potato flour, Huakaroro snacks showed an $L^*$ value of 51.71, whereas pure corn flour snacks had the highest $L^*$ value of 61.22. The $b^*$ at both levels of potato flour incorporation were lowest for Tutaekuri snacks. The microstructural characteristics of the extrudates such as cell structure and cell wall thickness changed considerably when potato flour was incorporated (50%) in the extruder feed. Moemoe, Tutaekuri and 100% corn flour snacks had the highest toughness, whereas the highest crispness was observed for the Huakaroro snacks. Lower and higher cold peak viscosities of 91 and 597 cP were observed for corn and Tutaekuri extrudates (in powdered form), respectively. The extrudates with 50% potato flour had higher breakdown and lower final viscosity than those containing 25% flour. The peak $G'$ values were highest for 100% corn, Moemoe and Karuparera snack pastes [Singh Jaspreet, Kaur Lovedeep, McCarthy Owen J, Moughan Paul J and Singh Harjinder, Development and characterization of extruded snacks from New Zealand Taewa (Maori potato) flours, Food Res Int, 2009, 42 (5-6), 666-673].

**Fruit**

### Edible film based on candelilla wax to improve the shelf life and quality of Avocado

Scientists at Mexico studied the effect of addition of ellagic acid (at three different concentrations) into candelilla wax matrix on shelf life and quality of whole Avocados (*Persea americana Mill*.). Control treatments were avocados coated with candelilla wax without ellagic acid and avocados without coating. The fruits were chosen for their maturity, size, free from infection and physical defects. All those samples were inoculated with a concentrated suspension of spores of *Colletotrichum gloeosporioides*, the main phytopathogenic fungus for avocados. Experiments were carried out completely divided into randomized groups. Changes in appearance, solids content, pH, $a_w$, lightness ($L^*$ value) and weight loss were monitored during 6 weeks every 8 days. A sensory evaluation of avocados coated with the best edible film was also performed. Edible films were able to reduce significantly the damage caused by *C. gloeosporioides*, reducing also significantly the change in appearance and weight loss in the fruits. Use of ellagic acid as part of the edible film has an important effect to improve the quality and shelf life of avocado. They found that using this new protection system the negative effects of *C. gloeosporioides* can be successfully reduced. It was concluded that the use of an edible film based on candelilla wax with a potent antioxidant ellagic acid on whole fruits is a good alternative to conserve fresh avocados [Saucedo-Pompa Saul, Rojas-Molina Romeo, Aguilar-Carbó Antonio F, Saenz-Galindo Aide, de La Garza Heliodoro, Jasso-Cantú Diana and Aguilar Cristóbal N, Edible film based on candelilla wax to improve the shelf life and quality of avocado, Food Res Int, 2009, 42 (4), 511-515].

### Antioxidant capacity and phenolic content of selected tropical fruits from Malaysia

Tropical fruits are well known to be associated with many medicinal properties. The antioxidant capacity and phenol content of three tropical fruits pulps, namely, honey pineapple (*Ananas comosus Merr.*), a local cultivar of banana (known as *pisang mas*) (*Musa paradasiaca Linn.*) and Thai seedless guava (*Psidium guajava Linn.*) were studied by researchers at Food Technology Division, School of Industrial Technology, Universiti Sains Malaysia, Penang, Malaysia. Three solvent systems were used (methanol, ethanol and acetone) at three different concentrations (50, 70 and 90%) and with 100% distilled water. The antioxidant capacity of the fruit extracts was evaluated using a ferric reducing/antioxidant power assay and the free radical-scavenging capacity was evaluated using 2,2-diphenyl-1-picrylhydrazyl radical-scavenging assays. The efficiency of the solvents used to extract phenols from the three fruits varied considerably.
The polyphenol content of Thai seedless guava was 123 to 191 gallic acid equivalents/100 g (GAE/100 g), that of pisang mas was 24.4 to 72.2 GAE/100 g, and that of honey pineapple was 34.7 to 54.7 GAE/100 g. High phenol content was significantly correlated with high antioxidant capacity [Alothman M, Bhat Rajeev and Karim AA, Antioxidant capacity and phenolic content of selected tropical fruits from Malaysia, extracted with different solvents, Food Chem, 2009, 115 (3), 785-788].

**Adding value to hard date (Phoenix dactylifera Linn.): Jam production**

The date palm tree (Phoenix dactylifera Linn.) is grown extensively in arid and semi-arid regions of the world, like northern Africa, the Arabian Peninsula and Iran. Dates having a hard texture are classified in Tunisia as second-grade dates. They are safe for human consumption and may possess high value components such as sugars and fibre that may be used in value-added applications. Second-grade dates from three potential Tunisian cultivars (‘Deglet Nour’, ‘Allig’ and ‘Kentichi’) showed the same sugar (~73.30-89.55 g/100 g dry matter), fibre (~7.95-18.83 g/100 g dry matter) and total phenolics (~280.6-681.8 mg of GAE/100 g) content as dates of high quality. ‘Deglet Nour’ and ‘Kentichi’ varieties were characterised by a high content of sucrose and low reducing sugar content; contrary to ‘Allig’ and the majority of other date varieties tested.

The work done by scientists at Tunisia and Belgium was intended to add value to these raw materials by using them in jam production. The corresponding jams were characterised in terms of chemical composition, physical (texture and water retention capacities) and sensory properties. Results showed a significant effect of the date variety on the composition and physical characteristics of date jams. Indeed, ‘Allig’ jam was richer in reducing sugars and was characterised by its higher firmness and water retention capacity. To test the acceptability of these new products, they compared them with quince jam (the most consumed in Tunisia). Results showed that ‘Allig’ and ‘Kentichi’ jams presented a higher overall acceptability. However, quince and ‘Deglet Nour’ jams did not show any significant differences (P > 0.05). Results from this work revealed essential information that could promote the commercialization of date jam. The use of dates may also be attractive to consumers as a positive alternative to conventional fruit in jam production [Besbesa Souhail, Driraa Lobna, Bleckerb Christophe, Deroanneb Claude and Attiaa Hamadi, Adding value to hard date (Phoenix dactylifera L.): Compositional, functional and sensory characteristics of date jam, Food Chem, 2009, 112 (2), 406-411].

**Volatile and non-volatile acids of noni fruit**

The noni fruits (Morinda citrifolia Linn.) were analysed for volatile and non-volatile acids by a combination of conventional sampling methods with gas chromatography/flame ionisation detection and gas chromatography/mass spectrometry. The researchers at Cuba while doing this investigation found a total of 34 volatile acids and 26 non-volatile acids in noni fruit. Octanoic acid (3.06 g/kg) and hexanoic acid (0.33 g/kg) were the major volatile acids, while malic acid (3.28 g/kg), malonic acid (1.46 g/kg) and fumaric acid (1.03 g/kg) were the main non-volatile acids. The combination of conventional isolation methods and instrumental techniques provided the most representative information so far on noni fruit acids [Pino Jorge A, Márquez Elíosbel and Castro Déborah, Volatile and non-volatile acids of noni (Morinda citrifolia L.) fruit, J Sci Food Agric, 2009, 89 (7), 1247-1249].
Steam blanching effect on polyphenoloxidase, peroxidase and colour of mango slices

Conventional methods of thermal processing such as pasteurisation, sterilisation and blanching often lead to a number of undesirable changes in foods, including loss of colour, flavour, texture and functionality. The heat stability of peroxidase (POD) and polyphenoloxidase (PPO) was investigated by researchers at Jiangnan University School of Food Science and Technology, Wuxi, PR China in mango (*Mangifera indica* Linn.) slices, and the relative colour was studied after different steam blanching times. There was complete inactivation after 5 min for POD and 7 min for PPO. Steam blanching of 3 min gave residual activity of 2.85 and 8.33% for PPO and POD, respectively, and when compared with samples blanched for 5 min had no effect on colour over 20 days of storage. Correlation was found between activities of PPO, POD and colour change over 20 days. After 7 min steam blanching the browning index was stable but less than at 3 and 5 min because non-enzymic browning had occurred. This research suggests that yellowness and lightness values contribute positively to the browning index (BI), compared to redness. For a better appreciation of the enzymes’ behaviour, protein content related to PPO and POD can be measured. In addition, a comparative study of nutrient retention, and the use of other methods to inactivate naturally-occurring enzymes, such as microwave, high pressure processing, etc., seems necessary [Ndiaye Cheikh, Xu Shi-Ying and Wang Zhang, Steam blanching effect on polyphenoloxidase, peroxidase and colour of mango (*Mangifera indica* L.) slices, *Food Chem*, 2009, 113 (1), 92-95].

Changes in texture, cellular structure and cell wall composition in apple tissue as a result of freezing

Apple texture is one of the critical quality features for the consumer. Texture depends on several factors that are difficult to control and which change with freezing. Researchers at France conducted studies to better understand the mechanisms involved in the texture degradation of apple tissues following freezing/thawing, their approach was to combine mechanical properties, cellular structure and cell wall composition measurements on fresh and thawed apples (Granny Smith) after three different freezing protocols (at −20, −80 and −196°C). This work highlighted the interest of applying macrovision and image texture analysis to quantify the freezing effects on cellular structure and ice crystal size. Freezing at −20°C and after immersion into liquid nitrogen were the protocols affecting the most fruit texture leading to cell membrane breakage resulting in cell wall collapse and tissue breakage, respectively, which accounted for the mechanical behaviour of the samples. All freezing protocols induced vacuole burst showing that the turgor pressure preservation remains critical during the freezing process [Chassagne-Bercès Sophie, Poirier Cécile, Devaux Marie-Françoise, Fonseca Fernanda, Lahaye Marc, Pigorini Giuseppe, Girault Christel, Marin Michèle and Guillon Fabienne, Changes in texture, cellular structure and cell wall composition in apple tissue as a result of freezing, *Food Res Int*, 2009, 42 (7), 788-797].
The freeze dried (FD) strawberries pieces are very good in taste, colour and flavour but texture collapse after rehydration limits the application of FD strawberry pieces in liquid carriers. Therefore, the researchers in China investigated effects of coating the freeze-dried pieces and the drying method after coating. The best formula for the coating solution is found to be: whey protein 10%, glycerol 3%, lactose 10%. Colour of strawberry pieces can be protected to some extent by adding Na⁺ and β-Cyclodextrin (β-CD) in the coating solution. The best proportions of Na⁺ and β-CD were 3mg/ml and 0.5mg/ml, respectively. Coated freeze-dried pieces of strawberry were dried in a spouted bed. The rehydration characteristics of the coated strawberry pieces were found to be influenced by the coating time as well as the drying conditions used [Huang Luelue, Zhang Min, Yan Wei-qiang, Mujumdar Arun S and Sun Dong-feng, Effect of coating on post-drying of freeze-dried strawberry pieces, J Food Eng, 2009, 92(1), 107-111].

**Effect of coating on post-drying of freeze-dried strawberry pieces**

The scientists at The University of Sydney, Australia carried out drying experiments using bananas at different degrees of ripeness in a kiln at dry-bulb temperatures of 50 to 100°C. The bananas were dried continuously and intermittently for 72 hours. For continuous drying, the formation of browning increases and reaches equilibrium, but it changes very little during the tempering periods in intermittent drying. The rate of the browning formation was found to decrease with the drying time and the moisture content. The temperature was found to have the effect of increasing the amount of browning for a temperature above than 80°C, where the amount of browning for the temperature of 100°C was found to be higher than those found for other temperatures, but this effect was not clearly observed for temperatures between 50 and 80°C. The final amounts of browning measured for temperatures of 50-80°C were found to be higher than those measured for continuous drying at similar temperatures, while the final amounts of browning were found similar for both continuous and intermittent drying at 100°C. The amounts of browning measured for overripe and ripe bananas were found to be higher than those measured for unripe bananas, suggesting that the sugar content may limit the browning reaction in the bananas. It was also found that the formation of browning in the bananas dried in the kiln at 100°C varies slightly compared with those dried in the oven at a similar temperature, meaning that the effects of the wet-bulb temperature and the air velocity on the colour development are small. Results in this work also suggest that the colour development may be modelled in the future using a reaction-based approach incorporating the effect of temperature and moisture content [Baini R and Langrish TAG, Assessment of colour development in dried bananas—measurements and implications for modelling, J Food Eng, 2009, 93(2), 177-182].

**Assessment of colour development in dried bananas ñ measurements and implications for modelling**

Decay caused by fungal pathogens is responsible for significant economic loss of grape fruit in vineyards worldwide. However, postharvest treatment is not advisable for this fruit owing to its thin waxy pericarp and succulent flesh, which are easily damaged. Therefore, preharvest treatment even at 1 day before harvest has been considered as a promising method to control postharvest decay of table grape fruit in storage. The researchers at China investigated preharvest application of antagonistic yeast combined with chitosan on table grape fruit.

**Preharvest application of antagonistic yeast combined with chitosan on table grape fruit**
The utilization of acid-tolerant bacteria on ethanol production from kitchen garbage

In order to achieve ethanol production from kitchen garbage under non-sterilized fermentation, the acid-tolerant Zymomonas mobilis named GZNS1, the researchers at University of Science and Technology Beijing, China selected and applied it in the fermentation system. Ethanol production from kitchen garbage under non-sterilized fermentation with GZNS1 was proved to be feasible. The utilization of control strain and acid-tolerant strain under different conditions demonstrated that the sequence of ethanol yield was followed: sterilized garbage with control strain inoculated under pH of 6 (52g/l)≈ sterilized garbage with GZNS1 inoculated under pH of 4 (48g/l)>non-sterilized garbage with GZNS1 inoculated under pH of 4 (46g/l). Further, the distillery waste during fermentation was adopted to recycle fermentation and acquired 50g/l ethanol, higher than those adjusted with tap water. The utilization of acid-tolerant bacteria combing with the utilization of distillery waste associated with the process can increase ethanol production, save energy and reduce the cost of ethanol production [Ma Hongzhi, Wang Qunhui, Qian Dayi, Gong Lijuan and Zhang Wenyu, The utilization of acid-tolerant bacteria on ethanol production from kitchen garbage, Renewable Energy, 2009, 34(6), 1466-1470].

Fruit

The integrative effects of preharvest application of Cryptococcus laurentii combined with low-concentration chitosan on decay and quality of table grape fruit during storage. Results have shown that spraying of antagonistic yeast combined with chitosan before harvest significantly reduced natural decay of fruit stored at 0°C. Preharvest treatment stabilised polyphenol oxidase activity, increased peroxidase and phenylalanine ammonia-lyase activities and decreased superoxide dismutase activity compared with control fruit. There was a higher ratio of soluble solid content to titratable acidity in treated fruit than in control fruit during storage. In addition, preharvest treatment affected the total phenolic content in fruit during storage. Thus, integrative application of C. laurentii and low-concentration chitosan before harvest may be a promising technology to control decay of table grape fruit in storage [Meng Xianghong and Tian Shiping, Effects of preharvest application of antagonistic yeast combined with chitosan on decay and quality of harvested table grape fruit, J Sci Food Agric, 2009, 89(11), 1838-1842].

Thin layer indirect solar drying of mango slices

The researchers at France carried out studies on modelling and experimental validation of thin layer indirect solar drying of mango slices to reduce the time taken in drying mango slices. The thin layer solar drying of mango slices of 8 mm thick was simulated and experimented using a solar dryer designed and constructed in laboratory. Under meteorological conditions of harvest period of mangoes, the results showed that 3 “typical days” of drying were necessary to reach the range of preservation water contents. During these 3 days of solar drying, 50%, 40% and 5% of unbound water were eliminated, respectively, at the first, second and the third day. The final water content obtained was about 16±1.33% d.b. (13.79% w.b.). This final water content and the corresponding water activity (0.6 ± 0.02) were in accordance with previous work. The drying rates with correction for shrinkage and the critical water content were experimentally determined. The critical water content was close to 70% of the initial water content and the drying rates were reduced almost at 6% of their maximum value at night. The thin layer drying model made it possible to simulate suitably the solar drying kinetics of mango slices with a correlation coefficient of $r^2=0.990$. This study thus contributed to the setting of solar drying time of mango and to the establishment of solar drying rates’ curves of this fruit [Dissa AO, Bathiebo J, Kam S, Savadogo PW, Desmorieux H and Kouliadi J, Modelling and experimental validation of thin layer indirect solar drying of mango slices, Renewable Energy, 2009, 34(4), 1000-1008].

Fuel