Food

Effect of the milling process on quality characteristics of rye flour

Most of rye flour is obtained by a gradual reduction system using roller flour mills, which generate different flour streams. The study of the different flour streams composition is necessary since it determines the flour quality and the flour uses. The scientists at Spain analysed four break streams and nine reduction streams for moisture, ash, starch, protein, damaged starch, falling number, amylose/amyllopectin ratio, β-glucans and colour. Mixing and pasting properties were also determined with a doughLAB and a Rapid Visco Analyser, respectively. As the milling process advanced, moisture and starch content decreased but protein, ash, β-glucans and damaged starch increased. The differences in composition are probably related to the effect of the roller mills and the increase in the contamination with bran. The absorption, development time and pasting viscosity increased as the milling proceeded, in detriment of the peak time. The β-glucan content was positively correlated to absorption, mixing tolerance index and pasting viscosity and negatively correlated to peak time. Differences in composition, above all, in bran, showed different mixing and pasting properties in rye streams. The most different streams corresponded to the last streams in the break process, in the sizings and in the middlings [Gómez Manuel, Pardo Jose, Oliete Bonastre and Caballero Pedro A, Effect of the milling process on quality characteristics of rye flour, J Sci Food Agric, 2009, 89(3), 470-476].

Fruit

Improving cranberry shelf-life using high voltage electric field treatment

The scientists at McGill University, Canada treated Cranberries (Vaccinium macrocarpon Ait.) with high voltage electric fields (HVEF) of 2, 5 or 8kV/cm in strength for 30, 60 or 120min in a parallel plate electrode system. The treated berries were stored at ambient conditions (23°C and 65% RH) for three weeks to study the effect of treatments on their respiration rate, physiological loss of mass (PLM), colour, total soluble solids (TSS) and skin puncture strength. Resulting respiration rates were in the range of 11.69-14.56ml CO₂/kg/h after the first week of storage and increased to 13.95 and 21.33ml CO₂/kg/h by the end of third week. For both two and three weeks of storage, HVEF-treated cranberries showed significantly lower respiration rates than the control. This particular attribute indicates the potential of HVEF for improving shelf-life. The PLM of HVEF-treated cranberries were in the range of 23.2–30.4% after three weeks of storage. There was no significant difference between treated and untreated berries in terms of absolute L*, a* and b* colour values; however, the colour difference value ΔEab* of treated berries was somewhat greater. The TSS content of various HVEF-treated cranberries was in the range of 7.27-7.69B, similar to the TSS content of untreated berries (7.4B) before storage. The skin puncture strength of different HVEF-treated cranberries was in the range of 11.7-14.3N; while the untreated berries (11.2N) showed lower values prior to storage [Palanimuthu V, Rajkumar P, Orsat V, Gariépy Y and Raghavan GSV, Improving cranberry shelf-life using high voltage electric field treatment, J Food Eng, 2009, 90(3), 365-371].
Ripeness and rot evaluation of ‘Tommy Atkins’ mango fruit through volatiles detection

An ultra fast GC (zNose™), based on an uncoated surface acoustic wave sensor was employed by the researchers at Canada to detect the volatiles of ‘Tommy Atkins’ mango fruits. The detected volatile signals were used to identify rot occurrence and evaluate mango ripeness during shelf-life. Respiration rate, colour and total soluble solids (TSS) were measured accordingly to indicate mango quality status. Two peaks detected with the zNose™ predicted rot occurrence with 90 and 87% accuracy, respectively, while another peak was 80% accurate in predicting ripeness with respect to a reference colour index. Partial least squares (PLS) regression combined with variable importance for projection (VIP) was used to select the peaks important in prediction. The rot prediction methods could have potential applications in the mango industry for the diagnosis of the occurrence of mango rots [Li Zhenfeng, Wang Ning, Raghavan G S Vijaya and Vigneault Clément, Ripeness and rot evaluation of ‘Tommy Atkins’ mango fruit through volatiles detection, J Food Eng, 2009, 91(2), 319-324].

Effect of integrated application of chitosan coating and modified atmosphere packaging on litchi cultivars

The storage life of litchi [Litchi chinensis (Gaertn.) Sonn.] is limited due to pericarp browning and decay. Modified atmosphere packaging (MAP) showed promising results for ensuring quality retention. However, to improve the efficiency of MAP the integrated treatment of a chitosan coating and MAP was investigated by the scientists at Postharvest Technology Group, Department of Microbiology and Plant Pathology, University of Pretoria, South Africa. The effect of chitosan (1.0g/l) + MAP was compared with MAP (control) and was effective in preventing decay, browning and retaining the pericarp colour in the cultivar McLean’s Red. Chitosan (1.0g/l) + MAP significantly reduced polyphenol oxidase (PPO) and peroxidase (POD) activity, retained membrane integrity, anthocyanin content and prevented the decline of pericarp colour values during storage. The POD activity was greater than the PPO activity in the cultivars McLean’s Red and Mauritius. The two cultivars differed in anthocyanin content and the activity of oxidation enzymes. The gas compositions within the packages were compared between chitosan at 1.0g/l and 20.0g/l concentration for both cultivars. Chitosan (20.0g/l) + MAP lowered the respiration during storage in both cultivars compared to 1.0 g/l + MAP. The McLean’s Red cultivar is better suited for chitosan (1.0g/l) + MAP integrated treatment than is Mauritius in retaining overall quality [Reuck Karen De, Sivakumar Dharini and Korsten Lise, Effect of integrated application of chitosan coating and modified atmosphere packaging on overall quality retention in litchi cultivars, J Sci Food Agric, 2009, 89(5), 915-920].
Efficacy of ozone to reduce microbial populations in Date fruits

Ozone is a strong oxidant and potent disinfecting agent. There are numerous application areas of ozone in food industry such as sanitation of food plant equipments, surface hygiene and reuse of waste water. While the application of ozone for dried fruits disinfection and for fresh fruits and vegetables microflora destruction has been studied extensively, relatively little information is available on the potential of ozone to reduce microbial populations in date fruits. Thus, in a study by researchers of Iran, ozone was applied in gas form at three concentrations (1, 3, and 5 ppm) for four different periods (15, 30, 45 and 60 min) on Iranian date fruits and the reduction in the total bacterial count, *Coliform*, *Staphylococcus aureus* as well as yeast/mold counts were examined. The promising results indicated the efficacy of ozone to reduce the microbial populations in date fruits. Escherichia coli and *S. aureus* were not found on cultured plates inoculated with the treated samples after treatment with 5 ppm (*P*<0.05) in 60 min. The method of ozone generation, type of application, as well as the optimal exposure time and concentration of ozone as an antimicrobial agent in date fruit is mentioned in detail. Ozone treated foods should also be packaged using proper methods such as hermetic or vacuum storage [Habibi Najafi Mohammad B and Khodaparast MH Haddad, Efficacy of ozone to reduce microbial populations in date fruits, *Food Control*, 2009, 20 (1), 27-30].

Biochemical changes in new plantain and cooking banana hybrids at various stages of ripening

New varieties of plantain and cooking banana with higher yields and improved pest and disease resistance are continuously being bred. Therefore, there was a need to study their properties during postharvest ripening. The researchers at Department of Nutrition and Food Science, University of Ghana, Legon-Accra, Ghana investigated the effects of ripening on the dry matter content, pH, titratable acidity, ascorbic acid content, browning potential, starch content and reducing and non-reducing sugar contents of new FHIA 19 and FHIA 20 plantain and FHIA 03 cooking banana hybrids. The starch and ascorbic acid contents of all hybrids decreased as ripening progressed. The starch and dry matter contents of the FHIA 03 cooking banana were reduced from about 750 to <100 g/kg and from 260 to 190g/kg, respectively after stage 9 of ripening, when samples had more black than yellow colour. The FHIA 03 cooking banana had the highest content of non-reducing sugars. The titratable acidity of the FHIA 03 cooking banana was higher than that of the FHIA 19 and FHIA 20 plantains. The browning potential of all hybrids decreased after stage 7 of ripening, when samples were yellow with black spots. The FHIA 19 plantain had the lowest browning potential. Thus significant reductions in the dry matter, ascorbic acid and starch contents of the plantain and cooking banana hybrids were observed during the progress of ripening. The cooking banana variety contained lower levels of dry matter, ascorbic acid and starch than the plantain varieties [Esther Sakyi-Dawson, Prudence Asamoah-Bonti and George Ampomah Amor, Biochemical changes in new plantain and cooking banana hybrids at various stages of ripening, *J Sci Food Agric*, 2008, 88(15), 2724-2729].
**Simulation of grape stalk deep-bed drying**

A mathematical representation of grape stalk deep-bed drying with variable air conditions over time and bed positions was developed by the scientists at Spain and Mexico. The model considers the heat and mass transfer (conduction and diffusion) within the different structures of the grape stalk: three infinite cylinders and one spherical and the heat and mass balances in the bulk air. The bed was represented assuming ideal mixed stages. A simulator was obtained from the model solution and validated with experimental drying curves of grape stalk obtained in a plant pilot drier. The simulator adequately predicts the experimental behaviour for grape stalk average moisture and the air output temperature during drying [García-Pérez JV, Carcel JA, MA García-Alvarado JA and Mulet A, Simulation of grape stalk deep-bed drying, *J Food Eng*, 2009, *90*(2), 308-314].

**Machine for the automatic sorting of pomegranate arils**

The pomegranate (*Punica granatum* Linn.) is a fruit with excellent organoleptic and nutritional properties, but the fact that it is difficult to peel affects its commercialization and decreases its potential consumption. One solution is to market the arils of pomegranate in a ready-to-eat form. However, after the peeling process, unwanted material, such as internal membranes and defective arils, is extracted together with good arils and must be removed on the packing line because the presence of such material shortens the shelf-life of the product or deteriorates its appearance. For different reasons, the commercial sorting machines that are currently available for similar commodities (cherries, nuts, rice, etc.) are not capable of handling and sorting pomegranate arils, thus making it necessary to build specific equipment. The scientists at Spain developed a computer vision-based machine to inspect the raw material coming from the extraction process and classify it in four categories. The machine is capable of detecting and removing unwanted material and sorting the arils by colour. The prototype is composed of three units, which are designed to singulate the objects to allow them be inspected individually and sorted. The inspection unit relies on a computer vision system. Two image segmentation methods were tested: one uses a threshold on the R/G ratio and the other is a more complex approach based on Bayesian Linear Discriminant Analysis (LDA) in the RGB space. Both methods offered an average success rate of 90% on a validation set, the former being more intuitive for the operators, as well as faster and easier to implement and for these reasons it was included in the prototype. Subsequently, the complete machine was tested in industry by working in real conditions throughout a whole pomegranate season, in which it automatically sorted more than nine tons of arils [Blasco J, Cubero S, Gómez-Sanchis J, Mira P and Moltó E, Development of a machine for the automatic sorting of pomegranate (*Punica granatum*) arils based on computer vision, *J Food Eng*, 2009, *90*(1), 27-34].

**Ultra- and nanofiltration of aqueous extracts from distilled fermented grape pomace**

The researchers at Spain processed aqueous extracts from pressed distilled grape pomace using ultrafiltration (UF) and nanofiltration (NF) membranes to obtain fractions enriched in compounds with antioxidant activity. The properties of concentrates (composition, phenolic content and antioxidant activity) were determined for different commercial UF and NF membranes as a function of the volume reduction factor. Membrane concentrates obtained under selected conditions were extracted with ethyl acetate to yield fractions with enhanced antioxidant activity. The radical scavenging capacities of ethyl acetate extracts were in the range reported for synthetic antioxidants. Cleaning resulted in the recovery of 92-100% of the initial permeability [Díaz-Reinoso Beatriz, Moure Andrés, Domínguez Herminia and Parajó Juan Carlos, Ultra- and nanofiltration of aqueous extracts from distilled fermented grape pomace, *J Food Eng*, 2009, *91*(4), 587-593].
Anthocyanins and fruit colour in plums during ripening

The accumulation of anthocyanins and the evolution of fruit colour were investigated by researchers at Slovenia during ripening of *Prunus domestica* Linn. Using HPLC (High performance liquid chromatography), the fruit of the ‘Jojo’, ‘Valor’, ‘Cacanska rodna’ and ‘Cacanska najbolja’ cultivars were quantified for anthocyanins during a 25-day period of ripening (a 33-day period in the case of ‘Jojo’). The major anthocyanin was cyanidin 3-rutinoside which, in ripe fruits, ranged from 4.1 to 23.4mg/100g FW (from 52.6 to 73.0%). It was followed by peonidin 3-rutinoside (from 6.5 to 37.9%), cyanidin 3-glucoside (from 1.8 to 18.4%), cyanidin 3-xylloside (from 4.7 to 7.8%) and peonidin 3-glucoside (from 0.0 to 0.4%). The ripening process resulted in a concentration increase of total anthocyanins and changed the ratios amongst the anthocyanins. The colour parameters, $L^*$, $a^*$, $b^*$, chroma and hue angle, of partially ripe plums were higher than those in the ripe fruit, but the CIRG index (colorimetric index) of partially ripe fruit was always lower than that of ripe fruit. The total anthocyanins were weakly correlated with each of the colour parameters; their relationships varied between cultivars and ripening stage. Correlation coefficients between individual anthocyanins and colour parameters in ripe plums were cultivar-dependent [Usenik Valentina, Štampar Franci and Veberič Robert, Anthocyanins and fruit colour in plums (*Prunus domestica* L.) during ripening, *Food Chem*, 2009, 114 (2), 529-534].

Quality changes during ripening of plums

Researchers at University of Ljubljana, Slovenia investigated the quality changes during fruit ripening after the appearance of fruit colour of four *Prunus domestica* Linn. plum cultivars, ‘Jojo’, ‘Valor’, ‘Cacanska rodna’ and ‘Cacanska najbolja’, during 25 or 33 day periods. Fruit samples were analyzed for fruit weight, firmness, soluble solids content, fruit colour, content of sugars (glucose, fructose, sorbitol and sucrose), organic acids (malic, fumaric and shikimic acids), phenolics (neochlorogenic acid, $p$-coumaroylquinic acid, chlorogenic acid and rutin) and anthocyanins (cyanidin-3-rutinoside and peonidin-3-rutinoside). Ripening resulted in statistically increased fruit weight and soluble solids, decreased fruit firmness, darker colour of fruits, increased concentration of total sugars, decreased concentration of total acids and increased concentration of anthocyanins. There was no influence of ripening on the content of phenols. The results show significant influences of cultivar on fruit weight, soluble solids content, firmness, fruit colour, concentration of total acids, SUAC index (calculated as a quotient of the sum of sugars and sum of acids), concentration of total phenols and anthocyanins in European plums. The results suggest the need to involve some measured parameters for determination of fruit maturity in plums (*P. domestica*), as are used in apples or in *P. salicina* Lindl. plums. There are several differences in the main characteristics among cultivars. Therefore, measured parameters should be prepared for specific plum cultivars or groups of cultivars with similar characteristics [Usenik Valentina, Kastelec Damijana, Veberič Robert and Štampar Franci, Quality changes during ripening of plums (*Prunus domestica* L.), *Food Chem*, 2008, 111 (4), 830-836].

Maturity-related chilling tolerance in mango fruit and the antioxidant capacity involved

The researchers at China evaluated the effect of mature stage on the chilling tolerance of mangoes (*Mangifera indica* Linn.) and the mechanism involved. During experiment the fruit were categorized into three stages of ripeness: Green (100% green fruit), Preyellow (10-20% yellow fruit) and Yellow (45-55% yellow fruit) after harvest and stored at 2°C for 12 days and then incubated at 25 °C for 2 days for chilling injury (CI) development. CI index in
Preyellow and Yellow fruit was significantly lower than that of the Green fruit, as a rapid increase in ion leakage was observed in the Green fruit. Activities of superoxide dismutase, catalase, ascorbate peroxidase and polyphenoloxidase of Preyellow and Yellow fruits were higher than those of the Green from day 6 to day 12 during cold storage. A lower content of malondialdehyde but higher levels of glutathione and ascorbic acid were maintained in Preyellow and Yellow fruit than that in Green fruit. These results suggested that stronger resistance of Preyellow and Yellow mangoes to CI compared to Green fruit was due to their higher antioxidant capacity involved in the tolerance to chilling temperature. Alleviating CI in mangoes during storage may be achieved by storing the fruit when skin colour is beginning to change to yellow from green [Zhao Zhilei, Cao Jiankang, Jiang Weibo, Gu Yuhong and Zhao Yumei, Maturity-related chilling tolerance in mango fruit and the antioxidant capacity involved, J Sci Food Agric, 2009, 89(2), 304-309].

**Effect of γ-irradiation on the physicochemical and sensory properties of raw unpeeled Almond kernels**

Almonds, *Prunus dulcis* (Mill.) D.A. Webb., like all other nuts, are typically high in fat (46-76%) but their fatty acid profile is beneficial in relation to risk of coronary heart disease. Quality of almonds may be substantially reduced if the product is subjected to insect damage during post-harvest storage on the ground and/or pre-harvest insects attack while the crop is still on the tree. Even more, growth of an aflatoxigenic Aspergillus species and production of aflatoxin may render almonds unfit for consumption. Irradiation can be an effective alternative technology in post-harvest pest control because of gamma rays’ ability to kill insects and inhibit mycotoxin biosynthesis during storage. Thus, researchers at Laboratory of Food Chemistry and Technology, Department of Chemistry, University of Ioannina, Ioannina, Greece carried out studies to determine the effect of γ-irradiation on lipid oxidation, volatiles’ production, change of surface colour and sensory quality of raw unpeeled almonds irradiated at doses of 0, 1, 1.5, 3, 5 and 7kGy. Results showed a ten-fold increase in peroxide value after irradiation at a dose of 7 kGy. A small but statistically significant (*P*<0.05) change was observed in hexanal concentration as a result of irradiation. No statistically significant (*P*>0.05) changes were recorded in polyunsaturated fatty acids up to a dose of 7kGy while monounsaturated fatty acids decreased manifested as a respective increase in saturated fatty acids up to 3kGy. Volatile compounds such as aldehydes, ketones and alcohols increased with increasing irradiation dose indicating enhanced lipid oxidation. Colour parameter *L*° decreased (*P*<0.05) at doses >3kGy while colour parameters *a*° and *b*° remained unaffected by irradiation. Sensory analysis showed that Almonds remained organoleptically acceptable up to a dose of 3kGy [Mexis SF, Badeka AV, Chouliara E, Riganakos KA and Kontominas MG, Effect of γ-irradiation on the physicochemical and sensory properties of raw unpeeled almond kernels (*Prunus dulcis*). Innov Food Sci Emerg Technol, 2009, 10 (1), 87-92].

**Equilibrium distribution coefficients during osmotic dehydration of Apricot**

The effect of initial osmotic solution concentration (40-70%, w/w), solution temperature (25-45°C), pretreatment before osmotic dehydration (by using chemicals such as K₂S₂O₅, Na₂S₂O₅, ethyl oleat + K₂S₂O₅, ethyl oleat + Na₂S₂O₅ and ethyl oleat + K₂CO₃) and the ratio of the sample to solution (1/4-1/25) on equilibrium distribution coefficients of apricot were investigated during osmotic dehydration by researchers at Turkey. The various osmotic agents such as sucrose, fructose, glucose, maltodextrin and sorbitol were used in osmotic dehydration of apricot. The distribution coefficients of water ranged from 1.893 to 0.822g/g for various concentrations, 1.302-0.651g/g for different temperatures, 2.013-0.560g/g for application of pretreatment and 1.126-0.822g/g for the ratio of the sample to solution,
Determination of optimum ripeness for edibility of postharvest Melons using nondestructive vibration

Consumers are interested in the period of optimum ripeness for edibility of melons as they continue to ripen even after harvest. However, melons exhibit various degrees of ripeness in a market; thus, making it difficult for consumers to assess the optimum ripeness for eating. To help solve this problem, researchers at Hiroshima University, Higashi-Hiroshima, Japan investigated the period of optimum edibility of melons (Cucumis melo Linn.) using a nondestructive method. The method is based on the fact that melons loose firmness in postharvest ripening. The predetermined period of optimum ripeness helps consumers to choose the timing for optimum edibility. They measured time-course changes in the elasticity index (EI) and sensory test index of melons at the postharvest stage. Using the correlation between the EI and the sensory test index, they determined the period of optimum ripeness for edibility of melons, which serves as an excellent indicator for optimum quality for eating [Taniwaki Mitsuru, Takahashi Masahiro and Sakurai Naoki, Determination of optimum ripeness for edibility of postharvest melons using nondestructive vibration, Food Res Int, 2009, 42 (1), 137-141].

Fuel

Ethanol from Guayule

Ethanol from guayule (Parthenium argentatum A. Gray) has been obtained after pretreating it with a process known as “organosolv”. This pretreatment makes guayule bagasse quite amenable to being fermented into ethanol. Guayule may be one of the newer additions to the long list of hardwoods suitable for organosolv pretreatment. As with all hardwoods and other green plants, guayule cell walls are made up of cellulose, hemicellulose and lignin. The value of using the organosolv process is that we get not only cellulose that’s readily fermented into ethanol, but also can recover the hemicellulose and the lignin. The hemicellulose can be fermented into other valuable chemicals and the lignin—which is of very high quality—can be burned to generate electricity or made into value-added products.

In other work, a chemical engineer at ARS’s Eastern Regional Research Center in Wyndmoor, Pennsylvania, is looking into converting guayule bagasse into bio-oil using pyrolysis—heating the bagasse in the absence of air. The energy content of the guayule bio-oil is more than 13,000 Btu per pound [Marcia Wood, Guayule: Go Native With This Promising Biofuel—and Biomedical—Crop, Agric Res Mag, 2009, 57(2), 18-19].