially mimics the defense-induced biochemical changes in coconut palm as observed under in vivo conditions. An enhanced accumulation of p-hydroxybenzoic acid as the major wall-bound phenolics was evident. This was followed by p-coumaric acid and ferulic acid. Along with enhanced peroxidases activities in elicited lines, the increase in activities of the early phenylpropanoid pathway enzymes such as, phenylalanine ammonia lyase (PAL), p-coumaroyl-CoA ligase (4CL) and p-hydroxybenzaldehyde dehydrogenase (HBD) in elicited cell cultures were also observed. Furthermore, supplementation of specific inhibitors of PAL, C4H and 4CL in elicited cell cultures led to suppressed accumulation of p-hydroxybenzoic acid, which opens up interesting questions regarding the probable route of the biosynthesis of this phenolic acid in *C. nucifera*.

**Keywords: *Cocos nucifera*; Cell cultures; p-Hydroxybenzoic acid; p-Hydroxybenzaldehyde dehydrogenase; Phenylalanine ammonia lyase**

P.I.P. Perera, V. Hoher, L.K. Weerakoon, D.M.D. Yakandawala, S.C. Fernando, J.-L. Verdeil, Early inflorescence and floral development in *Cocos nucifera* L. (Arecaceae: Arecoideae),

*South African Journal of Botany*, Volume 76, Issue 3, August 2010, Pages 482-492, ISSN 0254-6299, DOI: 10.1016/j.sajb.2010.03.006.

(<http://www.sciencedirect.com/science/article/B7XN9-502NK7V-1/2/bea361208e2765b1bd459109918b2a85>)

**Abstract:**

Palms are generally characterized by a large structure with a massive crown that creates difficulties in anatomical studies. The flowering behaviour of palm species may be a useful indicator of phylogenetic relationships and therefore evolutionary events. This paper presents a detailed histological study of reproductive development in coconut (*Cocos nucifera* L.), from initiation up to maturation of staminate and pistillate flowers. Reproductive development in coconut consists of a sequence of individual events that span more than two years. Floral morphogenesis is the longest event, taking about one year, while sex determination is a rapid process that occurs within one month. The inflorescence consists of different ultimate floral structural components. Pistillate flowers are borne in floral triads that are flanked by two functional staminate flowers. The staminate flowers are born in floral diads towards the base of the rachilla followed by solitary flowers in the middle to top of the rachilla. Three primary phases were identified in reproductive development, namely, transition of axillary bud into inflorescence bud, formation of floral buds, and sexualisation of individual flower buds. All developmental events with respect to stage or time of occurrence were determined.

**Keywords:** Anatomy; Arecaceae; Coconut; *Cocos nucifera* L.; Floral development; Histology; Ontogeny

Dayane Almeida de Sousa, Elisabeth de Oliveira, Marcio da Costa Nogueira, Breno Pannia Esposito, Development of a heavy metal sorption system through the PS functionalization of coconut (*Cocos nucifera*) fibers,

**Bioresource Technology**, Volume 101, Issue 1, January 2010, Pages 138-143, ISSN 0960-8524, DOI: 10.1016/j.biortech.2008.08.051.

(<http://www.sciencedirect.com/science/article/B6V24-4X3MR55-3/2/fbb49ff3ffb6c0121cead65d09839e61>)

**Abstract:**

Lignocellulosic residues are interesting materials for the production of heavy metal adsorbents for aquatic systems. Whole fibers taken from coconut (*Cocos nucifera*) husks were functionalized with the thiophosphoryl (PS) group by means of the direct reaction with Cl<sub>3</sub>PS, (CH<sub>3</sub>O)<sub>2</sub>CIPS or (CH<sub>3</sub>CH<sub>2</sub>O)<sub>2</sub>CIPS in order to obtain an adsorptive system for 'soft' metal ions, particularly Cd<sup>2+</sup>. These functionalized fibers (FFs) were characterized by means of elemental analysis, infrared spectroscopy, thermal analysis and acid-base titration. Adsorption isotherms for Cd<sup>2+</sup> fitted the Langmuir model, with binding capacities of 0.2-5 mmol g<sup>-1</sup> of FF at 25 [degree sign]C.

**Keywords:** *Cocos nucifera*; Cadmium; Sulfur; Phosphorus; Remediation

## PLANT DISEASES (1 jdl )

C.T.C. Costa, C.M.L. Bevilaqua, S.M. Morais, A.L.F. Camurca-Vasconcelos, M.V. Maciel, R.R. Braga, L.M.B. Oliveira, Anthelmintic activity of *Cocos nucifera* L. on intestinal nematodes of mice,

**Research in Veterinary Science**, Volume 88, Issue 1, February 2010, Pages 101-103, ISSN 0034-5288, DOI: 10.1016/j.rvsc.2009.05.008.

(<http://www.sciencedirect.com/science/article/B6WWR-4WGKKP0-1/2/062fcd11231a59cb4b8dc2fa48c88a7b>)

### **Abstract:**

In this study, we evaluated the anthelmintic activity of the liquid extracted from the bark of the green coconut (LBGC), as well as butanol extract obtained from LBGC, on mouse intestinal nematodes. Thirty-six naturally infected mice were distributed into six groups receiving the following treatments: Group I: 1000 mg/kg of LBGC; Group II: 2000 mg/kg of LBGC; Group III: 500 mg/kg of butanol extract; Group IV: 1000 mg/kg of butanol extract; Group V: 0.56 mg/kg febendazole; and Group VI: 3% dimethylsulfoxide. The chemical composition of the LBGC and its butanol extract was determined by phytochemical tests. A dose of 1000 mg/kg of butanol extract had 90.70% efficacy in reducing the mouse worm burden ( $p < 0.05$ ). Phytochemical tests revealed the presence of triterpens, saponins and condensed tannins in the LBGC and butanol extracts. These results suggest that *Cocos nucifera* extracts may be useful in the control of intestinal nematodes.

**Keywords: Medicinal plants; In vivo; Cocos nucifera; Syphacia obvelata  
Aspiculuris tetraptera; Anti-parasitic; Phytochemical tests**

Gabriel Lizama-Uc, Ivan A. Estrada-Mota, Maria Goretty Caamal-Chan, Ramon Souza-Perera, Carlos Oropeza-Salin, Ignacio Islas-Flores, Jose Juan Zuniga-Aguilar, Chitosan activates a MAP-kinase pathway and modifies abundance of defense-related transcripts in calli of *Cocos nucifera* L.,

**Physiological and Molecular Plant Pathology**, Volume 70, Issues 4-6, April-June 2007, Pages 130-141, ISSN 0885-5765, DOI: 10.1016/j.pmpp.2007.08.001.

(<http://www.sciencedirect.com/science/article/B6WPC-4PHJTN7-1/2/a88b08cac4b3f1ef3ce7c82501ccce0d>)

### **Abstract:**

As the study of coconut defense responses against pathogenic microorganisms is hampered by the absence of suitable model systems, we investigated if imbibition of coconut calli with chitosan could be used in vitro to simulate the molecular interactions that occur with pathogens. Our results showed that calli imbibition with 10 mg mL<sup>-1</sup> chitosan caused the accumulation of hydrogen peroxide, and stimulated a [beta]-1,3-glucanase activity with an R<sub>f</sub> near 0.1. In addition, in-gel kinase assay and specific immunoblotting showed that a ~46 kDa MAPK-like protein was activated shortly after elicitation, and remained in this state for at least 80 min. Chitosan addition also differentially modified the expression of some genes, whose DNA sequence showed high similarities to receptor-like kinases (RLKs), Verticillium-like protein, and

mitochondrial alternate oxidase 1b. Addition of salicylic acid to the calli also modified transcript abundance for these genes, while methyl jasmonate did not seem to influence their expression, implying that they could be involved in defense responses. These results strongly suggest that elicitation of coconut tissues cultivated in vitro constitutes a suitable alternative to characterize both biochemical and molecular interactions that occur between the coconut palm and its associated pathogens.

**Keywords: Cocos nucifera L.; Differential display; Chitosan; Plant-pathogen interaction**

## **PALANT GENETICS AND BREEDING (1 jdl)**

Dong-dong LI, Yong-mei FAN, Construction and Characterization of a cDNA Library from the Pulp of Coconut (*Cocos nucifera* L.),

***Agricultural Sciences in China***, Volume 7, Issue 9, September 2008, Pages 1071-1076, ISSN 1671-2927, DOI: 10.1016/S1671-2927(08)60148-0.

(<http://www.sciencedirect.com/science/article/B82XG-4THKV6G-6/2/0672580d4ddd7bd3e82b4afe47347768>)

### **Abstract:**

To investigate the gene expression profile of endosperm development, a cDNA library was constructed and characterized from the pulp of coconut at different developmental stages. The constructed cDNA library incorporated approximately 1 x 10<sup>7</sup> clones in total, and the size of the insertion fragments ranged from 800 to 2 000 bp. Sequencing results of 100 randomly picked clones showed that the recombination rate was 96%. In subsequent sequence analysis, 41 clones (41%) were homologous to known function proteins, and 23 clones showed high amino acid identity (more than 80%) with the corresponding genes of different plants. Semi-quantitative RT-PCR indicated that oleosin and globulin genes are pulp-specific expression, and have differential expression level in different developmental stage. Clone 29, recognized as homologous to KIAA1239 protein (*Homo sapiens*), was observed to occur nine times, indicating that this gene may be over-expressed during the endosperm development stage. However, the homologous protein was found only in mammals, and the detailed function is still unknown. Elucidation of the functional characterization of these genes will be carried out immediately.

**Keywords: cDNA library; coconut; Cocos nucifera L; pulp**

## STORAGE OF PLANT PRODUCTS (2 Jdl)

Eduardo H.M. Walter, Dirce Y. Kabuki, Luciana M.R. Esper, Anderson S. Sant'Ana, Arnaldo Y. Kuaye, Modelling the growth of *Listeria monocytogenes* in fresh green coconut (*Cocos nucifera* L.) water,

**Food Microbiology**, Volume 26, Issue 6, September 2009, Pages 653-657, ISSN 0740-0020, DOI: 10.1016/j.fm.2009.04.003.

(<http://www.sciencedirect.com/science/article/B6WFP-4W4CWM1-2/2/43229513c14067f243e85d9395ce85f5>)

### **Abstract:**

The behaviour of *Listeria monocytogenes* in the fresh coconut water stored at 4 [degree sign]C, 10 [degree sign]C and 35 [degree sign]C was studied. The coconut water was aseptically extracted from green coconuts (*Cocos nucifera* L.) and samples were inoculated in triplicate with a mixture of 5 strains of *L. monocytogenes* with a mean population of approximately 3 log<sub>10</sub> CFU/mL. The kinetic parameters of the bacteria were estimated from the Baranyi model, and compared with predictions of the Pathogen Modelling Program so as to predict its behaviour in the beverage. The results demonstrated that fresh green coconut water was a beverage propitious for the survival and growth of *L. monocytogenes* and that refrigeration at 10 [degree sign]C or 4 [degree sign]C retarded, but did not inhibit, growth of this bacterium. Temperature abuse at 35 [degree sign]C considerably reduced the lagtimes. The study shows that *L. monocytogenes* growth in fresh green coconut water is controlled for several days by storage at low temperature, mainly at 4 [degree sign]C. Thus, for risk population this product should only be drunk directly from the coconut or despite the sensorial alterations should be consumed pasteurized.

**Keywords: Coconut water; Juice; Listeria monocytogenes; Growth; Predictive modelling**

Moumita Chakraborty, Adinpunya Mitra, The antioxidant and antimicrobial properties of the methanolic extract from *Cocos nucifera* mesocarp,

**Food Chemistry**, Volume 107, Issue 3, 1 April 2008, Pages 994-999, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2007.08.083.

(<http://www.sciencedirect.com/science/article/B6T6R-4PKXBWB-7/2/ff987a18aca90cba4232bcd49dfa2b7b>)

### **Abstract:**

The antioxidant activity of the methanolic extract prepared from different stages of *Cocos nucifera* L. mesocarp was demonstrated, by DPPH, FRAP and deoxyribose assays, and suggests the potential of the mesocarp extract to be used for therapeutic purposes. Antimicrobial activity of the crude mesocarp extract was tested against *Staphylococcus aureus* ATCC 25923, *Bacillus subtilis* ATCC 441, *Escherichia coli* ATCC 25922 and *Pseudomonas aeruginosa* MTCC 7925. The extract exhibits a potent anti-staphylococcal activity. Probable compounds responsible for the bioactivity were identified by means of HPLC and UV/ESI-MS spectroscopic analyses. Their structures

were deduced as 5-O-caffeoylquinic acid (chlorogenic acid), dicaffeoylquinic acid and three tentative isomers of caffeoylshikimic acid.

**Keywords: Mesocarp; ESI/MS spectroscopy; Dicaffeoylquinic acid; HPLC; Chlorogenic acid**

## **CHEMICAL COMPOSITION (1 jdl)**

Kathrine Conrad, Correlation between the distribution of lignin and pectin and distribution of sorbed metal ions (lead and zinc) on coir (*Cocos nucifera* L.), *Bioresource Technology*, Volume 99, Issue 17, November 2008, Pages 8476-8484, ISSN 0960-8524, DOI: 10.1016/j.biortech.2007.08.088.

(<http://www.sciencedirect.com/science/article/B6V24-4SS8N9C-1/2/2eb018156b7941ccdd999fb6b088fb93>)

### **Abstract:**

Plant fibres are capacious for sorption of metal ions, and can be used in water cleaning. Knowledge about the sorption will help in selection of the fibre and optimisation of its chemical modification, if any. The aim of this paper is to investigate the connection, if any, between the distribution of lignin and pectin and the loading of Pb and Zn on coir (mesocarp fibres from *Cocos nucifera* L.).

The coir consisted mainly of xylem and a fibre sheath. The lignin was evenly distributed in the cell walls of the fibre sheath, but in the xylem, there was no detectable content in the compound middle lamella, and a smaller content of lignin in the secondary walls than in the walls of the fibre sheath. The only detectable content of pectin in the fibre sheath walls was in the middle lamella, cell corners and extracellular matrix, while in the xylem, the pectin was almost evenly distributed in the wall, with a higher concentration in the middle lamella and cell corners. All cell walls facing the lacuna had a high content of pectin. The metal ions were mainly loaded on the xylem and cell walls facing the lacuna, maybe with an additional trend to be loaded on the large fibres. Lead was distributed on and across the whole secondary wall. Zinc was loaded on the secondary walls, but there was no information about the distribution across the wall. If there is a simple correlation between the loading of metal ions and the distribution of lignin or pectin, these investigations point at no correlation with lignin and a positive correlation with pectin. It has to be stressed that these conclusions are made on limited material and are therefore preliminary in nature.

**Keywords: Biosorption; Distribution of metal ions; Lignin; Pectin; Plant fibres**

## **PLANT PROPAGATION**

Sisunandar, Peter A. Sopade, Yohannes M.S. Samosir, Alain Rival, Steve W. Adkins, Dehydration improves cryopreservation of coconut (*Cocos nucifera* L.),

*Cryobiology*, Volume 61, Issue 3, December 2010, Pages 289-296, ISSN 0011-2240, DOI: 10.1016/j.cryobiol.2010.09.007.

(<http://www.sciencedirect.com/science/article/B6WD5-516M786-1/2/bfe14ec96280f519a2fbae415229bcf9>)

**Abstract:**

Cryopreservation of coconut can be used as a strategy to back up the establishment of living collections which are expensive to maintain and are under constant threat from biotic and abiotic factors. Unfortunately, cryopreservation protocols still need to be developed that are capable of producing a sizeable number of field-grown plants. Therefore, we report on the development of an improved cryopreservation protocol which can be used on a wide range of coconut cultivars. The cryopreservation of zygotic embryos and their recovery to soil-growing plants was achieved through the application of four optimised steps viz.: (i) rapid dehydration; (ii) rapid cooling; (iii) rapid warming and recovery in vitro and (iv) acclimatisation and soil-supported growth. The thermal properties of water within the embryos were monitored using differential scanning calorimetry (DSC) in order to ensure that the freezable component was kept to a minimum. The feasibility of the protocol was assessed using the Malayan Yellow Dwarf (MYD) cultivar in Australia and then tested on a range of cultivars which were freshly harvested and studied in Indonesia. The most efficient protocol was one based on an 8-h rapid dehydration step followed by rapid cooling step. Best recovery percentages were obtained when a rapid warming step and an optimised in vitro culture step were used. Following this protocol, 20% (when cryopreserved 12 days after harvesting) and 40% (when cryopreserved at the time of harvest) of all MYD embryos cryopreserved could be returned to normal seedlings growing in soil. DSC showed that this protocol induced a drop in embryo fresh weight to 19% and significantly reduced the amount of water remaining that could produce ice crystals (0.1%). Of the 20 cultivars tested, 16 were found to produce between 10% and 40% normal seedlings while four cultivars generated between 0% and 10% normal seedlings after cryopreservation. This new protocol is applicable to a wide range of coconut cultivars and is useful for the routine cryopreservation of coconut genetic resources.

**Keywords:** Dehydration; Differential scanning calorimetry; Germplasm conservation; Embryo culture; Recalcitrant seeds

Dongdong Li, Yusheng Zheng, Li Wan, Xiaoming Zhu, Zhekui Wang, Differentially expressed microRNAs during solid endosperm development in coconut (*Cocos nucifera* L.),

*Scientia Horticulturae*, Volume 122, Issue 4, 3 November 2009, Pages 666-669, ISSN 0304-4238, DOI: 10.1016/j.scienta.2009.07.002.

(<http://www.sciencedirect.com/science/article/B6TC3-4WXRDS0-1/2/5bdadb87c02a32500f05d8172eca9ee1>)

**Abstract:**

MicroRNAs (miRNAs) are a class of 20-24 nt, endogenously expressed, non-coding RNAs that play important regulatory roles in plants and animals. To identify miRNAs potentially involved in tissue development and compound anabolism, we studied miRNA expression profiles in endosperm of coconut at different developmental

stages. Based on the annotation in miRBase (release 10.1), we measured a total of 179 miRNAs in immature (95 expressed miRNAs) and mature tissues (176 expressed miRNAs) using microarrays, respectively. The comparative analyses on miRNA expression profiles between these two groups of tissues showed that 23 miRNAs were up-regulated and nine miRNAs were down-regulated in matured endosperm. We further confirmed the increased expression of four miRNAs and decreased expression of a miRNA in immature endosperm using real-time PCR. Moreover, we computationally predicted the target genes of 32 miRNAs with differential expression ( $p < 0.01$ ), and identified the lowest-score targets of six miRNAs. Finally, we discussed the potential functional relevance of several differentially expressed miRNAs.

**Keywords: Coconut; Endosperm; Expression; Development; miRNA**

Chia-Lin Chang, Rong-Tsun Wu, Quantification of (+)-catechin and (-)-epicatechin in coconut water by LC-MS,

**Food Chemistry**, Volume 126, Issue 2, 15 May 2011, Pages 710-717, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2010.11.034.

(<http://www.sciencedirect.com/science/article/B6T6R-51G3W99-5/2/6afa678013a30f930d40d8afe34142e2>)

**Abstract:**

An analytical technique has been developed to detect trace amounts of both (+)-catechin and (-)-epicatechin in the coconut water extract. Both (+)-catechin and (-)-epicatechin in the coconut water were found for the first time by the solid-phase extraction, and they were further analysed using liquid chromatography (LC)-ion trap mass spectrometry (MS) equipped with positive atmospheric pressure chemical ionisation interface on multiple reaction monitoring mode. The limit of detection and quantification for (+)-catechin were 7.8 and 15.6 [ $\mu$ g/ml, respectively, while those for (-)-epicatechin were 3.9 and 7.8 [ $\mu$ g/ml, respectively. The average concentration of (+)-catechin and (-)-epicatechin in the coconut water was 0.344 and 0.242 [ $\mu$ g/ml, respectively. The LC-MS/MS analysis accelerated the quantitative analysis of (+)-catechin and (-)-epicatechin in the coconut water extract with high accuracy, precision and recovery. Results obtained in this study will serve as quality control and useful reference for drug development.

**Keywords: (+)-Catechin; (-)-Epicatechin; Cocos nucifera Linn.; LC-MS/MS**

Sukumar Puhan, N. Saravanan, G. Nagarajan, N. Vedaraman, Effect of biodiesel unsaturated fatty acid on combustion characteristics of a DI compression ignition engine,

**Biomass and Bioenergy**, Volume 34, Issue 8, August 2010, Pages 1079-1088, ISSN 0961-9534, DOI: 10.1016/j.biombioe.2010.02.017.



(<http://www.sciencedirect.com/science/article/B6V22-4YNT8X0-2/2/a4ae8c20ce8cc777cf14b1cfb5e1e06f>)

**Abstract:**

Several research works have been carried out on biodiesel combustion, performance and emissions till today. But very few studies have been made about the chemistry of biodiesel that affects the diesel engine operation. Biodiesel is derived from vegetable oil or animal fats, which comprises of several fatty acids with different chain length and bonding. The present work focuses on the effect of biodiesel molecular weight, structure (Cis & Trans), and the number of double bonds on the diesel engine operation characteristics. Three types of biodiesel with different molecular weight and number of double bond were selected for the experimental studies. The biodiesels were prepared and analyzed for fuel properties according to the standards. A constant speed diesel engine, which develops 4.4 kW of power, was run with biodiesels and its performance was compared with diesel fuel. The results show that Linseed oil methyl ester with high linolenic (unsaturated fatty acid ester) does not suit best for diesel engine due to high oxides of nitrogen emission and low thermal efficiency.

**Keywords:** *Linum usitatissimum*; *Cocos nucifera*; *Jatropha integerrima*  
**Compacta; Combustion; Performance; Emission**

Kathrine Conrad, Hans Christian Bruun Hansen, Sorption of zinc and lead on coir, ***Bioresource Technology***, Volume 98, Issue 1, January 2007, Pages 89-97, ISSN 0960-8524, DOI: 10.1016/j.biortech.2005.11.018.

(<http://www.sciencedirect.com/science/article/B6V24-4J2M1MT-1/2/2c17c94f7141cae7278059f0cd57ac39>)

**Abstract:**

Pilot tests have shown that coir (fibres from *Coco nucifera*) is suitable as a metal ion sorbent. Batch sorption experiments were carried out with Zn and Pb to quantify the sorption kinetics, the pH dependence of the sorption, sorption isotherms at pH 3.0 and pH 5.6, and desorption. Unground and unmodified coir was used and the metal concentrations ranged between 0 and 0.015 mM (1000 [ $\mu$ g/l]) for Zn and 0 and  $9.7 \times 10^{-4}$  mM (200 [ $\mu$ g/l]) for Pb. The pH maximum was 4.5 (91%) for Zn and 2.5 (97%) for Pb. Pb had a higher sorption affinity than Zn, and the affinity was higher at pH 5.6 than at pH 3.0. The isotherms could be represented by the Freundlich, but not by the Langmuir models in the concentration range tested. Desorption experiments demonstrated that less than 1% and 13% of the sorbed Pb and Zn, respectively, could be desorbed at pH 5.6 during 2 h.

**Keywords:** *Fibre; Biosorption; Lead; Zinc; pH dependence; Isotherms; Desorption*

**FOOD TECHNOLOGY (3 jdl)**

Kamolwan Jangchud, Pimolpan Puchakawimol, Anuvat Jangchud, Quality changes of burnt aromatic coconut during 28-day storage in different packages,

***LWT - Food Science and Technology***, Volume 40, Issue 7, September 2007, Pages 1232-1239, ISSN 0023-6438, DOI: 10.1016/j.lwt.2006.08.014.

(<http://www.sciencedirect.com/science/article/B6WMV-4M57HHR-1/2/f499e6e442b766d092d36274ca8f0487>)

**Abstract:**

The shelf-life of unwrapped, film-wrapped and vacuum-packed burnt aromatic coconut was studied at 5±1 [degree sign]C and 80-90% relative humidity. Regardless of the packaging treatments, weight loss of whole burnt coconut increased with storage time. Transmittance and lightness (L\*) values of coconut water decreased (P<0.05) with longer storage time. The pH of coconut water and coconut meat from the vacuum-packed treatment decreased as storage time increased. Sensory analysis showed that, for all treatments, the yellowness intensity of coconut water increased whereas its transparency decreased with time. The sourness intensity of vacuum-packed coconut water increased on later days of storage. Only the film-wrapped coconut, having the shortest shelf-life, had mold on its shell and husk at the end of storage. This study showed that the unwrapped, film-wrapped and vacuum-packed burnt coconuts could be stored for up to 14, 18 and 28 days, respectively, under the conditions used in this study.

**Keywords:** Burnt aromatic coconut; Quality; Packaging; Storage

K.N. Matsui, L.M. Granado, P.V. de Oliveira, C.C. Tadini, Peroxidase and polyphenol oxidase thermal inactivation by microwaves in green coconut water simulated solutions,

***LWT - Food Science and Technology***, Volume 40, Issue 5, June 2007, Pages 852-859, ISSN 0023-6438, DOI: 10.1016/j.lwt.2006.03.019.

(<http://www.sciencedirect.com/science/article/B6WMV-4K12CMF-3/2/36561b321c9d7e86d6f7e3bfc40c855d>)

**Abstract:**

Enzymes from coconut water such as peroxidase (POD) and polyphenol oxidase (PPO) when in contact with oxygen begin reactions causing nutritional and color losses. Solutions simulating the chemical constituents of coconut water were submitted to a batch process in a microwave oven. PPO and POD inactivation data could be characterized by: PPO/water D93 [degree sign]C=16.5 s (z=35.5 [degree sign]C); PPO/sugars D91 [degree sign]C=18 s (z=33[degree sign]C); POD/water D91.5 [degree sign]C=44 s (z=24 [degree sign]C) and POD/sugars D92 [degree sign]C=20.5 s (z=19.5 [degree sign]C). The contact between salts and enzymes promoted a drastic reduction of the initial activity. After the incidence of microwave energy at temperatures above 90 [degree sign]C, enzymes activity was not detected. These results can indicate an adequate choice of temperature conditions to inactivate coconut water enzymes. The knowledge of how green coconut water constituents

influence POD and PPO activity will supply useful information about microwave processing of coconut water.

**Keywords: Microwaves; Peroxidase; Polyphenol oxidase; Thermal processing**

Panida Unagul, Caetharin Assantachai, Saranya Phadungruengluij, Manop Suphantharika, Morakot Tanticharoen, Cornelis Verduyn, Coconut water as a medium additive for the production of docosahexaenoic acid (C22:6 n3) by *Schizochytrium mangrovei* Sk-02,

**Bioresource Technology**, Volume 98, Issue 2, January 2007, Pages 281-287, ISSN 0960-8524, DOI: 10.1016/j.biortech.2006.01.013.

(<http://www.sciencedirect.com/science/article/B6V24-4JJ87S4-1/2/1fd4323fb5432473bf923b5bcdd009a8>)

**Abstract:**

The effect of coconut water (CW) on biomass and docosahexaenoic acid (DHA, C22:6 n3) formation by *Schizochytrium mangrovei* Sk-02 was studied in a yeast extract-diluted sea water medium. Optimal CW-level was ca. 33% (v/v), resulting in a biomass level of 28 g/l with a DHA-content of 20% (w/w) or 6 g DHA/l, almost 50% higher than in non-supplemented cultures at the same initial sugar level. Study on the growth-promoting effects of coconut water suggested that it could be (partially) mimicked by addition of trace elements; the fatty acids present in CW did not appear to be incorporated or effect fatty acid formation by the organism. CW-addition was also effective in media with other nitrogen sources such as casitone, peptone and tryptone. Its inclusion (at 50% v/v) increased biomass levels two-to-three-fold with concomitant increases in the DHA-level.

**Keywords: Coconut water; Docosahexaenoic acid; Growth promoter; Schizochytrium; Yield**

## **SEED (4 jdl)**

Alice Baux, Thomas Hebeisen, Didier Pellet, Effects of minimal temperatures on low-linolenic rapeseed oil fatty-acid composition,

**European Journal of Agronomy**, Volume 29, Issues 2-3, August 2008, Pages 102-107, ISSN 1161-0301, DOI: 10.1016/j.eja.2008.04.005.

(<http://www.sciencedirect.com/science/article/B6T67-4SRM8CG-1/2/742cc1d8194dc90f1adc590617cc13c2>)

**Abstract:**

Rapeseed oil is rich in alpha-linolenic acid (C18:3) and has a low content in saturated fatty acids. It is therefore considered as a very healthy edible oil. However, its high polyunsaturated fatty acid content makes it sensitive to temperature oxidation and therefore not suitable for deep-frying. Low-linolenic varieties with C18:3 content lower than 3.5% have been bred, but a large variability of alpha-linolenic acid content has been often observed in agricultural production of these new lines. Identifying

factors affecting the fatty acid profile of oilseed rape should make it possible to produce rapeseed with alpha-linolenic acid content lower than 2.5% and therefore more suitable for frying and other uses in the food industry. Fatty acid composition is affected by environmental conditions, temperature being the main factor. Previous works showed that for conventional double-low rapeseed varieties, low minimal temperatures during the 60 days following the onset of flowering were related to higher alpha-linolenic acid contents. Monitoring the fatty acid profile in low-linolenic varieties from the beginning of seed filling to full maturity showed that alpha-linolenic acid synthesis occurred mainly between 550 and 850 degree-days (base 0 [degree sign]C) after the onset of flowering, that is during the 20 first days of seed filling in Swiss conditions, i.e. 41-60 days after the onset of flowering. During this period, the determination coefficient of a second order regression between final alpha-linolenic acid (C18:3) content and minimal daily temperature was even better, with  $R^2 = 0.87$ . A significant positive relation was also found for the regression between minimal temperature and oleic acid (C18:1) content for the cultivar Splendor ( $R^2 = 0.77$ ) but no correlation could evidence a relation between temperature and linoleic acid (C18:2) content. An easier way to show the relationship between linolenic acid content and minimal temperatures is based on the assumption that fatty acid desaturases regulated by temperature are active at low temperatures only. It consists in counting how many times during this period daily minimal temperature reaches a minimal threshold temperature of 13 [degree sign]C. The relationship between final alpha-linolenic acid content and the number of days with minimal temperature below 13 [degree sign]C is as good as the one presented before, i.e. with a determination coefficient,  $R^2 = 0.85$ . This simple model could be used to determine the growing areas with low linolenic acid content.

**Keywords: Alpha-linolenic acid; Temperature; Seed filling; Low-linolenic cultivar**

Steven C. Cermak, Amber L. John, Roque L. Evangelista, Enrichment of decanoic acid in cuphea fatty acids by molecular distillation,

***Industrial Crops and Products***, Volume 26, Issue 1, June 2007, Pages 93-99, ISSN 0926-6690, DOI: 10.1016/j.indcrop.2007.02.001.

(<http://www.sciencedirect.com/science/article/B6T77-4NBR8MX-1/2/ac67e618833817ceefa3bbf8181c349d>)

**Abstract:**

The introduction of a new crop often requires the development of new products and purification techniques of either the oil or fatty acids. Most new crops enter the cosmetic market first due to their high rates of return. However, the cosmetic market often demands highly pure and colorless materials. A molecular distillation unit is a powerful method of separation; separation occurs at extremely low pressures, and therefore at reduced temperatures compared with normal distillations and makes it very suitable for cuphea germplasm line PSR-23 (*C. lanceolata* x *C. viscosissima*) fatty acids. Refined cuphea fatty acids, which are mainly short-chain saturated fatty acids such as decanoic acid (C-10), were distilled using a lab-scale centrifugal molecular distillation unit to yield a distillate that was colorless (Gardner color = 1-). The optimal

distillation conditions were explored by varying the rotor temperature and flow rate onto the rotor. As the conditions were varied, the distillate and residue were monitored for Gardner color, fatty acid composition, and mass split rate between the distillate and residue. Under a high flow rate (2.23 g/min), enrichment of C-8 and C-10 in the distillate was increased to 96% in a single-pass distillation (rotor temperature = 65 [degree sign]C) with no unsaturation in the distillate while maintaining a split ratio of 1.5. A high flow, multiple-pass distillation (rotor temperature = 70 [degree sign]C) of a distillate fraction produced a distillate that was 99.8% saturated fatty acid and 0.2% unsaturated with very high split flow ratios. Overall, laboratory distillation of cuphea fatty acids successfully demonstrated the ability to achieve either high quantities of C-8 and C-10 or total saturated samples.

**Keywords: Centrifugal molecular distillation; Cuphea fatty acids; Decanoic acid; Distillation; Molecular distillation; Octanoic acid**

Amanuel G. Ghebretinsae, Shirley A. Graham, Gerardo R. Camilo, Janet C. Barber, Natural infraspecific variation in fatty acid composition of *Cuphea* (Lythraceae) seed oils,

***Industrial Crops and Products***, Volume 27, Issue 3, May 2008, Pages 279-287, ISSN 0926-6690, DOI: 10.1016/j.indcrop.2007.11.002.

(<http://www.sciencedirect.com/science/article/B6T77-4RM8977-1/2/4ebf72f31e68315a7d72f2518c23ea39>)

**Abstract:**

Fatty acid analyses of seed lipids were performed for 28 populations representing three widely distributed *Cuphea* species. Locality and climatic data for all samples were also compiled. The objectives of this study were to examine the extent of variation in seed oil composition among the wild populations, and to discover any patterns of relationship between fatty acid composition of seed oils and environmental factors. While we found the dominant fatty acid in the oil of each species remained consistent over the environmental and geographical ranges of the samples in the present study, variation as high as 30.6% in the amount of the dominant fatty acid produced was observed. Correlation analysis between fatty acid composition and the individual environmental factors of latitude, elevation or temperature showed no consistent pattern of influence. However, when considered together, the interaction of all three, and especially latitude and elevation, contributed significantly to the variation among populations. Environmental data at microhabitat level and through controlled environmental experiments will be needed for more precise understanding of factors affecting *Cuphea* seed oil composition at the population level.

**Keywords: Cuphea; Infraspecific variation; Medium chain fatty acids**

V.G. Sandhya, T. Rajamohan, Comparative evaluation of the hypolipidemic effects of coconut water and lovastatin in rats fed fat-cholesterol enriched diet,

**Food and Chemical Toxicology**, Volume 46, Issue 12, December 2008, Pages 3586-3592, ISSN 0278-6915, DOI: 10.1016/j.fct.2008.08.030.

(<http://www.sciencedirect.com/science/article/B6T6P-4TC3516-1/2/0af3ec7da9d5fe31a18146ce915240d0>)

**Abstract:**

The coconut water presents a series of nutritional and therapeutic properties, being a natural, acid and sterile solution, which contains several biologically active components, l-arginine, ascorbic acid, minerals such as calcium, magnesium and potassium, which have beneficial effects on lipid levels. Recent studies in our laboratory showed that both tender and mature coconut water feeding significantly ( $P < 0.05$ ) reduced hyperlipidemia in cholesterol fed rats [Sandhya, V.G., Rajamohan, T., 2006. Beneficial effects of coconut water feeding on lipid metabolism in cholesterol fed rats. *J. Med. Food* 9, 400-407]. The current study evaluated the hypolipidemic effect of coconut water (4 ml/100 g body weight) with a lipid lowering drug, lovastatin (0.1/100 g diet) in rats fed fat-cholesterol enriched diet ad libitum for 45 days. Coconut water or lovastatin supplementation lowered the levels of serum total cholesterol, VLDL + LDL cholesterol, triglycerides and increased HDL cholesterol in experimental rats ( $P < 0.05$ ). Coconut water feeding decreased activities of hepatic lipogenic enzymes and increased HMG CoA reductase and lipoprotein lipase activity ( $P < 0.05$ ). Incorporation of radioactive acetate into free and ester cholesterol in the liver were higher in coconut water treated rats. Coconut water supplementation increased hepatic bile acid and fecal bile acids and neutral sterols ( $P < 0.05$ ). Coconut water has lipid lowering effect similar to the drug lovastatin in rats fed fat-cholesterol enriched diet.

**Keywords: Coconut water; Cholesterol; Lovastatin; HMG CoA reductase; Bile acids**