Influence of pre-gelatinised maize starch on the rheology, microstructure and processing of imitation cheese

For cost and health reasons, there has been increased interest recently in incorporation starch into imitation cheese formulations where the interaction between the added starch and the protein source (usually casein) has been shown to influence the rheological properties of the imitation cheese. Imitation cheese is widely used as an ingredient in prepared foods such as pizza, lasagne, cordon bleu products where its rheological properties, that dictate whether it melts or maintains its structure, are critical. Hence the researchers at Food Research Centre, Moorepark, Fermoy, Ireland and University College Dublin, Ireland examined the effects of pre-gelatinised maize starch on the rheology, microstructure and processing of imitation cheese and use the findings to attempt to elucidate why pre-gelatinised maize starch had such dramatic effects on the rheology of imitation cheese on heating.

Imitation cheeses were manufactured with increasing levels (0-9%, w/w) of pre-gelatinised maize starch in partial replacement of rennet casein. At increased starch levels, longer processing times (10min at 78°C using 9%, w/w starch) were necessary compared to the control (5min) because of the reduced protein present to emulsify/stabilise the fat droplets. Scanning electron and confocal microscopy revealed that increased starch addition resulted in a less homogeneous protein matrix, with a honeycomb appearance although the fat globules remained small and uniformly sized. With increased levels of starch up to 9% (w/w), the storage modulus, peak stress and stress relaxation times significantly increased while hardness values remained unchanged. Results indicated that the inclusion of pre-gelatinised maize starch impaired the hydration of the casein as well as the thermoplastic properties of the imitation cheese and has most application in food products where flow resistance is required, particularly at increased temperatures [Mounsey John S and O’Riordan E Dolores, Influence of pre-gelatinised maize starch on the rheology, microstructure and processing of imitation cheese, J Food Eng, 2008, 84(1), 57-64].

Quality of spaghetti in base Amaranthus wholemeal flour added with quinoa, broad bean and chick pea

Several studies have been carried out to improve the protein content of pasta by the addition of raw materials of vegetable source and or animal source. High-protein plant materials are derived mainly from soybean, pea, lupine, amaranth, quinoa, broad bean and chick pea and can be used as isolates, flour or in their concentrated form. Amaranth is a staple food which has a protein content of 18% and it is recognized as lysine rich high-protein grains which have the potential to meet the world’s requirements and contains significant amounts of calcium, iron, potassium, phosphorous, vitamins and dietary fibre. The scientists at University of Foggia and Università degli Studi di Foggia, Via Napoli, Foggia, Italy investigated the quality of three gluten free spaghetti typologies, made from Amaranthus flour plus the addition of quinoa, broad bean or chick pea. The quality of the produced spaghetti was compared to that of spaghetti made of durum semolina control. Tests were run on the samples to determine breakage susceptibility of dry spaghetti, the cooking resistance, instrumental stickiness in cooking and over cooking, cooking loss and some sensorial attributes at the optimal cooking time. The spaghetti obtained from Amaranthus flour when compared to the control, had equal or lower dry breakage susceptibility and cooking resistance, higher cooking loss and visibly lower instrumental stickiness. However, these spaghetti did not demonstrate relevant sensorial differences [Chillo S, Laverse J, Falcone PM and Del Nobile MA, Quality of spaghetti in base Amaranthus whole meal flour added with quinoa, broad bean and chick pea, J Food Eng, 2008, 84(1), 101-107].
Effect of resistant starch on the water binding properties of imitation cheese

The effect of moisture and resistant starch concentration on the water activity \( (a_w) \) and water sorption of imitation cheese was investigated by the scientists of University College Dublin, Belfield, Dublin, Ireland. The Guggenheim–Anderson–deBoer (GAB) equation was found to be a good description of the experimental moisture sorption isotherms. Inclusion of starch in cheese increased moisture sorption over the \( a_w \) range studied. The GAB monolayer value indicated starch-containing cheese bound an additional 1.4g water/100g dry matter when compared to a starch-free cheese. Increasing cheese moisture content had an insignificant effect on moisture sorption but increased \( a_w \). Increasing starch concentration had little influence on the GAB parameters but nonetheless decreased \( a_w \). It is believed that starch, while relatively inert in terms of water binding, may organise water molecules causing them to be physically entrapped within the cheese matrix. By not competing with protein for water molecules, the starch allowed the water to remain available for plasticization to maintain good functionality of the cheese [Duggan E, Noronha N, O’Riordan ED and O’Sullivan M, Effect of resistant starch on the water binding properties of imitation cheese, *J Food Eng*, 2008, 84(1), 108-115].

Effect of different protein isolates and transglutaminase on rice flour properties

The effect of the addition of different protein isolates (pea, soybean, egg albumen and whey proteins) on the viscosimetric and rheological properties of the rice flour dough and the development of a protein network through the use of microbial transglutaminase (TG) were evaluated by the scientists of Institute of Agrochemistry and Food Technology, Valencia, Spain. Protein isolates significantly \( (P<0.05) \) modified the gelatinization and gelling behaviour of the rice starch determined in the rapid viscoanlyser. Pea, soybean and whey proteins significantly \( (P<0.05) \) decreased the final viscosity in addition, whey protein also promoted a significant decrease (27.3%) in the peak viscosity. The elastic modulus value \( (G’) \) recorded in the oscillatory tests was significantly \( (P<0.01) \) affected by both the protein isolates and the TG. The extent of the effect was dependent on the protein source; pea and soybean increased this parameter, whereas egg albumen and whey protein drastically decreased it. A modification in the emulsifying properties was also observed by the addition of protein isolates and the TG treatment. The decrease in the amount of free amino groups after TG treatment confirmed the protein crosslinking catalysed by TG. Therefore, the use of protein isolates and TG broads the applications of rice flour in the bakery industry and brings about an increase in the protein content with the subsequent nutritional improvement of the resulting products [Marcoa Cristina and Rosell Cristina M, Effect of different protein isolates and transglutaminase on rice flour properties, *J Food Eng*, 2008, 84(1),132-139].

Kinetics of cooking unsoaked and presoaked rice

The scientists at Central Food Technological Research Institute, Mysore, India and Siddaganga Institute of Technology, Tumkur, India conducted studies to examine the cooking rate in excess-water and optimal-water cooking of unsoaked as well as presoaked rice at atmospheric conditions. Optimal-water cooking studies were conducted in the electric rice cooker, the most energy efficient appliance, in both normal and controlled modes of cooking. Cooking rate was examined for excess-water and optimal-water cooking of unsoaked and presoaked rice. The linear relationship between the logarithmic moisture gain ratios of cooked rice and the time of cooking showed that cooking rate
followed the equation of a first-order chemical reaction. During excess-water cooking of presoaked rice a single rate constant was observed, while in the case of unsoaked rice two rate constants were observed. Interestingly, optimal-water cooking in electric rice cooker showed that the number of rate constants increased by one as compared to excess-water cooking for both unsoaked and presoaked rice. Controlled cooking, an energy saving method proposed earlier by the authors behaved similar to the normal method of cooking under otherwise identical conditions. Present evaluation of cooking rate constants under commonly

practiced conditions of cooking would be useful in designing more efficient rice cookers [Chakkaravarthi A, Lakshmi S, Subramanian R and Hegde VM, Kinetics of cooking unsoaked and presoaked rice, J Food Eng, 2008, 84 (2), 181-186].

Evaluation of snack foods from barley–tomato pomace blends by extrusion processing

The scientists at University of Gaziantep, Gaziantep, Turkey and University of California, Davis, United States processed blends of barley flour and tomato pomace in a co-rotating twin-screw extruder. The experimental design with die temperature (140-160°C), screw speed (150-200rpm) and tomato pomace level (2-10%) as independent variables produced 20 different combinations that were studied using response surface methodology to investigate the effect of these variables on system parameters (SME, die melt temperature and die pressure) and product responses (expansion, bulk density, water absorption and solubility indices, texture and colour). Extrudate from five experiments within 20 samples was selected for sensory evaluation in terms of colour, texture, taste, off-odour and overall acceptability. Regression equations describing the effect of each variable on the system parameters and product responses were obtained. The system parameters and product responses were most affected by changes in temperature, pomace level and to a lesser extent by screw speed. Extrudates with 2 and 10% tomato pomace levels extruded at 160°C and 200rpm had higher preference levels for parameters of colour, texture, taste and overall acceptability. The results suggested that tomato pomace can be extruded with barley flour into an acceptable and nutritional snack [Altan Aylin, McCarthy Kathryn L and Maskan Medeni, Evaluation of snack foods from barley-tomato pomace blends by extrusion processing, J Food Eng, 2008, 84 (2), 231-242].

Effect of spontaneous fermentation on the physical properties of corn starch and its noodles

The scientists at China Agricultural University, Beijing and Jiangxi Science and Technology Normal University, Nanchang, China isolated starch from spontaneously fermented corn to study the effect of fermentation on the physical properties of corn starch and the suitability of fermented corn for starch noodles. Considering the security of fermentation, aflatoxin B₁ content in fermented samples was also tested. Results showed that above 75°C, fermented samples had significantly lower swelling power and solubility than control samples ($P<0.05$). The peak viscosity and breakdown initially increased and then decreased, while final viscosity and setback decreased gradually with fermentation time. Fermented samples had significantly higher gel strength ($P<0.05$) and noodles from them had higher maximum tensile stress, maximum tensile strain and work to break the noodles. Results of sensory evaluation indicated that fermentation significantly improved quality of corn starch noodles and quality of starch noodles from corn fermented for 19 days was comparable to mung bean starch noodles. The spontaneous fermentation was reported to be safe based on the results of toxin test [Yuan Mei-Lan, Lu Zhan-Hui, Cheng Yong-Qiang and Li Li-Te, Effect of spontaneous fermentation on the physical properties of corn starch and rheological characteristics of corn starch noodles, J Food Eng, 2008, 85(1), 12-17].
Impact of wheat and oat polysaccharides on the digestion and absorption processes

The scientists at Welfare and Nutrition, Research Centre Foulum, Denmark investigated the impact of wheat and oat polysaccharides provided as rolls with contrasting dietary fibre characteristics on ileal digesta and portal and arterial plasma glucose concentrations. The diets were offered as baked rolls to eight pigs fitted with a T-shaped cannula for total collection in a crossover design and to four portal vein- and mesenteric artery-catheterised pigs. Ileal digesta were collected at 2 h intervals during an 8 h sampling period and portal and arterial blood at 10 min intervals from 10 min up to 120 min and then at 30 min intervals up to 240 min post-feeding. There was substantial variation in the flow of ileal digesta during the 8 h sampling period, but the flow was more uniform when feeding the oat rolls compared with the wheat rolls. Carbohydrates were the predominant ileal constituent, with most of them present as non-starch polysaccharides and with starch in both diets almost completely digested at the end of the small intestine. Ingestion of the two diets was followed by a rapid rise in postprandial glucose concentration but with no significant difference in either portal or arterial glucose concentration pattern between the two diets. The recovery of glucose in the portal vein up to 240 min after feeding represented 47-64% of consumed starch. Cellulose, resistant starch and arabinoxylans were almost completely recovered at the ileum, while there was a substantial loss of mixed linkage (1→3)(1→4)-β-D-glucan [Knudsen Knud Erik Bach and Jorgensen Henry, Impact of wheat and oat polysaccharides provided as rolls on the digestion and absorption processes in the small intestine of pigs, J Sci Food Agric, 2007, 87(13), 2399-2408].

Influence of whey protein concentrate on the rheological characteristics of dough and quality of unleavened flat bread

In order to explore the possibility of using whey protein concentrate (WPC) as a functional ingredient in Indian traditional product - South Indian Parotta investigations were made by scientists at Central Food Technological Research Institute, CSIR, Mysuru, India. During experiment the effect of replacement of wheat flour with 5, 10 and 15% WPC on the farinograph, extensograph, amylograph characteristics of wheat flour, quality of parotta and microstructure of baked parotta were studied. The results showed an increase in farinograph stability, extensograph resistance to extension up to 10% WPC and a decrease in the farinograph water absorption, extensograph extensibility, amylograph peak viscosity, cold paste viscosity, breakdown and setback values with an increase in the level of WPC from 0 to 15%. The quality characteristics of parottas showed that the spread ratio decreased and shear force values increased significantly above 5% level. Control parotta and parotta with 5% WPC were soft, possessed thin and transparent layers whereas parottas beyond 5% WPC had thick, fused and opaque layers. The parottas with 5% WPC were rated good. The quality characteristics of parottas were adversely affected beyond 5% level of WPC. The microstructure of the top and middle layer of baked parotta with 5% WPC showed that there was a disruption in the continuity of the gluten matrix [Indrani D, Prabhasankar P, Rajiv Jyotsna and Rao G Venkateswara, Influence of whey protein concentrate on the rheological characteristics of dough, microstructure and quality of unleavened flat bread (parotta), Food Res Int, 2007, 40 (10), 1254-1260].
Bioavailability and storage stability of vitamin A fortificant in fortified cookies

Vitamin A deficiency is one of the major nutritional deficiencies affecting population in developing regions. In Pakistan, 60% of the child deaths are due to diarrhoea and respiratory infection, which are associated with vitamin A deficiency. Researchers at Pakistan conducted studies to assess the bioavailability and stability of vitamin A fortificant in cookies fortified with retinyl acetate. Cookies fortified with vitamin A (retinyl acetate) were manufactured and physically, chemically and sensorial analyzed. Efficacy studies were carried and serum retinol concentrations were measured to assess the bioavailability of vitamin A, different organ weights were also measured to check the effects of vitamin A on organ weights and body growth. The treatment T4 containing (257.85 µg) 45% RDA fortification level of retinyl acetate was judged best considering, physical, chemical and sensory characteristics. Baking losses were lowest in T4. Efficacy study revealed that serum retinol concentrations were 125.19 µg/dl in control group and it was raised to 148.64 µg/dl in T4. Fortification of cookies with 257.85 µg (45% RDA) of retinol acetate improved nearly all quality attributes and through efficacy studies it was concluded that vitamin A significantly affects growth and body functioning of rats. Conclusively cookies fortified with 257.85 µg of retinol acetate can be used effectively to overcome vitamin A deficiency in the children [Masood Sadiq Butt, Muhammad Umair Arshad, Muhammad Shahzad Alam and Muhammad Tahir Nadeem, Bioavailability and storage stability of vitamin A fortificant (retinyl acetate) in fortified cookies, Food Res Int, 2007, 40(10), 1212-1219].

Added ingredient effect on interaction of simulated beef flavour and soy protein isolate

The influence of ingredients such as glucosamine, sucrose, ascorbic acid and/or polyethylene glycol, on the release of beefy aroma components of simulated beef flavour (SBF) in the presence of soy protein isolate (SPI), were investigated by researchers of Food Nutrition and Health Program at The University of British Columbia, British Columbia, Canada. Conformational changes of SPI protein structure induced by the added ingredients were also detected. Addition of ascorbic acid alone or with polyethylene glycol resulted in reduction of disulfide bonds, increase in surface hydrophobicity and increase in unordered structure of SPI. The SPI-SBF mixtures containing ascorbic acid alone or with polyethylene glycol showed increased GC peak areas of indicator peaks, which were associated with an increase in the perceived beef characteristic attributes in descriptive analysis, as expressed by enhancement of roasted note and diminishing of soymilk-like and cereal notes. These results provide the basis for further research to elucidate strategies to maximize perception of beefy aroma in soy based products.

In another study by them, descriptive sensory analysis (DA) and gas chromatography (GC) analysis were conducted to investigate changes in aroma characteristics of simulated beef flavour upon addition of soy protein isolate. Five attributes (beefy, roasted, yeasty, soymilk-like and cereal) were selected to assess various mixtures of SBF and SPI. The results of DA confirmed that “roasted”, “beefy” and “yeasty” notes were highly positively correlated with SBF concentration and the beefy related notes were substantially suppressed by increasing SPI content. Fifteen peaks from GC analysis were selected as indicator peaks to represent beefy attribute based on their odour-active properties assessed by GC-olfactometry and correlation of their peak areas with beefy intensity in mixtures of SPI and SBF assessed by DA. The indicator peaks may form the basis of further research to explicate the nature of SPI-SBF interactions to explain the suppression of perceived intensity of beef flavour in soy protein products [Moon Soo-Yeun and Eunice Li-Chan CY, Assessment of added ingredient effect on interaction of simulated beef flavour and soy protein isolate by gas chromatography, spectroscopy and descriptive sensory analysis, Food Res Int, 2007, 40(10), 1227-1238; Changes in aroma characteristics of simulated beef flavour by soy protein isolate assessed by descriptive sensory analysis and gas chromatography, ibid, 2007, 40(10), 1239-1248].
Several studies have been done to improve the quality of Buckwheat (Fagopyrum esculentum Moench) flour by using a gradual milling method in which whole buckwheat grains were milled into various fractions. Hence, scientists at Osaka Prefecture University, Sakai, Japan, University of Technology, Hanoi, Vietnam and Hyogo University of Teacher Education, Hyogo, Japan in their experiments characterized 16 fractions milled from whole buckwheat grains from the outer to inner parts and used for noodle making. Protein and ash contents of flour increased in the order from the inner to the outer fractions. Each fraction contained nine main fatty acids in which the concentration of palmitic, stearic, linoleic and linolenic acids tended to decrease from the inner to outer parts of the grain, whereas the concentration of oleic acid in the middle parts of grain was higher than in the other parts. The peak viscosity was different among the fractions. The optimum cooking time and whiteness of uncooked and cooked noodles substituted with 40% of the fractions decreased from the inner to outer fractions, whereas noodles made from the inner fractions were harder and less elastic than those from the outer fractions. Thus the different buckwheat fractions contributed to different quality of noodles. However, the appropriate fractions could be used for noodle making to improve the quality depending on nutritional demands [Hung Pham Van, Maeda Tomoko, Tsumori Rie and Morita Naofumi, Characteristics of fractionated flours from whole buckwheat grain using a gradual milling system and their application for noodle making, J Sci Food Agric, 2007, 87(15), 2823-2829].

Effect of beet and honey on quality improvement and carotene retention in a carrot fortified milk product

Researchers at Department of Food Technology and Biochemical Engineering, Jadavpur University, Kolkata, West Bengal, India studied the effect of beet and honey on quality attributes and carotene retention of carrot fortified milk product during storage at 30°C. Six types of samples were prepared and stored in a close container at 30°C for 10 days. The samples were CC (chhana:carrot = 1:1), CCB1 (chhana:carrot:beet = 2:1:1), CCB2 (chhana:carrot:beet = 4:3:1), CCH1 (chhana:carrot:honey = 2:1:1), CCH2 (chhana:carrot:honey = 4:3:1) and CCBH (chhana:carrot:beet:honey = 3:1:1:1). Effect of beet and honey on the quality of the samples was evaluated on the basis of changes in acidity, pH, free fatty acid level and sensory analysis of the samples. Carotene retention was determined on the basis of amount of carotene degraded after processing and storage. With the longer storage time, acidity, free fatty acid content increased and pH, carotene retention as well as colour preferences and overall acceptance decreased for all the samples. Addition of beet and honey in both proportion to the product showed synergistic role i.e. they reduced the acidity and free fatty acid formation, pH reduction and carotene degradation. However, regarding sensory evaluation, honey addition to the carrot based milk product showed better result. Equal mixture of carrot, beet and honey was best regarding antioxidant activity and retention of carotene. Thus, the addition of equal mixture of beet and honey along with carrot is effective for quality improvement and carotene retention of carrot fortified milk product [Bandyopadhyay Mahuya, Chakraborty Runu and Raychaudhuri Upal, Effect of beet and honey on quality improvement and carotene retention in a carrot fortified milk product, Innov Food Sci Emerg Technol, 2008, 9(1), 9-17].
Egg chips prepared by using different millet flours as binders

Scientists at Central Food Technological Research Institute, CSIR, Mysuru, India prepared egg chips using millet flours as binders and conducted studies about their rancidity and microbial profiles during storage. Whole liquid egg was homogenized and mixed with optimized quantities of refined wheat flour, rice flour, corn starch, spices, salt and millet flour, viz. pearl millet, barley or sorghum. The dough was flattened in to 2-3 mm thick sheet, cut in to 2.5 × 3 cm strips and fried in refined sunflower oil to obtain ready-to-eat egg chips. The cooled chips were packed in metalised polyester bags, sealed with air or nitrogen-gas and stored at ambient temperature (27 ± 2°C) for 4 months. Inclusion of barley flour caused lowest fat content (14.9%) and water activity ($a_w = 0.38$). Decrease in pH (6.3-6.5 to 5.6-6.0), crispiness (11.3-15.4 to 7.8-13.1 N), sensory quality scores (6.8-8.8 to 5.2-7.9) and increase in $a_w$ (0.38-0.46 to 0.44-0.55), free fatty acids (0.17-0.32 to 0.83-1.76 as % oleic), thiobarbituric acid values (0.62-0.75 to 1.46-2.13 mg malonaldehyde/kg) were noticed in fried egg chips during storage at 27 ± 2°C. Hunter colour values were marginally affected. Low standard plate counts (1.7-2.9 log cfu/g) and spore counts (1.2-1.6 log cfu/g) and absence of yeasts and moulds, coliforms, staphylococci and enterococci throughout the storage period ensured the microbiological safety of egg chips. All the products were sensorily acceptable during storage up to 4 months and barley egg chips, however, were judged superior by the panelists compared to chips containing pearl millet or sorghum flours [Yashoda KP, Modi VK, Jagannatha Rao R and Mahendrakar NS, Eggs chips prepared by using different millet flours as binders and changes in product quality during storage, Food Control, 2008, 19(2), 170-177].

Characterization of a fibre-rich powder of unripe banana flour

The development of nutraceutical ingredients is of current interest for the food industry. Researchers at Mexico and Venezuela prepared a fibre-rich powder (FRP) by liquefaction of raw banana flour (RBF) and its chemical composition, water- and oil-holding capacity and antioxidant capacity were evaluated. Total dietary fibre (TDF) was higher in FRP than in the RBF, but the total starch (TS), potentially available starch (AS) and resistant starch (RS) contents were lower in the processed product, since the liquefaction process involves granular disruption and starch hydrolysis, resulting in reduced TS and AS and increased TDF. The reduced RS content is also explained by the loss of granular integrity, which is the main factor responsible for the indigestibility of native banana starch. Total indigestible fraction content of FRP was relatively high, the soluble fraction being lower than the insoluble portion. A very fast reduction of DPPH was observed in the presence of FRP, indicating that polyphenols in this preparation efficiently quench free radicals. Tested at various temperatures, the FRP and RBF exhibited similar water and oil-holding capacities. The main difference was observed in water-holding capacity at 80°C, where FRP was less efficient than the raw material, a fact associated with starch gelatinization in RBF treated at that temperature. FRP might be a potential ingredient for development of products with high TDF and indigestible fraction contents, as well as important antioxidant capacity [Rodríguez-Ambriz SL, Islas-Hernández JJ, Agama-Acevedo E, Tovar J and Bello-Pérez LA, Characterization of a fibre-rich powder prepared by liquefaction of unripe banana flour, Food Chem, 2008, 107(4), 1515-1521].
**Different sweeteners in peach nectar**

Many articles have been published with negative visions related to sugar, because people believe that its intake is related to obesity. For this reason, artificial sweeteners have received special attention. In order to substitute sucrose successfully, it is necessary to know previously sweetener concentrations that would be used and their sweetness equivalency related to sucrose. Hence, researchers at Department of Food and Nutrition - Faculty of Food Engineering, University of Campinas, Campinas, Brazil conducted studies to determine the ideal sweetness in a peach nectar sweetened with sucrose, using a just-about-right scale and the equivalent sweetness of samples sweetened with aspartame; cyclamate/saccharin blend 2:1; stevia; sucralose and acesulfame-K, using Magnitude Estimation. The concentration of sucrose considered as ideal by the consumers was 10%, with sweeteners’ equivalent concentrations of 0.054% for aspartame; 0.036% for cyclamate/saccharin blend 2:1; 0.10% for stevia; 0.016% for sucralose and 0.053% for acesulfame-K [Juliana Maria Porto Cardoso and Helena Maria André Bolini, Different sweeteners in peach nectar: Ideal and equivalent sweetness, Food Res Int, 2007, 40(10), 1249-1253].

**Influence of different amounts of vegetable coagulant from cardoon and calf rennet on cheeses made with sheep milk**

Different amounts of powdered vegetable coagulant (PVC) obtained from cardoon [Cynara cardunculus Linn. (normal amount= PVC; double the normal amount=2PVC)] were compared by researchers at Spain with calf rennet in cheese made from sheep milk, by determining different chemical, biochemical, and sensory characteristics throughout of 6 months of ripening. For most of the chemical parameters studied, no differences were observed between the coagulants assayed. However, significantly higher (P<0.05) levels of casein hydrolysis, measured as soluble nitrogen (SN), non-protein nitrogen (NPN), amino acid nitrogen (AAN) and ammonia-nitrogen (N.NH$_3$), were observed after 2 days of ripening in cheeses produced with 2PVC compared with those made with normal amount of PVC. Furthermore, only the levels of SN and NPN were significantly higher (P<0.05) in cheeses produced with PVC than those obtained with calf rennet. The main sensory characteristics were enhanced (P<0.05) in cheeses obtained with vegetable coagulant in comparison to those made with calf rennet. The bitter taste of cheeses produced with 2PVC was not significantly stronger (P>0.05) than in those produced with a normal amount of vegetable coagulant. The increased proteolytic activity of the vegetable enzymes enable manufacturers to produce fully ripened cheeses (especially when the amount of the vegetable coagulant is doubled) with all the genuine end-product organoleptic characteristics approximately 3 months earlier than if calf rennet is used [Galán E, Prados F, Pino A, Tejada L and Fernández-Salgueiro J, Influence of different amounts of vegetable coagulant from cardoon Cynara cardunculus and calf rennet on the proteolysis and sensory characteristics of cheeses made with sheep milk, Int Dairy J, 2008, 18(1), 93-98].

**Fruit**

**Shrinkage and porosity of banana, pineapple and mango slices during air-drying**

It is very important to monitor characteristics of fruits (e.g. volume, shrinkage and porosity) during drying. There is lack of study in comparing different methods to measure dried product’s apparent volume. Specific volume, shrinkage and porosity of banana, pineapple and mango during air-drying were investigated by the researchers at Department of Process and Chemical Engineering, University College Cork, Cork, Ireland. Banana, pineapple and