Optimization of pulping conditions for *Hibiscus cannabinus* Linn. and *Hibiscus sabdariffa* Linn.

Scientists at India carried out investigations to provide optimized pulping conditions for better utilization of *Hibiscus cannabinus* Linn. and *H. sabdariffa* Linn. — an alternative raw material for expensive softwood fibres as these agricultural residues bear the characteristic of some softwoods and certainly to most of the hardwoods. Morphological analysis and chemical composition of them show their suitability for producing paper of various grades. Due to identical pulping conditions, *H. cannabinus* and *H. sabdariffa* can be delignified together by kraft pulping process. The optimum cooking conditions for both were found to be as, active alkali 16%, sulfidity 20%, temperature 160°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 [Dutt Dharm, Upadhyay JS, Singh Bahadur and Tyagi CH, Studies on *Hibiscus cannabinus* and *Hibiscus sabdariffa* as an alternative pulp blend for softwood: An optimization of kraft delignification process, *Ind Crops Prod*, 2009, 29 (1), 16-26].

Jute-fibre glass-plywood/particle board composite

Jute-fibre glass reinforced sheets were prepared by scientists at India with shellac-containing sheet moulding compound. Highest tensile strength and tensile modulus values of jute-fibre glass composites were obtained in the range of 49.76-51.71 MPa and 1.84-1.85 Gpa, respectively. Flexural strength and flexural modulus were found to be in the range of those of the reinforced sheets prepared using fibre glass alone, when the thickness of the sheets was increased up to 7-7.5 mm. Flame retardance of the sheets could be improved with the use of flame retardant. Thermal resistance of the sheets was found to be up to 220°C. Lamination of plywood and particle board was also tried with jute-fibre glass, which yielded improved mechanical properties [Goswami DN, Ansari ME, Day A, Prasad N and Baboo B, Jute-fibre glass-plywood/particle board composite, *Indian J Chem Technol*, 2008, 15 (4), 325-331].

Greaseproof paper from Banana pulp fibre

Utilization of banana pulp fibre for producing greaseproof paper has been investigated by researchers at North-East Institute of Science and Technology (CSIR), Jorhat, India. The morphological characteristics of plant and fibre, chemical constituents of the sheath, characteristics of pulp and physical strength properties of hand sheet of 45±5 gsm made from banana pulp alone or in combination with bamboo pulp fibre are presented. Results showed that *Musa paradisica* Linn. contain high quantity of gums and muclage inside the sheaths. The pentosan content (13.5%) may also impart the greaseproof properties. The drainage time of the banana pulp increases with the increase of beating time. At 80°SR freeness, the pulp becomes hydrated and forms a jelly like stock. The paper made out of this hydrated pulp stock shows the characteristics of greaseproof paper with burst index 6.10 kpm²/g, tear index 7.00 mNm²/g and tensile index 51.2 N/m with very good blister and oil resistibility. The physical strength properties of the paper may further be enhanced by incorporating 20% bamboo pulp beaten up to 85°SR freeness and mixed with banana semi bleached pulp stock beaten up to 85°SR freeness [Goswami T, Kalita Dipul and Rao PG, Greaseproof paper from Banana (*Musa paradisica* L.) pulp fibre, *Indian J Chem Technol*, 2008, 15 (5), 457-461].
Improving the use of kenaf for kraft pulping

Kenaf (Hibiscus cannabinus Linn.) is an 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 fibres 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 fibres 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 fibres, hinders separation of the two fractions and raises operational costs.

Thus, researchers at Spain carried out studies to examine the influence of the core-bark ratio on the properties of mixed kenaf pulp. They 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 fibres to be added to bast fibres. 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 (19.8mNm²/g) and excellent tensile index (72Nm/g). Also, energy consumption was reduced if only the bark fraction was refined. The proposed strategy thus provides increased fibre yields of kenaf per hectare per year and valorizes the core fraction [Villar JC, Revilla E, Gómez N, Carbajo JM and Simón JL, Improving the use of kenaf for kraft pulping by using mixtures of bast and core fibers, Ind Crops Prod, 2009, 29 (2-3), 301-307].

Effects of husk particle size and calcium chloride on coconut husk–cement composites

Coconut husks, residues generated during coconut processing, are available in abundant quantities in many parts of the tropics but are often treated as a waste material. Thus, in a study conducted at Department of Agricultural and Environmental Engineering, University of Ibadan, Ibadan, Oyo, Nigeria the effects of particle size and calcium chloride (CaCl₂) on strength and sorption properties of cement-bonded composites produced from coconut (Cocos nucifera Linn.) husk were investigated. Particle size, CaCl₂, and the interaction of both variables had significant effects (P<0.05) on the density and the Modulus of Elasticity (MOE), while only particle size had significant effects (P<0.05) on the Modulus of Rupture (MOR) of the composites. MOE, MOR, Water Absorption and Thickness Swelling (at 24h) compare favourably with values reported for cement-bonded composites produced from similar lignocellulosics. These properties can be exploited in many applications where lightweight concretes are required [Olorunnisola Abel O, Effects of husk particle size and calcium chloride on strength and sorption properties of coconut husk–cement composites, Ind Crops Prod, 2009, 29 (2-3), 495-501].

Effects of pre-treatment of Rattan on the hydration of Portland cement

Wood-cement composite panels are employed in building construction for diverse purposes including flooring, siding and ceiling. The woody part of these composites is obtainable from different sources including fast growing (plantation) tree species, wood and agricultural residues, and non-commercial or low-value tree species. Effects of aqueous extraction, sieving, mixing with coconut husk and addition of calcium chloride on the compatibility of Laccosperma secundiflorum (G. Mann. & H. Wendl.) Kuntz (Rattan) with Portland cement, in terms of
Biopolymers have the potential to serve as coating materials for paper to improve its performance properties. Thus, objectives of the study done at Department of Food Engineering, Faculty of Engineering at Kamphaengsaen, Kasetsart University, Nakhonpathom, Thailand were to determine the effect of hydroxypropyl methylcellulose (HPMC), glycerol (Gly) and beeswax (BW) coatings on the physical properties and water vapour permeability (WVP) of coated papers. It was found that HPMC coated paper showed significant differences on physical properties, compared with uncoated\((P<0.05)\). Folding endurance of HPMC-based coated papers greatly increased which indicated improved durability of coated paper. Moreover, HPMC-based coated papers increased in stretch and decreased in tensile index. HPMC-based coatings reduced WVP and further reduction was obtained when beeswax was incorporated in the HPMC-lipid composite coated paper. Paper coated with hydrocolloid and lipid can be used to produce packages with the potential to be used to maintain agricultural produce quality for the food industry, and may have other applications (i.e., medical packaging) [Sothornvit Rungsinee, Effect of hydroxypropyl methylcellulose and lipid on mechanical properties and water vapour permeability of coated paper, Food Res Int, 2009, 42 (2), 307-311].

The proposed compatibility index, based on the ratio of the setting times of wood-cement mixture and neat cement, yielded satisfactory results comparable to propositions from previous researchers [Olorunnisola Abel O, Effects of pre-treatment of rattan (Laccosperma secundiflorum) on the hydration of Portland cement and the development of a new compatibility index, Cement Concr Compos, 2008, 30 (1), 37-43].

## Effect of hydroxypropyl methylcellulose and lipid on mechanical properties and water vapour permeability of coated paper

Biopolymers have the potential to serve as coating materials for paper to improve its performance properties. Thus, objectives of the study done at Department of Food Engineering, Faculty of Engineering at Kamphaengsaen, Kasetsart University, Nakhonpathom, Thailand were to determine the effect of hydroxypropyl methylcellulose (HPMC), glycerol (Gly) and beeswax (BW) coatings on the physical properties and water vapour permeability (WVP) of coated papers. It was found that HPMC coated paper showed significant differences on physical properties, compared with uncoated\((P<0.05)\). Folding endurance of HPMC-based coated papers greatly increased which indicated improved durability of coated paper. Moreover, HPMC-based coated papers increased in stretch and decreased in tensile index. HPMC-based coatings reduced WVP and further reduction was obtained when beeswax was incorporated in the HPMC-lipid composite coated paper. Paper coated with hydrocolloid and lipid can be used to produce packages with the potential to be used to maintain agricultural produce quality for the food industry, and may have other applications (i.e., medical packaging) [Sothornvit Rungsinee, Effect of hydroxypropyl methylcellulose and lipid on mechanical properties and water vapour permeability of coated paper, Food Res Int, 2009, 42 (2), 307-311].

## Differences in residual lignin properties between Betula verrucosa and Eucalyptus urograndis kraft pulps

The scientists at Finland and Japan compared the ultrastructural features of two oxygen delignified hardwood kraft pulps- Eucalyptus urograndis and Betula verrucosa Ehrh. (Birch) and demonstrated a marked difference in their residual lignin properties. In this study, properties such as crystallinity and crystal size of cellulose, molecular weights, carboxyl group contents and carbohydrate compositions of the two kraft pulps were compared. The examined pulps were observed to be relatively similar. A significant difference, however, was observed in the size exclusion chromatography measurements, which indirectly suggested that a significant portion of residual lignin in eucalyptus pulp was associated with cellulose. Birch pulp, in contrast, exhibited a more conventional tendency for hardwood pulps: lignin mainly associated with hemicelluloses [Hänninen Tuomas A, Kontturi Eero, Isogai Akira and Vuorinen Tapani, Differences in residual lignin properties between Betula verrucosa and Eucalyptus urograndis kraft pulps, Biopolymers, 2008, 89(10), 889-893].
Influence of modified starch on the process water quality in paper making and the paper properties

The influence of modified (cationic) starch on the process water quality in paper making and paper properties has been investigated by the researchers at Pulp and Paper Institute and Faculty of Chemistry and Chemical Technology, Ljubljana, Slovenia. The experiments were conducted on sulfate hardwood pulp by applying both tap and paper mill process water. When process water is used, the retained amount of starch on fibres decreases, which most probably results from a partial neutralization of the cationic charge on modified starch, thereby reducing its attraction to the anionic groups on a fibre. By adding the modified starch, the turbidity of process water is to some extent reduced, indicating that the suspended organic substances are removed from process water. Due to starch accumulation, the load of process water by organic substances (determined via the TOC analysis) is not reduced, but is rather increased when the modified starch is added. In most cases, the addition of modified starch improved the investigated paper properties. However, these properties varied in correlation with the quality of the used water, despite the fact that the dosage of modified starch remained constant. This demonstrates the influence of process water quality, not only on the paper properties, but also on the efficiency of process chemicals, such as the modified starch, in the papermaking process [Nejc Zakraj and Janvit Golob, The Influence of Modified Starch on the Process Water Quality in Papermaking and the Paper Properties, Starch - Stärke, 2009, 61(2), 109-115].

Investigations on the cushioning properties of honeycomb paperboard

The scientists at China studied cushioning properties of honeycomb paperboards by means of experimental analysis. Experimental results indicate that the cushioning behaviour of paper honeycombs with and without liners are similar, but the cushioning capability is significantly larger for the material with liners. Experiment and theory show that the relative density of paper honeycomb core has a significant effect on the cushioning properties of honeycomb paperboards however, the basis weight of the liner has only little effect. Experimental results also show that the energy absorption properties of multilayer honeycomb paperboards are not always higher than those of monolayer honeycomb paperboards and that the height of honeycomb paperboard has an effect on its cushioning properties. These results can be used to characterize and improve the cushioning properties of honeycomb paperboard pads efficiently [Wang Dong-Mei and Wang Zhi-Wei, Experimental investigation into the cushioning properties of honeycomb paperboard, Pack Technol Sci, 2008, 21(6), 309-316].

New ways to enhance the functionality of paperboard by surface treatment–A review

The scientists at Department of Chemical Engineering, Karlstad, Sweden reviewed recent development of functional materials to improve the barrier properties of paperboard with emphasis on bio-based polymers. Focus is directed to novel application techniques and water-borne, renewable coating materials. Some aspects on substrate properties and the requirements on food packaging are discussed as are the processability, convertability, recyclability and biodegrad-
ability of packaging materials. The functionality, advantages and disadvantages of several bio-based polymers are presented in detail. Among these are starch and cellulose derivatives, chitosan, alginate, wheat gluten, whey proteins, polycaprolactone, poly(lactic acid) and polyhydroxyalkanoates. Also discussed is the enhancement of barrier properties by incorporation of nanosized materials, by application of thin protective top coatings and local reinforcement by self-healing agents [Andersson Caisa, New ways to enhance the functionality of paperboard by surface treatment-A review, Pack Technol Sci, 2008, 21(6), 339-373].

**Modifications in Eucalyptus globulus Labill. kraft process**

Increasing the yield of the wood pulping process allows the reduction of specific wood costs. Process modifications with a great impact on pulp yield are the profiling of chemical charges and addition of anthraquinone (AQ). Therefore, the scientists at University of Aveiro, Department of Chemistry, Aveiro, Portugal investigated the influence of effective alkali (EA) profiling and addition of anthraquinone on E. globulus Labill. kraft pulping performance. The impact of such process modifications on the ECF bleaching process and on the papermaking properties of the resulting bleached pulps was also evaluated. An EA profiling cook may lead to a pulp yield gain, which is more significant as the total EA charge used in the kraft cook increases. AQ addition to kraft pulping leads to a significant yield increase. The ClO₂ charge required to fully bleach the pulps was lower for EA profiling and higher for kraft + AQ unbleached pulps. Bleached AQ pulp presents a high beatability due to high pulp xylan retention. Thus, a low total EA charge is the key parameter for high polysaccharide retention on pulp. AQ addition constitutes a feasible strategy to increase pulp yield. Bleaching performance and papermaking properties of pulps produced with the three different methods may be affected by the kraft pulping modifications [Santiago AS and Neto C Pascoal, Eucalyptus globulus kraft process modifications: Effect on pulping and bleaching performance and papermaking properties of bleached pulps, J Chem Technol Biotechnol, 2008, 83(9),1298-1305].

**Spices**

**The effect of Garlic on ischemic preconditioning and ischemia reperfusion induced cardiac injury**

The effect of garlic (Allium sativum Linn.) extract on ischemic preconditioning and ischemia reperfusion induced cardiac injury has been studied by researchers at India. Hearts from adult albino rats of Wistar strain were isolated and immediately mounted on Langendorff's apparatus for retrograde perfusion. After 15 min of stabilization, the hearts were subjected to four episodes of 5 min ischemia, interspersed with 5 min reperfusion (to complete the protocol of ischemic preconditioning), 30 min global ischemia, followed by 120 min of reperfusion. In the control and treated groups, respective interventions were given instead of ischemic preconditioning. The magnitude of cardiac injury was quantified by measuring lactate dehydrogenase and creatine kinase concentration in the coronary effluent and myocardial infarct size by macroscopic volume method. The study demonstrates that garlic extract exaggerates the cardio protection offered by ischemic preconditioning and per se treatment with garlic extract also protects the myocardium against ischemia reperfusion induced cardiac injury [Bhatti Rajbir, Singh Kushlinder, Ishar MPS and Singh Jatinder, The effect of Allium sativum on ischemic preconditioning and ischemia reperfusion induced cardiac injury, Indian J Pharmacol, 2008, 40(6), 261-265].