

**Komoditas : Kenaf
Tahun 2004-2008 (34 judul)**

K.L. Nyam, C.P. Tan, O.M. Lai, K. Long, Y.B. Che Man, Physicochemical properties and bioactive compounds of selected seed oils, *LWT - Food Science and Technology*, Volume 42, Issue 8, October 2009, Pages 1396-1403, ISSN 0023-6438, DOI: 10.1016/j.lwt.2009.03.006.

(<http://www.sciencedirect.com/science/article/B6WMMV-4VVR22M-1/2/1ea813a5d807b4971e9504953f574699>)

Abstract:

The physicochemical properties and chemical composition of oil extracted from five varieties of plant seeds (bittermelon, Kalahari melon, kenaf, pumpkin and roselle seeds) were examined by established methods. The thermal properties of extracted oils by differential scanning calorimetry were also evaluated. Sensorial profiles of these seed oils were defined through the CieLab (L^* , a^* , b^*) colour. Most of the quality indices and fatty acid compositions showed significant ($P < 0.05$) variations among the extracted oils. Physicochemical properties of the oils extracted were iodine value, 86.0-125.0 g I₂/100 g oil; saponification value, 171.0-190.7 mg of KOH/g of oil; acid value, 1.1-12.9 mg of KOH/g of oil, free fatty acid, 0.6-6.5 g/100 g of oil, and peroxide value 1.5-6.5 meq of O₂/kg of oil. Palmitic, oleic and linoleic acids were the major fatty acids in all of the extracted seed oils except for bittermelon, where eleostearic acid was the major fatty acid. Gallic, protocatechuic, p-hydroxybenzoic, vanillic, caffeic, syringic, p-coumaric and ferulic acids were identified in the extracted plant oils. Among these, vanillic acid was predominant in all extracted oils. The oils were rich in tocopherols with [gamma]-tocopherol as the major components in all oil samples. Among the phytosterols, sitosterol was the major phytosterol extracted from the five plant seed oils. The seeds of these plants contain a great number of valuable minor compounds, which have a potential high value as food and for production of non-food products.

Keywords: Oil; Oilseeds; Physicochemical; Chemical composition; Thermal properties

Cheng Yi Ong, Sui Kiong Ling, Rasadah Mat Ali, Chin Fei Chee, Zainon Abu Samah, Anthony Siong Hock Ho, Soo Hwang Teo, Hong Boon Lee, Systematic analysis of in vitro photo-cytotoxic activity in extracts from terrestrial plants in Peninsula Malaysia for photodynamic therapy, *Journal of Photochemistry and Photobiology B: Biology*, Volume 96, Issue 3, 4 September 2009, Pages 216-222, ISSN 1011-1344, DOI: 10.1016/j.jphotobiol.2009.06.009.

(<http://www.sciencedirect.com/science/article/B6TH0-4WNB535-2/2/c6e219cee84372f10696455df6468886>)

Abstract:

One hundred and fifty-five extracts from 93 terrestrial species of plants in Peninsula Malaysia were screened for in vitro photo-cytotoxic activity by means of a cell viability test using a human leukaemia cell-line HL60. These plants which can be classified into 43 plant families are diverse in their type of vegetation and their natural habitat in the wild, and may therefore harbour equally diverse metabolites with potential pharmaceutical properties. Of these, 29 plants, namely three from each of the Clusiaceae, Leguminosae, Rutaceae and Verbenaceae families, two from the Piperaceae family and the remaining 15 are from Acanthaceae, Apocynaceae, Bignoniaceae, Celastraceae, Chrysobalanaceae, Irvingiaceae, Lauraceae, Lythraceae, Malvaceae, Meliaceae, Moraceae, Myristicaceae, Myrsinaceae, Olacaceae and Sapindaceae. *Hibiscus cannabinus* (Malvaceae), *Ficus deltoidea* (Moraceae), *Maranthes corymbosa* (Chrysobalanaceae), *Micromelum* sp., *Micromelum minutum* and *Citrus hystrix* (Rutaceae), *Cryptocarya griffithiana* (Lauraceae), *Litchi chinensis* (Sapindaceae), *Scorodocarpus bornensis* (Olacaceae), *Kokoona reflexa* (Celastraceae), *Irvingia malayana* (Irvingiaceae), *Knema curtisii* (Myristicaceae), *Dysoxylum sericeum* (Meliaceae), *Garcinia atroviridis*, *Garcinia mangostana* and *Calophyllum*

inophyllum (Clusiaceae), *Ervatamia hirta* (Apocynaceae), *Cassia alata*, *Entada phaseoloides* and *Leucaena leucocephala* (Leguminosae), *Oroxylum indicum* (Bignoniaceae), *Peronema canescens*, *Vitex pubescens* and *Premna odorata* (Verbenaceae), *Piper mucronatum* and *Piper* sp. (Piperaceae), *Ardisia crenata* (Myrsinaceae), *Lawsonia inermis* (Lythraceae), *Strobilanthes* sp. (Acanthaceae) were able to reduce the in vitro cell viability by more than 50% when exposed to 9.6 J/cm² of a broad spectrum light when tested at a concentration of 20 [mu]g/mL. Six of these active extracts were further fractionated and bio-assayed to yield four photosensitisers, all of which are based on the pheophorbide-a and -b core structures. Our results suggest that the main photosensitisers from terrestrial plants are likely based on the cyclic tetrapyrrole structure and photosensitisers with other structures, if present, are present in minor amounts or are not as active as those with the cyclic tetrapyrrole structure.

Keywords: Photo-cytotoxicity; Terrestrial plants; Malaysia; Photosensitiser; Photodynamic therapy; Cancer

Soheil Aber, Alireza Khataee, Mohsen Sheydaei, Optimization of activated carbon fiber preparation from Kenaf using K₂HPO₄ as chemical activator for adsorption of phenolic compounds, *Bioresource Technology*, In Press, Corrected Proof, Available online 18 August 2009, ISSN 0960-8524, DOI: 10.1016/j.biortech.2009.07.074.

(<http://www.sciencedirect.com/science/article/B6V24-4X1GFW7-F/2/a104a186ed4b9b69eeb05f102a4dba20>)

Abstract:

The present work reports the preparation of activated carbon fiber (ACF) from Kenaf natural fibers. Taguchi experimental design method was used to optimize the preparation of ACF using K₂HPO₄. Optimized conditions were: carbonization at 300 [degree sign]C, impregnation with 30% w/v K₂HPO₄ solution and activation at 700 [degree sign]C for 2 h with the rate of achieving the activation temperature equal to 2 [degree sign]C min⁻¹. The surface characteristics of the ACF prepared at optimized conditions were also studied using pore structure analysis, scanning electron microscopy (SEM) and Fourier transform infrared (FT-IR) spectroscopy. Pore structure analysis shows that micropores constitute the most of the porosity of the prepared ACF. The ability of the ACF prepared at optimized conditions to adsorb phenol and p-nitrophenol from aqueous solution was also investigated. The equilibrium data of phenol and p-nitrophenol adsorption on the prepared ACF were well fitted to the Langmuir isotherm. The maximum adsorption capacities of phenol and p-nitrophenol on the prepared ACF are 140.84 and 136.99 mg g⁻¹, respectively. The adsorption process follows the pseudo-first-order kinetic model.

Keywords: Isotherm; Kinetics; Phenol; p-Nitrophenol; Taguchi

Kim Wei Chan, Maznah Ismail, Supercritical carbon dioxide fluid extraction of *Hibiscus cannabinus* L. seed oil: A potential solvent-free and high antioxidative edible oil, *Food Chemistry*, Volume 114, Issue 3, 1 June 2009, Pages 970-975, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2008.10.055.

(<http://www.sciencedirect.com/science/article/B6T6R-4TVJNRM-2/2/2ff1ec3229973abbb03c985997914162>)

Abstract:

The supercritical fluid extraction (SFE) trends and antioxidant activities of *Hibiscus cannabinus* seed oils were studied. SFE results indicate that extraction pressure is the major factor determining the oil yield. In comparison, classic Soxhlet extraction (SOX/L) yielded higher oil content than SFE ($P < 0.05$). However, no significant differences in oil content were observed in SFE at 600 bars/80 [degree sign]C, rapid Soxhlet extraction (SOX/S) and conventional ultra-sonic assisted solvent extraction (SONIC) ($P > 0.05$). Antioxidant activities of *H. cannabinus* seed oils were compared with 7 types of commercial edible oils. DPPH scavenging activity test indicated that *H. cannabinus* seed oil extracted by SFE at 200 bars/80 [degree sign]C possessed the highest antiradical activity whereas beta-carotene bleaching (BCB) assay revealed that all *H.*

cannabinus seed oils (except for SFE at 400 bars/80 [degree sign]C and 600 bars/80 [degree sign]C) exhibited higher antioxidant activity than all commercial edible oils ($P < 0.05$). Thus, SFE - H. cannabinus seed oil may serve as an excellent source of solvent-free edible oil with high antioxidant properties.

Keywords: H. cannabinus seed oil; Supercritical carbon dioxide extraction; Antioxidant activity

J.C. Villar, E. Revilla, N. Gomez, J.M. Carbajo, J.L. Simon, Improving the use of kenaf for kraft pulping by using mixtures of bast and core fibers, *Industrial Crops and Products*, Volume 29, Issues 2-3, March 2009, Pages 301-307, ISSN 0926-6690, DOI: 10.1016/j.indcrop.2008.06.002.

(<http://www.sciencedirect.com/science/article/B6T77-4T083BB-1/2/e28ad866b8807e01b6c430f60f4abeb5>)

Abstract:

Kenaf (*Hibiscus cannabinus* L.) is a herbaceous annual plant amenable to use as a papermaking raw material. Kraft and soda pulping of kenaf have so far been done exclusively on the bark fraction (about 34-38% of the stem) or whole stem of the plant. Using kenaf bark exploits the higher quality of its bast fibers but reduces the typically high crop yields of this plant. In any case, core kraft pulp has acceptable properties some of which (e.g. tensile index, burst index) can even surpass those of bark pulp. Pulp made from both fractions has been found to exhibit better bonding properties than bark pulp. However, too high a proportion of core fibers can result in difficult drainage, a low tear strength or poor air permeability. These problems restrict the proportion of core that can be mixed with bast fibers, hinders separation of the two fractions and raises operational costs.

The primary purpose of this study was to examine the influence of the core-bark ratio on the properties of mixed kenaf pulp. We used unrefined core pulp and refined bark pulp. Based on the results for kraft sacks, obtaining kenaf paper from both fractions has some advantages. Because Gurley air porosity changed dramatically with the proportion of core pulp used, it was used to determine the maximum amount of core fibers to be added to bast fibers. A proportion of up to 34% was found to have no adverse effect on air permeability. Such a proportion allowed paper strength to be preserved with an acceptable tear index (19.8 mN m²/g) and excellent tensile index (72 N m/g). Also, energy consumption was reduced if only the bark fraction was refined. The proposed strategy thus provides increased fiber yields of kenaf per hectare per year and valorizes the core fraction.

Keywords: Nonwood plants; Kenaf; Kraft pulping; Bast fiber; Core fiber

Y. Liu, M.T. Labuschagne, The influence of environment and season on stalk yield in kenaf, *Industrial Crops and Products*, Volume 29, Issues 2-3, March 2009, Pages 377-380, ISSN 0926-6690, DOI: 10.1016/j.indcrop.2008.07.005.

(<http://www.sciencedirect.com/science/article/B6T77-4T9JWCH-1/2/adaa2348a32f08d629fc4edf2463b472>)

Abstract:

Kenaf is an important fiber crop worldwide. It was recently introduced to South Africa as a commercial fiber crop. The aim of this study was to determine how different environments and seasons influence stalk yield. Nine kenaf cultivars from various countries were analysed in two environments, over two consecutive seasons, where one location was irrigated and the other not. Data were recorded for total fresh yield, defoliated stalk yield and dry stalk yield. Yield stability was analysed with four different statistical models. The dry stalk yield varied from 15.33 to 17.78 ton/ha. El Salvador and Tainung 2 had high dry stalk yields in the favourable environments, but Tainung 2 did not have stable yield across all trials. Everglades 41 and El Salvador were the most stable of the varieties across both environments and seasons. El Salvador was the cultivar that had the highest and most stable dry stalk yield in the two seasons and two locations in South Africa, and should perform well in commercial production.

Keywords: South Africa cultivation; Fiber; Kenaf; Stalk yield

L.M. Lauriault, N. Puppala, The influence of rainfed and limited irrigation conditions and early vs. late plantings on kenaf as a potential industrial crop in the southern High Plains, USA, *Industrial Crops and Products*, Volume 29, Issues 2-3, March 2009, Pages 549-553, ISSN 0926-6690, DOI: 10.1016/j.indcrop.2008.10.006.

(<http://www.sciencedirect.com/science/article/B6T77-4V5XP1D-1/2/ea0ff0ae62831d17af4bd6805d0f4c29>)

Abstract:

Kenaf (*Hibiscus cannabinus* L.) is a nonwoody fiber source with many uses. To evaluate the dry matter yield potential of kenaf at two locations in the southern High Plains of the USA and the effects of late planting/late emergence as a possible replacement for hail damaged cotton, four varieties were grown in 2004 and 2005 at New Mexico State University's Agricultural Science Centers at Clovis, under limited irrigation, and Tucumcari, under rainfed conditions. Each study was a randomized complete block design having four replicates. A year x location interaction existed ($P < 0.0469$) for kenaf yield largely due to precipitation amount and distribution. Either late planting or late emergence due to low soil moisture at planting significantly reduced yields (3.62 vs. 0.63 Mg ha⁻¹ for mid-May planting and emergence and early July emergence or planting, respectively, $P < 0.0001$). Consequently, kenaf would not be suitable for recovering input costs when planted after failure of cotton. The very late maturing variety Gregg had consistently lower numeric yields than Dowling, Everglades 41, and Tainung 2 in all comparisons, with the strongest trend within the emergence date comparison ($P < 0.0912$). Kenaf varieties should be selected for any location that finish blooming approximately three to four weeks prior to the average first autumn freeze to allow for maximum growth.

Keywords: Kenaf; Cotton; Biofuel; Paper; Irrigated; Semi-arid

H. Komiyama, A. Enomoto, Y. Sueyoshi, T. Nishio, A. Kato, T. Ishii, K. Shimizu, Structures of aldouronic acids liberated from kenaf xylan by endoxylanases from *Streptomyces* sp., *Carbohydrate Polymers*, Volume 75, Issue 3, 11 February 2009, Pages 521-527, ISSN 0144-8617, DOI: 10.1016/j.carbpol.2008.08.021.

(<http://www.sciencedirect.com/science/article/B6TFD-4TDC0DW-1/2/ed6dcb65a70cf0de568333351e75d109>)

Abstract:

Streptomyces sp. SK519 was cultivated in the medium containing 0.5% birch wood xylan to produce extracellular xylanase. The xylanase was isolated from the culture supernatant by ammonium sulfate precipitation and partially purified by absorbing on the insoluble xylan. Alkali-extracted kenaf glucuronoylan of which main chain primarily consisting of (1-4)-linked [beta]-D-xylopyranose (Xylp), some of which carry [alpha]-(1-2)-linked 4-O-methylglucopyranosyl acid (MeGlcAp) and glucopyranosyluronic acid (GlcAp) as side chain was digested with the xylanase preparation. At the final stage of digestion, main neutral oligosaccharides were xylotriose (Xyl3) and xylobiose (Xyl2) followed by xylo-tetraose (Xyl4). Xylose was only formed in a trace amount. As acidic oligosaccharides liberated, following seven aldopentao- and aldotetraouronic acids were isolated in a pure state, respectively, by preparative anion-exchange chromatography. Their structures were determined by analysis of constitutional sugar residues and ¹H and ¹³C NMR spectroscopy.

Xyl-[beta]-1,4-[MeGlcA-[alpha]-1,2-]Xyl-[beta]-1,4-Xyl-[beta]-1,4-Xyl;
[MeGlcA-[alpha]-1,2-]Xyl-[beta]-1,4-Xyl-[beta]-1,4-Xyl-[beta]-1,4-Xyl;
Xyl-[beta]-1,4-[GlcA-[alpha]-1,2-]Xyl-[beta]-1,4-Xyl-[beta]-1,4-Xyl
[GlcA-[alpha]-1,2-]Xyl-[beta]-1,4-Xyl-[beta]-1,4-Xyl-[beta]-1,4-Xyl
[MeGlcA-[alpha]-1,2-]Xyl-[beta]-1,4-Xyl-[beta]-1,4-D-Xyl
[GlcA-[alpha]-1,2-]Xyl-[beta]-1,4-Xyl-[beta]-1,4-Xyl

Xyl-[beta]-1,4-Xyl-[beta]-1,3-Rha-[alpha]-1,2-GalA-[alpha]-1,4-Xyl

Keywords: Kenaf xylan; Xylanase; Streptomyces; Aldopentaouronic acid; Aldotetraouronic acid; NMR spectrometry; Ion exchange chromatography

Dharm Dutt, J.S. Upadhyay, Bahadur Singh, C.H. Tyagi, Studies on Hibiscus cannabinus and Hibiscus sabdariffa as an alternative pulp blend for softwood: An optimization of kraft delignification process, *Industrial Crops and Products*, Volume 29, Issue 1, January 2009, Pages 16-26, ISSN 0926-6690, DOI: 10.1016/j.indcrop.2008.03.005.

(<http://www.sciencedirect.com/science/article/B6T77-4SJGWNN-2/2/fd42290cac6e8897d2ef5d5194e8982b>)

Abstract:

Hibiscus cannabinus and Hibiscus sabdariffa, agro-based residues consist of bast and wood fibers which resemble to those of softwood and hardwood, respectively. The runkel ratio of core fibers H. cannabinus and H. sabdariffa is comparable to that of *Picea abies*, whereas, it is much less than those of hardwood like *Eucalyptus tereticornis*. The slenderness ratio of H. cannabinus is much closer to *P. abies* in comparison to H. sabdariffa whereas, it is 7.7 and 13% less than *E. tereticornis*. The flexibility coefficient of H. cannabinus and H. sabdariffa are slightly lower than that of *P. abies* but it is 59.6 and 57.0% are more than that of *E. tereticornis*. It indicates that morphological characteristics of core fibers of H. cannabinus and H. sabdariffa closely resemble to that of softwood except fiber length which can be compensated by long bast fibers. Due to identical pulping conditions, H. cannabinus and H. sabdariffa can be delignified together by kraft pulping process. The optimum cooking conditions for H. cannabinus and H. sabdariffa were found to be as, active alkali 16%, sulfidity 20%, temperature 160 [degree sign]C, time (at temperature) 120 min and wood to liquor ratio of 1:4.5. An anthraquinone (AQ) dose of 0.05% at an active alkali dose of 13% (as Na₂O) produces the screening rejects and kappa number similar to that obtained by using 15% active alkali (as Na₂O). The reaction kinetics study indicates that delignification is of first order. Low sulfidity AQ additive kraft pulping at constant H-factor produces better strength properties compared to non-additive kraft cooks.

Keywords: H. cannabinus; H. sabdariffa; Morphological characteristics; Kraft pulping; Lignin; Pulp yield; Kappa number; Activation energy; 1st order reaction constant; Anthraquinone

Steef J.J. Lips, Goretti M. Iniguez de Heredia, Richard G.M. Op den Kamp, Jan E.G. van Dam, Water absorption characteristics of kenaf core to use as animal bedding material, *Industrial Crops and Products*, Volume 29, Issue 1, January 2009, Pages 73-79, ISSN 0926-6690, DOI: 10.1016/j.indcrop.2008.04.011.

(<http://www.sciencedirect.com/science/article/B6T77-4SN8V4F-2/2/088c00e32158de9701dea3907f0ca312>)

Abstract:

Kenaf is grown these days as a minor fibre crop in some Asian countries, but also in the US and recently in Southern European countries such as Italy. The yield of extracted bast fibres is below 1/3 of that of the kenaf stem weight. In the US and Europe a profitable outlet for the remaining woody core is important for economical production of the crop. The use of kenaf core as animal bedding material is considered here as potential market outlet. An important aspect for this application is the moisture absorption capacity of the material. This paper describes evaluation of the water absorption capacity of different kenaf core fractions in comparison with other commercial animal bedding materials like straw and wood shavings. The water absorption of kenaf core particles is shown to be in the range of the other tested materials and especially the soft pith material showed very high absorbency.

Keywords: Kenaf; Hibiscus cannabinus L.; Woody core; Animal bedding; Water absorption

Sherif M.A.S. Keshk, Homogenous reactions of cellulose from different natural sources, Carbohydrate Polymers, Volume 74, Issue 4, 21 November 2008, Pages 942-945, ISSN 0144-8617, DOI: 10.1016/j.carbpol.2008.05.022.

(<http://www.sciencedirect.com/science/article/B6TFD-4SPC0PP-1/2/0ef4bee8e00aed18fd1467b3bf58dc51>)

Abstract:

Two different homogenous reactions on bacterial cellulose (BC), kenaf fiber (KF) and microcrystalline cellulose (MC) were performed to monitor their chemical reactivity. The first reaction was selective oxidation of the primary hydroxyl group with sodium chlorite in the presence of catalytic amount of sodium chloride. While, the second was the formation of triester hypiodous cellulose using potassium iodate and potassium iodide. The chemical structures of these derivatives were investigated using FT-IR and solid state ¹³C NMR spectroscopies. The BC fibrils required the shortest time among these cellulose samples for both reactions, whereas the viscosity values of BC after iodination and oxidation have the best values compared to KF and MC. FT-IR results show the absence of the hydroxy group of BC and a weak absorption band in both KF and MC. On the other hand, the crystallinity index (CI) of BC is higher than those of both KF and MC. FT-IR spectra of the oxidized different cellulose samples, confirmed the presence of a strong absorption band at around 1590 cm⁻¹ that attributed to vibration band of carbonyl group of carboxylic moiety. Moreover, in the ¹³C NMR spectrum of oxidized cellulose, the lack of signal at 62 ppm and the appearance of signal at 171 ppm indicated that the primary alcohol group is completely oxidized to carboxylic acid. These results showed that BC had a higher reactivity than other samples due to its great purity and low degree of polymerization.

Keywords: Bacterial cellulose; Kenaf; Microcrystalline cellulose; Triester hypiodous cellulose

C.H. Chia, S. Zakaria, K.L. Nguyen, M. Abdullah, Utilisation of unbleached kenaf fibers for the preparation of magnetic paper, Industrial Crops and Products, Volume 28, Issue 3, November 2008, Pages 333-339, ISSN 0926-6690, DOI: 10.1016/j.indcrop.2008.03.012.

(<http://www.sciencedirect.com/science/article/B6T77-4SG551Y-1/2/b2082f6366da63f3e6f92b6075c520e4>)

Abstract:

Unbleached kenaf fibers were selected for the manufacture of magnetic paper using chemical coprecipitation method. This method involved precipitation and loading of nano-sized ferrite particles into the lumen of the kenaf fibers. While the degree of loading depended on both the degree of agitation and temperature of the coprecipitation, the thermal stability of the produced magnetic paper depended mainly on the temperature. The magnetic particles deposited on the fiber surface had detrimental effects on the strength of the produced paper. The coercivity value of the magnetic paper depended on the type of ferrite produced from the coprecipitation.

Keywords: Kenaf fibers; Coprecipitation; Ferrites; Magnetic paper

H. Komiyama, A. Kato, H. Aimi, J. Ogihara, K. Shimizu, Chemical structure of kenaf xylan, Carbohydrate Polymers, Volume 72, Issue 4, 10 June 2008, Pages 638-645, ISSN 0144-8617, DOI: 10.1016/j.carbpol.2007.10.003.

(<http://www.sciencedirect.com/science/article/B6TFD-4R420KH-1/2/fa65a35a22a2124c72031ac2fcd55e45>)

Abstract:

Methylation and partial acid hydrolysis of xylans from the bast and core of kenaf (*Hibiscus cannabinus*) showed that the main chain of these xylans consists of (1 → 4)-linked [β]-d-xylopyranosyl (Xylp) residues, some of which carry a [α]-1,2-linked 4-O-methylglucopyranosyluronic acid (Me-GlcAp) and glucopyranosyluronic acid (GlcAp) residues as side chains. Partial hydrolysis of kenaf xylans afforded two series of aldouronic acids from aldobio- to aldotetraouronic acids. The acids of the first series composed of 4-O-Me-d-GlcAp and d-Xylp

residues: 4-O-Me-GlcA-Xyl3, 4-O-Me-GlcA-Xyl2 and 4-O-Me-GlcA-Xyl. The second series composed of d-GlcAp and d-Xylp: GlcA-Xyl3, GlcA-Xyl2 and GlcA-Xyl.

In addition to these acids, another aldobiouronic acid, 4-O-([alpha]-d-GalAp)-d-Xyl was found to be present in the partial hydrolysate.

The molar ratio of GalA, GlcA, 4-O-Me-GlcA, and Xyl residues was calculated to be 1.0:2.0:9.4:119 for the bast xylan and 1.0:1.3:7.9:99.4 for the core xylan.

Keywords: Kenaf; Xylan; Aldouronic acid; ¹³C NMR spectroscopy; Ion exchange chromatography; Partial hydrolysis

Narendra Reddy, Yiqi Yang, Characterizing natural cellulose fibers from velvet leaf (*Abutilon theophrasti*) stems, *Bioresource Technology*, Volume 99, Issue 7, May 2008, Pages 2449-2454, ISSN 0960-8524, DOI: 10.1016/j.biortech.2007.04.065.

(<http://www.sciencedirect.com/science/article/B6V24-4P1275R-3/2/633177d60f2265fa5b40cbd52366c2e9>)

Abstract:

Velvet leaf (*Abutilon theophrasti*) that is currently considered a weed and an agricultural problem could be used as a source for high quality natural cellulose fibers. The fibers obtained from the velvet leaf stems are mainly composed of approximately 69% cellulose and 17% lignin. The single cells in the fiber have lengths of approximately 0.9 mm, shorter than those in common bast fibers, hemp and kenaf. However, the widths of single cells in velvet leaf fibers are similar to the single cells in hemp and kenaf. The fibers exhibited breaking tenacity from 2.4 to 3.9 g/denier (325-500 MPa), breaking elongation of 1.6-2.4% and Young's modulus of 140-294 g/denier (18-38 GPa). Overall, velvet leaf fibers have properties similar to that of common bast fibers such as hemp and kenaf. Velvet leaves fibers could be processed on the current kenaf processing machineries for textile, composite, automotive and other fibrous applications.

Keywords: Biofiber; Velvet leaf; Cellulose; Biomass; Properties

Alireza Ashori, Warwick D. Raverty, Nafty Vanderhoek, John V. Ward, Surface topography of kenaf (*Hibiscus cannabinus*) sized papers, *Bioresource Technology*, Volume 99, Issue 2, January 2008, Pages 404-410, ISSN 0960-8524, DOI: 10.1016/j.biortech.2006.12.011.

(<http://www.sciencedirect.com/science/article/B6V24-4NJ26HF-1/2/195778e1760356d01f888f38d52684f2>)

Abstract:

Bleached kenaf handsheets sized with different polymers such as chitosan, polyvinyl alcohol and cationic starch, were used for the determination of surface topography. A non-contact profilometer, the AltiSur(R)500, was used to characterize the topography of structural details in the paper surface. Numerical and visual characterization of surface roughness indicated that the surface of chitosan-sized paper was less rough than other surfaces, and all the sized papers were commonly smoother than the unsized paper. One property of bio-polymer of chitosan is its ability to form films that improve the surface properties of paper when it is applied to the surface of the sheet.

Keywords: Profilometer; Roughness; Topography characteristics; Air-leak; Kenaf; Chitosan

R. Coetzee, M.T. Labuschagne, A. Hugo, Fatty acid and oil variation in seed from kenaf (*Hibiscus cannabinus* L.), *Industrial Crops and Products*, Volume 27, Issue 1, January 2008, Pages 104-109, ISSN 0926-6690, DOI: 10.1016/j.indcrop.2007.08.005.

(<http://www.sciencedirect.com/science/article/B6T77-4PVY2PP-2/2/8114b15debd56bb0ae39ab22446484fa>)

Abstract:

Kenaf (*Hibiscus cannabinus* L.) is a fibre plant native to east-central Africa. The potential for using kenaf seeds as a source of edible oil is often overlooked when considering kenaf as a fibre and feed crop. The aim of this research was to study and compare the fatty acid composition and oil

content of eight commercial kenaf varieties from various countries. Linoleic, oleic, and palmitic acid were the predominant fatty acids in all cultivars. Percentages of fatty acids varied greatly among different kenaf varieties. Gregg had the highest percentage of linoleic acid whilst El Salvador had the lowest. El Salvador had the highest percentage of oleic acid and Endora had the highest percentage of palmitic acid. Stearic acid and palmitic acid were positively correlated, as well as stearic and linoleic acid. Increasing stearic and linolenic acid and reducing palmitic acid at the same time therefore might be difficult through conventional breeding. The oil content was 19.84% on average and there was not much difference between the varieties. The relatively high oil content and the unique fatty acid composition, suggested that kenaf seed could be used as a source of edible oil. Kenaf oil can be considered nutritionally healthy because of the relatively high amount of monounsaturated and polyunsaturated fatty acids.

Keywords: Kenaf; Oil; Fatty acids; Correlation

P.T. Murphy, K.J. Moore, T.L. Richard, C.J. Bern, Enzyme enhanced solid-state fermentation of kenaf core fiber for storage and pretreatment, *Bioresource Technology*, Volume 98, Issue 16, November 2007, Pages 3106-3111, ISSN 0960-8524, DOI: 10.1016/j.biortech.2006.10.032.

(<http://www.sciencedirect.com/science/article/B6V24-4MSY8CB-3/2/8af5f93b4be0f56efe22ecb41cc7e0af>)

Abstract:

Kenaf is an annual fiber crop adaptable to a wide range of climates and soil types. This study investigated the use of kenaf core fiber as a feedstock for enzyme-enhanced fermentation. Triplicate kenaf core fiber samples were treated with enzymes having cellulase:hemicellulase activity ratios of 0:1, 0.015:1, 0.45:1, and 2.54:1 at a rate of 5010 IU/kg dry matter hemicellulase activity, vacuum-sealed, and incubated at 37 [degree sign]C for 21 d. Samples were analyzed for pH, water soluble carbohydrates, organic acids, and hemicellulose and cellulose concentrations. All treatments produced a pH less than 4.0, which is sufficient for stable storage. Treatments with 2.54:1 and 0.45:1 produced the highest water soluble carbohydrate and lactic acid concentrations. Enzymes with no or low cellulase activity produced results similar to the control. Utilizing enzyme mixtures with high cellulase activity is an effective pretreatment method for ensiled kenaf core fiber.

Keywords: Kenaf; Ensilage; Storage; Pretreatment; Fermentation

K. Kirwan, R.M. Johnson, D.K. Jacobs, G.F. Smith, L. Shepherd, N. Tucker, Enhancing properties of dissolution compounded *Miscanthus giganteus* reinforced polymer composite systems: Part 1. Improving flexural rigidity, *Industrial Crops and Products*, Volume 26, Issue 1, June 2007, Pages 14-27, ISSN 0926-6690, DOI: 10.1016/j.indcrop.2006.12.013.

(<http://www.sciencedirect.com/science/article/B6T77-4N5CSK6-1/2/e50aa31fc7c45e9e212c0399ab571d29>)

Abstract:

Natural fibre-reinforced polymer composites have found increased favour of late, particularly within the automotive industry where Kenaf is often used alongside flax, hemp and jute as a reinforcement for car panels door trims and parcel shelves, for example. By developing viable composites from alternative materials grown in the UK (i.e. *Miscanthus*), it is hoped to increase financial opportunities for farmers within this country who are either currently growing *Miscanthus* for biomass or who wish to diversify from more traditional hemp farming.

The purpose of this work is to determine the suitability of *Miscanthus* fibres as a reinforcement in poly(vinyl alcohol) (PVA) when dissolution blended and injection moulded. The formulation and processing parameters were altered and a design of experiments methodology was employed in order to determine whether the variation of factors led to improved performance. This paper focuses upon the research into improvements of flexural properties of the composite material

produced, and then establishes the optimum processing conditions for maximum flexural performance.

Keywords: Natural fibre; Composite; Mechanical properties; Injection moulding; Dissolution blending; Design of experiments; Flexural modulus; Miscanthus; Poly(vinyl alcohol)

Kaoru Abe, Yasuo Ozaki, Wastewater treatment by using kenaf in paddy soil and effect of dissolved oxygen concentration on efficiency, *Ecological Engineering*, Volume 29, Issue 2, 1 February 2007, Pages 125-132, ISSN 0925-8574, DOI: 10.1016/j.ecoleng.2006.02.003.

(<http://www.sciencedirect.com/science/article/B6VFB-4MH2BVG-1/2/05bf07c4fc90d189e58a0ea178107921>)

Abstract:

We previously reported that kenaf (*Hibiscus cannabinus* L.) planted in a zeolite-bed filter-ditch system provided highly effective treatment of wastewater. Here we compared that system with treatment in fallow paddy fields irrigated in different ways in a greenhouse. Paddy soil was a useful alternative to zeolite as the bed filter material. The efficiency of removal of N and P under furrow irrigation and flooding was 82-92% of that of the zeolite system. Most kenaf roots were distributed in water with a high dissolved oxygen (DO) concentration and a high redox potential; few roots grew in reducing soil under water. The roots distributed in the water contributed most to wastewater treatment. A low DO concentration (0.3 mg L⁻¹) decreased the efficiency of N and P removal. However, nightly low DO concentration (near 0 mg L⁻¹) alternating with daily high DO concentration did not seriously restrict the efficiency. An increase of alpha-naphthylamine oxidation activity in kenaf roots at low DO concentration is discussed in regard to induction of an oxygen-protective enzyme.

Keywords: *Hibiscus cannabinus*; Nitrogen; Phosphorus; Removal; Furrow irrigation; Roots oxidation activity

Leigh Davison, David Pont, Keith Bolton, Thomas Headley, Dealing with nitrogen in subtropical Australia: Seven case studies in the diffusion of ecotechnological innovation, *Ecological Engineering*, Volume 28, Issue 3, The Growth of Ecological Engineering: The Fifth Annual Conference of the American Ecological Engineering Society, 1 December 2006, Pages 213-223, ISSN 0925-8574, DOI: 10.1016/j.ecoleng.2006.07.012.

(<http://www.sciencedirect.com/science/article/B6VFB-4KV2RKT-2/2/c5a26a50c33815d8325a5ef290533bd1>)

Abstract:

This paper describes seven case studies in which ecotechnological approaches are being used to reduce the discharge of nitrogen to the environment in three local government jurisdictions in the moist subtropical zone of eastern Australia. Both technical performance and factors relating to acceptance of the technologies are examined. Three of the technologies have survived early setbacks to achieve increasing acceptance. Composting toilets and reed beds (sub-surface flow wetlands) have achieved takeoff in the on-site wastewater context in the Lismore City Council area where the level of adoption (based on 2004-2005 figures) for both technologies was approximately 30% of newly approved systems. In both cases, the level of adoption has been favoured by local scientific studies which have confirmed claims regarding technical performance and by regulations which encourage the reduction of nitrogen discharge to the environment. Free water surface (FWS) wetlands are installed as polishing devices at three of the 10 sewage treatment plants (STPs) in Lismore and the adjoining Byron and Richmond River Shires. Early problems arising from inexperience at design, construction and management of these wetlands have been overcome as local familiarity has increased. This confidence has been a factor in the decision to support a major upgrade to the West Byron constructed wetland system and to install a further three wetlands locally.

A further two technologies each have one full-scale system in operation. A 24 ha multipurpose wetland regeneration project for effluent polishing and transpiration, acid sulfate soil management, wetland regeneration, and carbon sequestration, recently installed at the end of the West Byron STP treatment train, is reducing total nitrogen concentrations from approximately 4-1 mg/L. A landfill leachate treatment system incorporating pond, macrophyte zones, horizontal flow gravel filter and single pass sand filter is reducing NH₄-N and TKN concentrations by 95% and 84%, respectively.

The final two technologies described are associated with the reuse and/or treatment of municipal wastewaters. The annual crops hemp and kenaf have both exhibited high N uptake rates in irrigated crop trials. However, their short growing season has resulted in rejection as production crops at one STP in the Byron Shire. The recent realization that the perennial pasture grass *Setaria sphacelata* can perform the role of wetland macrophyte has given rise to the concept of the 'wet-and-dry-land' cell. Still at the pilot stage, this ecotechnology may have application in areas with distinct wet and dry seasons.

Keywords: Composting toilet; Ecotechnology; Free water surface wetland; Innovation diffusion; Landfill leachate; Reed bed; Wet-and-dry-land cell; Wastewater reuse; Wetland restoration

M.K. Nacos, P. Katapodis, C. Pappas, D. Daferera, P.A. Tarantilis, P. Christakopoulos, M. Polissiou, Kenaf xylan - A source of biologically active acidic oligosaccharides, *Carbohydrate Polymers*, Volume 66, Issue 1, 5 October 2006, Pages 126-134, ISSN 0144-8617, DOI: 10.1016/j.carbpol.2006.02.032.

(<http://www.sciencedirect.com/science/article/B6TFD-4JWMT6S-1/2/09611bbab3051a3458d439b9a84c9ab4>)

Abstract:

Two xylose-rich hemicellulose fractions were obtained from kenaf wood (*Hibiscus cannabinus* L.) through a series of sequential extractions which dissociated xylans from other cell wall components. These fractions were subsequently used as substrates for the production of biologically active aldouronic acids. Incubation of the xylans with a family 10 *Thermoascus aurantiacus* endoxylanase resulted in the isolation of an aldotetrauronic acid as the main acidic oligosaccharide in the hydrolysis products. Enzymic hydrolysis with a family 11 *Sporotrichum thermophile* endoxylanase instead resulted in the isolation of a aldopentauronic acid as the main acidic oligosaccharide. The identity and purity of both xylans and aldouronic acids were assessed with solid-state FT-IR, solid-state and solution ¹³C NMR spectroscopy.

Keywords: Kenaf; Hemicellulose; Extraction; Endoxylanase; Xylan; Uronic acid; Oligosaccharide; FT-IR spectroscopy; ¹³C NMR spectroscopy

Marianthi Tsakalimi, Kenaf (*Hibiscus cannabinus* L.) core and rice hulls as components of container media for growing *Pinus halepensis* M. seedlings, *Bioresource Technology*, Volume 97, Issue 14, September 2006, Pages 1631-1639, ISSN 0960-8524, DOI: 10.1016/j.biortech.2005.07.027.

(<http://www.sciencedirect.com/science/article/B6V24-4H7T0J9-2/2/f8c74fc89c6910045618f0787a6358fc>)

Abstract:

The feasibility of replacing peat or perlite with rice hulls and ground kenaf core to grow a Mediterranean species (*Pinus halepensis* M.), was investigated. Treatments involved the following growing media: 70 peat:30 perlite as a control, 70 peat:30 rice hulls, 50 peat:50 rice hulls, kenaf (100%) and 60 kenaf:20 peat:20 rice hulls. The seedlings' quality and the physical and chemical properties of the substrates were evaluated. After this, the seedlings were planted in the field and their field performance was recorded. The results showed that the growth medium 70 peat:30 rice hulls can successfully be used for the production of *P. halepensis*, since the seedlings' nursery and field performance were similar to, or even better than those obtained with the control medium.

The seedlings produced in the growth media containing kenaf did not attain a suitable planting size and showed poorer field performance than control seedlings.

Keywords: *Pinus halepensis*; Substrate; Rice hulls; Kenaf; Peat; Growth; Field performance

Hulya Kalaycioglu, Gokay Nemli, Producing composite particleboard from kenaf (*Hibiscus cannabinus* L.) stalks, *Industrial Crops and Products*, Volume 24, Issue 2, September 2006, Pages 177-180, ISSN 0926-6690, DOI: 10.1016/j.indcrop.2006.03.011.

(<http://www.sciencedirect.com/science/article/B6T77-4K5ST2C-1/2/8a0041cf5b29b505d4b76ff9d64a0231>)

Abstract:

The purpose of this study was to investigate the usage of kenaf (*Hibiscus cannabinus* L.) stalks as a raw material for particleboard manufacturing. The parameters affecting particleboard manufacturing from kenaf were determined to be press temperature, and time, pressure, density and shelling ratio. The experimental results showed that the parameters were found to be effective on the physical (thickness swelling) and mechanical (modulus of rupture, and internal bond strength) properties with the exception of pressure, significantly. It appears that kenaf can be used to manufacture particleboard.

Keywords: Particleboard; Kenaf; Physical property; Mechanical properties

Sherif Keshk, Wiwin Suwinarti, Kazuhiko Sameshima, Physicochemical characterization of different treatment sequences on kenaf bast fiber, *Carbohydrate Polymers*, Volume 65, Issue 2, 25 July 2006, Pages 202-206, ISSN 0144-8617, DOI: 10.1016/j.carbpol.2006.01.005.

(<http://www.sciencedirect.com/science/article/B6TFD-4J9X30J-4/2/d262ad6e4141ac7413a68dacbaa16ee3>)

Abstract:

Three different processing sequences for pulping kenaf (*Hibiscus cannabinus* L.) bast fibers were investigated, and the chemical composition (cellulose, hemicellulose and lignin content) and physical properties (viscosity, degree of polymerization and crystallinity index) of the extracted pulp were determined. Three processing steps were employed: treatment with (a) ammonium oxalate, (b) sodium hydroxide, and (c) acidic chlorite. Variations in the order, conditions and duration of their application resulted in three different pulping methods. The kenaf fiber treated sequentially with acidified sodium chlorite, 0.5% ammonium oxalate and 1% sodium hydroxide (AC-AO-SH1) generated the greatest yield and highest kappa number; whereas the sample treated sequentially with 0.5% ammonium oxalate, 15% sodium hydroxide and acidic chlorite (AO-SH15-AC) developed the highest viscosity. No significant difference in hemicellulose content was observed between pulping methods. While Fourier Transform Infra Red spectra (FT-IR) and X-ray diffractometry of all extracted pulp samples revealed the same chain conformation, mean hydrogen bonding, and crystallinity index were apparent. X-ray diffractograms indicated the presence of residual oxidized lignin between the planes of the fibers subjected to AC-AO-SH1 processing sequence that were absent from fibers processed differently. From CP/MAS 13C NMR spectra of extracted pulp, weak shoulder peaks at 57 and 110 ppm were observed in sample treated by AC-AO-SH1 sequence that confirm the presence of oxidized lignin. Lignin content may adversely affect the viscosity of treated kenaf bast fiber.

Keywords: Crystallinity index; CP/MAS 13C NMR spectroscopy; FT-IR spectroscopy; Kappa number; Kenaf; Viscosity; X-ray diffractometry

Robert D. Stipanovic, Lorraine S. Puckhaber, Joseph H. Reibenspies, Howard J. Williams, The absolute configuration of (-)-3-hydroxy-[α]-calacorene, *Phytochemistry*, Volume 67, Issue 13, Reports on Structure Elucidation, July 2006, Pages 1304-1308, ISSN 0031-9422, DOI: 10.1016/j.phytochem.2006.05.019.

(<http://www.sciencedirect.com/science/article/B6TH7-4K8SC2W-4/2/7cb127395237b1c76810f835461834e9>)

Abstract:

3-Hydroxy-[alpha]-calacorene was identified in extracts from cold-shocked seedlings of cotton (*Gossypium hirsutum* L.) and kenaf (*Hibiscus cannabinus* L.), both of which are members of the Malvaceae family. (-)-3-Hydroxy-[alpha]-calacorene was isolated from *Heterotheca inuloides* Cass. (Asteraceae). HPLC on a chiral stationary phase column showed that the 3-hydroxy-[alpha]-calacorene from cotton and kenaf had the same relative configuration, while that from *H. inuloides* was of the opposite configuration. X-ray crystallographic analysis established the absolute configuration of the compound in *H. inuloides* as (8R)-(-)-3-hydroxy-[alpha]-calacorene.

Keywords: *Heterotheca inuloides*; *Gossypium hirsutum*; *Hibiscus cannabinus*; Malvaceae; Cotton; Kenaf; Biosynthesis; Sesquiterpene; (-)-3-Hydroxy-[alpha]-calacorene

Brian S. Baldwin, J. Wesley Graham, Population density and row spacing effects on dry matter yield and bark content of kenaf (*Hibiscus cannabinus* L.), *Industrial Crops and Products*, Volume 23, Issue 3, May 2006, Pages 244-248, ISSN 0926-6690, DOI: 10.1016/j.indcrop.2005.06.005.

(<http://www.sciencedirect.com/science/article/B6T77-4GX0C84-3/2/ac548a0521c794d46f857e5cde7c574f>)

Abstract:

Efforts to bring kenaf from experimental crop status to an accepted alternative in established cropping systems have been ongoing for years. To compete with existing crops and maximize monetary returns, the effects of agronomic practices on yield and crop quality must be better understood. Row spacing and population density are implicated in dry matter yield, and therefore, bast fiber production. Four row spacings, four population densities, and two cultivars were examined to determine these effects on dry matter accumulation and bark content. Of all factors evaluated, only row spacing significantly affected dry matter yield. Yield was greatest at the 35.5-cm row spacing, and lowest at the 71- and 101.6-cm row spacings. With regard to bast yield, calculated as a percentage of total sample dry weight, a significant cultivar x row spacing interaction occurred. However, data indicate that manipulating row spacing to maximize total stalk yield per hectare resulted in the highest bast fiber yield for the two cultivars tested. The narrowest row spacing of 35.5 cm, gave the greatest biomass yield as well as the highest bark yield per hectare.

Keywords: Kenaf; *Hibiscus cannabinus* L.; Bast; Fiber yield; Row spacing; Population density

Liliana N. Gray, Norma G. Collavino, Graciela E. Simon, Jorge A. Mariotti, Diallelic analysis of genetic effects determining days to flowering in kenaf, *Industrial Crops and Products*, Volume 23, Issue 2, March 2006, Pages 194-200, ISSN 0926-6690, DOI: 10.1016/j.indcrop.2005.06.001.

(<http://www.sciencedirect.com/science/article/B6T77-4GX0C84-1/2/b313a3b09bebfc738edb8c02bdadeb7d>)

Abstract:

The genetic control determining the days to flowering, defined as the number of days from emergence to the beginning of flowering is considered an important characteristic for breeding purpose. We investigated this factor in kenaf (*Hibiscus cannabinus* L.), as part of an agroindustrial project in northwest Argentina. A diallelic cross approach was considered in this study. Six highly inbred photosensitive cultivars were used in the cross, namely, Endora, Pandora, Tainung 1, Line 42, Line 21, and Line 29. Significant differences among F1 family means as well as among general combining ability (GCA) and specific combining ability (SCA) components were found based on the Griffing genetic-statistical method IV, Model 1. A predominant additive effect was detected for the days to flowering, giving high heritability estimates ($H = DGD = 0.96$; $h^2 = 0.69$), and suggests the possibility of effective selection for earliness in these cultivars. Early flowering in Line 29 was highly heritable, and therefore, is important for breeding purposes. Line 42, despite being the

earliest, did not transmit this characteristic to its progenies, possibly because of epistatic genetic effects. The regression of the covariances of F1 families on the non-recurrent parent (W_r) and the variance of the 'n' families (V_r) revealed that some dominance effects also occurred in the form of a partial dominance for early flowering. These results support the evidences revealed by the analysis of means of combinations between early and late flowering lines.

Keywords: Kenaf; *Hibiscus cannabinus* L.; Flowering; Gene action; Combining ability; Heritability

Ken-ichi Kuroda, Akiko Nakagawa-izumi, Bibhuti B. Mazumder, Yoshito Ohtani, Kazuhiko Sameshima, Evaluation of chemical composition of the core and bast lignins of variety Chinpi-3 kenaf (*Hibiscus cannabinus* L.) by pyrolysis-gas chromatography/mass spectrometry and cupric oxide oxidation, *Industrial Crops and Products*, Volume 22, Issue 3, November 2005, Pages 223-232, ISSN 0926-6690, DOI: 10.1016/j.indcrop.2005.01.002.

(<http://www.sciencedirect.com/science/article/B6T77-4FK3PD6-1/2/9377d238248177522bc6dd8f9d4271ce>)

Abstract:

In order to clarify the chemical composition of in situ lignin of kenaf (*Hibiscus cannabinus* L.), variety Chinpi-3, the core and bast fibers were fractionated from the 6-month matured kenaf with small stalks (309.0 cm height x 1.3 cm diameter, lignin content 16.6%) and large stalks (390.0 cm height x 2.3 cm diameter, lignin content 18.8%). The samples were subjected to conventional pyrolysis-gas chromatography/mass spectrometry (500 [degree sign]C/4 s), and cupric oxide oxidation. The quantitative pyrolysis results showed that (1) the differences in stalk size, when harvested at the same maturity, do not influence the lignin composition, (2) in situ core lignin is a mixed lignin comprising 1.4 parts of syringyl-, 1 part of guaiacyl-, and a small part of p-hydroxyphenyl lignin units, and (3) in in situ bast fiber lignin the syringyl lignin units are present in greater quantities than the guaiacyl lignin units. The cupric oxide oxidation results also supported the pyrolysis results.

Keywords: Pyrolysis-gas chromatography/mass spectrometry; Kenaf (*Hibiscus cannabinus* L.); In situ lignin composition; Syringyl lignin units; Guaiacyl lignin units; Stalk dimensions; Cupric oxide oxidation

Harbans L. Bhardwaj, Charles L. Webber III, Glenn S. Sakamoto, Cultivation of kenaf and sunn hemp in the mid-Atlantic United States, *Industrial Crops and Products*, Volume 22, Issue 2, September 2005, Pages 151-155, ISSN 0926-6690, DOI: 10.1016/j.indcrop.2004.08.002.

(<http://www.sciencedirect.com/science/article/B6T77-4DH2JC9-2/2/fa12c8cd6e868b3c90550ed9160350d3>)

Abstract:

Sunn hemp (*Crotalaria juncea* L.), a legume plant, has potential in the mid-Atlantic region of the U.S. as a renewable source of fiber and pulp, due to its biological nitrogen fixation capability that can help reduce/eliminate N pollution of Chesapeake Bay. Most research in this region has focused on kenaf (*Hibiscus cannabinus* L.) and little is known about sunn hemp. We evaluated effects of three planting dates (late-May, mid-June, and late-June) and three row spacings (0.3, 0.6, and 0.9 m) on dry matter yields (DMY) of kenaf and sunn hemp during 1997, and 1998 by using three crop treatments (CT1: kenaf grown with 100 kg N ha⁻¹; CT2: sunn hemp grown without inoculation and with 100 kg N ha⁻¹; and CT3: sunn hemp inoculated with *Bradyrhizobium* but without N fertilization). DMY following CT1 and CT3 (7.8 and 6.4 Mg ha⁻¹, respectively) during 1997 were similar and greater than that following CT2 (5.7 Mg ha⁻¹). However, DMY following CT1, CT2, and CT3 were similar in 1998 and ranged from 12.6 to 13.4 Mg ha⁻¹. Kenaf planting date did not affect DMY during 1997 but during 1998 the highest DMY was obtained from kenaf planted in late-May. The optimal planting date for sunn hemp during 1997 was mid-June, whereas in 1998 it was late-May. Row spacing effects on kenaf DMY were not significant. Row spacings of 0.3 m were optimal for DMY of N-fertilized sunn hemp during 1997 and 1998, whereas row

spacing did not affect DMY of non-fertilized, but affected inoculated sunn hemp. We conclude that both kenaf and sunn hemp could produce similar dry matter yields in the mid-Atlantic region of U.S.

Keywords: *Crotalaria juncea* L.; *Hibiscus cannabinus* L.; Nitrogen fertilization; Crop diversification

A. Tsakonas, V. Stergiou, M. Polissiou, K. Akoumianakis, H. C. Passam, Kenaf (*Hibiscus cannabinus* L.) based substrates for the production of compact plants, *Industrial Crops and Products*, Volume 21, Issue 2, March 2005, Pages 223-227, ISSN 0926-6690, DOI: 10.1016/j.indcrop.2004.04.008.

(<http://www.sciencedirect.com/science/article/B6T77-4CFV8DF-1/2/a037226f99d1018be0643d548f232bb4>)

Abstract:

Growth media based on whole-stem kenaf (*Hibiscus cannabinus* L.) and sand have been used to produce compact lettuce (*Lactuca sativa* L.) and pepper (*Capsicum annum* L.) plants. Seeds were sown directly in kenaf-containing substrates and growth was recorded for up to 100 days after sowing. The presence of whole-stem kenaf (core and bark), even at a ratio of 10:90 (kenaf:sand), inhibited plant growth expressed as plant height, leaf number, and plant fresh and dry weight. When plants were subsequently transplanted to a kenaf-free substrate, growth continued at a similar rate to that of the control (sown and grown in peat and sand). The inhibitory effect of kenaf is located both in the core and bark, but is decreased by soaking the kenaf in NH_4NO_3 prior to use. A possible role for whole-stem kenaf (core and bark) in the production of compact plants is proposed.

Keywords: Kenaf; Substrate; Germination; Growth; Pepper; Lettuce

P. Khristova, O. Kordsachia, T. Khider, Alkaline pulping with additives of date palm rachis and leaves from Sudan, *Bioresource Technology*, Volume 96, Issue 1, January 2005, Pages 79-85, ISSN 0960-8524, DOI: 10.1016/j.biortech.2003.05.005.

(<http://www.sciencedirect.com/science/article/B6V24-4C76D1R-1/2/7812a9a4d83453402c9d31aff0b61c2d>)

Abstract:

Soda-anthraquinone (soda-AQ), alkaline sulphite-anthraquinone (AS-AQ) and alkaline sulphite-anthraquinone-methanol (ASAM) pulping of date palm rachis and leaves from Sudan was carried under different conditions, and pulps with variable yields and mechanical properties were obtained. The date palm rachis gave best yields and mechanical properties with the AS-AQ or the ASAM process, while the leaves were best pulped with the soda method with low yield, but very good strength properties. Blending with 10% and 30% kenaf bark pulp was beneficial, especially for the AS-AQ pulps. Totally chlorine free (TCF) bleached rachis pulps were obtained of high brightness and strength properties suitable for use in writing and printing papers.

Keywords: Date palm rachis; Date palm leaves; Papermaking; Fiber morphology; Chemical composition; Pulping with additives; TCF bleaching; Blending; Kenaf

Bibhuti B. Mazumder, Akiko Nakgawa-izumi, Ken-ichi Kuroda, Yoshito Ohtani, Kazuhiko Sameshima, Evaluation of harvesting time effects on kenaf bast lignin by pyrolysis-gas chromatography, *Industrial Crops and Products*, Volume 21, Issue 1, January 2005, Pages 17-24, ISSN 0926-6690, DOI: 10.1016/j.indcrop.2003.12.003.

(<http://www.sciencedirect.com/science/article/B6T77-4BK2JYV-1/2/56b5bc5c795cd14ea06b1fbbbe4d9bfc>)

Abstract:

A Chinese kenaf (*Hibiscus cannabinus* L.), variety Sekko-ichi, was planted in May 1996, and harvested at 76, 116, 152, 185, and 226 days after planting. The hand-separated bast fibers were analyzed for lignin content and in situ lignin composition to clarify their variations with maturity.

Bast fibers increased in lignin until 152 days after planting, and did not increase thereafter. Variations in in situ lignin compositions with maturity were monitored using pyrolysis-gas chromatography. The volatile pyrolysis products released at 500 [degree sign]C for 4 s were identified by gas chromatography-mass spectrometry. Pyrolysis products derived from guaiacyl and syringyl lignin units were revealed. The yield of guaiacyl lignin-derived pyrolysis products decreased with maturity, while the yield of the syringyl analogous increased with maturity. The ratio of yield of syringyl lignin-derived products to that of guaiacyl ones (S/G) increased from 1.86 to 3.16 with maturity, but remained constant at 152 days after planting. High S/G ratio showed that mature bast lignin is of syringyl type. Quantitative pyrolysis results suggested that harvesting of kenaf at age of 5-months growth period provides a raw material with an ease of delignification.

Keywords: Kenaf bast lignin; Harvesting time; Analytical pyrolysis; Lignin composition

C. Ververis, K. Georghiou, N. Christodoulakis, P. Santas, R. Santas, Fiber dimensions, lignin and cellulose content of various plant materials and their suitability for paper production, *Industrial Crops and Products*, Volume 19, Issue 3, May 2004, Pages 245-254, ISSN 0926-6690, DOI: 10.1016/j.indcrop.2003.10.006.

(<http://www.sciencedirect.com/science/article/B6T77-4B66CRN-1/2/49b71479988b44d6578527044e9ce6d3>)

Abstract:

Fiber dimensions and lignin and cellulose content of various highly productive, non-wood plants and agricultural residues were examined to assess their suitability for paper production. Plants like kenaf (*Hibiscus cannabinus* L.) and giant reed (*Arundo donax* L.) internodes gave very good derived values, especially slenderness ratio, which is directly comparable to some softwood and most hardwood species. Cotton (*Gossypium hirsutum* L.) stalks, miscanthus (*Miscanthus x giganteus*) and switchgrass (*Panicum virgatum* L.) have shorter fibers resulting to poorer flexibility and Runkel ratios, but still satisfactory slenderness ratios. Finally, fibers from olive tree (*Olea europea* L.) and almond tree (*Prunus dulcis* L.) prunings presented relatively short and thick fibers producing the poorest derived values among all the species examined. Fiber dimensions did not differ significantly within each species, when samples from different stalks/branches or different positions (base, middle top) were examined. The only exception were cotton stalks, where those differences did not have any significant effect on fiber derived values.

Chemical analysis of the raw plant materials revealed satisfactory levels of [alpha]-cellulose content (close to 40%) and Klason lignin content (<30%) compared to those of hardwoods and softwoods. Relatively increased (>25%) lignin content in miscanthus, switchgrass and almond prunings may require additional pulping time and chemical charge compared to those of other non-wood raw materials. Analysis of samples at various heights/lengths of the plant materials showed that lignin and cellulose content depends on tissue maturity, but does not change significantly within each species.

Keywords: Fiber dimensions; Lignin and cellulose content; Non-wood plants; Agricultural residues; Mechanical strength

D. E. Akin, L. L. Rigsby, W. H. Morrison III, Oil Red as a histochemical stain for natural fibers and plant cuticle, *Industrial Crops and Products*, Volume 19, Issue 2, March 2004, Pages 119-124, ISSN 0926-6690, DOI: 10.1016/j.indcrop.2003.08.002.

(<http://www.sciencedirect.com/science/article/B6T77-49W2RB5-2/2/41f5548c85638ecc3aa9c2cebd338bc4>)

Abstract:

Properties of natural fibers are influenced by the nature of their surface. Oil Red was evaluated as a histochemical stain for the waxy components on the surface of cotton and flax fibers and of plant cuticles. A positive reaction for arachidyl stearate and differential staining of fibers after sequential extraction of fatty acids and alcohols indicated that Oil Red stained wax components in plant

materials. For cotton (*Gossypium hirsutum*) fibers, Oil Red stained to a greater extent the regions closest to the seed coat, especially at points where fibers attached to the seed coat. Fiber regions at a distance from the seed coats stained irregularly, suggesting that the wax was unevenly distributed. Flax (*Linum usitatissimum*) bast fibers, in contrast, did not stain with Oil Red, but the protective stem cuticle was intensely stained. The positive histochemical reaction for cuticle identified non-fiber fragments in processed and cleaned flax fibers, thus providing a quick method to detect visually trash components in fiber and products. Likewise, bast fibers from kenaf (*Hibiscus cannabinus*) did not stain well with Oil Red, whereas the stem cuticle gave a positive reaction. The general usefulness of Oil Red as a histochemical stain for the plant cuticle was demonstrated in leaves and stems of mature corn (*Zea mays*) and fresh bermudagrass (*Cynodon dactylon*) leaves. Oil Red provides a quick, qualitative histochemical method to demonstrate the wax-containing cuticle in plants.

Keywords: Cuticle; Wax; Cotton; Flax; Kenaf; Bermudagrass; Corn; Histochemistry