

Energy conservation in domestic rice cooking

Energy conservation in cooking rice is an important area for scientific investigation. The scientists at Central Food Technological Research Institute, Mysore, India and Tezpur University, Tezpur, India conducted experiments to measure the energy consumption during normal and controlled cooking of both unsoaked and presoaked rice using two types of domestic cooking appliance, namely, an electric rice cooker and a pressure cooker. Cooking rice with controlled energy input, under pressure and with presoaking were the three

approaches, which resulted in saving of energy. Electric rice cooker was found to be the most energy-efficient among the different combinations of cooking appliance and the types of heat source used in the study. The energy consumption was much less (23-57%) compared to other methods. Prior soaking of rice generally reduced energy consumption as well as cooking time, more prominently during normal cooking. Controlled cooking offered more savings in energy compared to presoaking rice. Considering the energy consumption and cooking time,

controlled cooking of presoaked rice was found to be the best among the several approaches investigated. Measurement of water evaporation loss appears to be a good indirect method of assessing the efficiency of heat utilization. Controlled energy input is another useful method that optimizes the energy utilization for cooking, besides presoaking and pressure cooking. Controlled cooking is desirable in all types of rice cooking [Das Tribeni, Subramanian R, Chakkaravarthi A, Singh Vasudeva, Ali SZ and Bordoloi PK, Energy conservation in domestic rice cooking, *J Food Eng*, 2006, 75(2), 156-166].

Red yeast rice stimulates bone formation

Red yeast rice (RYR), rice that has been fermented by the red yeast *Monascus purpureus*, is frequently used in Chinese cuisine to flavour Peking duck and has also been used in traditional medicinal therapy in Asia for centuries. It has been reported that certain strains of RYR produce sufficient levels of lovastatin and other related statins to lower cholesterol levels when ingested by patients with hyperlipidemia. These

findings may explain, in part, the suggested benefits of treating heart disease with RYR in conventional Chinese medicine.

The scientists at USA worked on the effect of red yeast rice on bone formation in rats and because of the bone anabolic effect of statins, they hypothesized that RYR may also be capable of stimulating bone formation. They evaluated several different strains of RYR

and identified strains that contained a natural form of lovastatin. These lovastatin-containing strains were shown to produce strong bone anabolic effects both *in vitro* and *in vivo*, indicating a potential application of RYR as a therapy for bone loss in conditions such as osteoporosis [Gutierrez Gloria E, Mundy Benjamin, Rossini Gianni, Garrett, Chen Stephen T and Mundy Gregory R, Red yeast rice stimulates bone formation in rats, *Nutr Res*, 2006, 26(3), 124-129].

Bamboo leaves antioxidants reduce acrylamide formation in potato crisps and French fries

The scientists at Department of Food Science and Nutrition, College of Biosystems Engineering and Food Science, Zhejiang University, China investigated the efficiency of antioxidant of bamboo leaves

(AOB) on the reduction of acrylamide during thermal processing and to summarize the optimal level of AOB applied in potato-based products. During experiments potato crisps and French fries

were immersed into different contents of AOB solution, and the frying processing parameters were optimized. The acrylamide content was determined by liquid chromatography-tandem mass

spectrometry (LC-MS/MS). The sensory evaluation was performed in double blind manner. The results showed that nearly 74.1% and 76.1% of acrylamide in potato crisps and French fries was reduced when the AOB addition ratio was 0.1% and 0.01% (w/w), respectively. The maximum inhibitory rate was achieved when the

immersion time was designed as 60 seconds. Sensory evaluation results showed that the crispness and flavour of potato crisps and French fries processed by AOB solution had no significant difference compared to normal potato matrixes ($P>0.05$) when the AOB addition ratio was $<0.5\%$ (w/w). Thus, AOB could

significantly reduce acrylamide formation in potato-based foods and keep original crispness and flavour of potato matrixes [Zhang Y, Chen J, Zhang X, Wu X and Zhang Y, Addition of antioxidant of bamboo leaves (AOB) effectively reduces acrylamide formation in potato crisps and French fries, *J Agric Food Chem*, 2007, **55**(2), 523-528].

Concentrated oat beta-glucan lowers serum lipids

Soluble fibres lower serum lipids, but are difficult to incorporate into products acceptable to consumers. The scientists at Department of Food Science and Nutrition, University of Minnesota, USA investigated the physiological effects of a concentrated oat beta-glucan on cardiovascular disease endpoints in human subjects. They also compared the fermentability of concentrated oat beta-glucan with inulin and guar gum in a model intestinal fermentation system. During experiment seventy-five hypercholesterolemic men and women were randomly assigned to one of two treatments: 6 g/day concentrated oat beta-glucan or 6 g/day dextrose (control). Fasting blood samples were collected at baseline, week 3, and week 6 and analyzed for total cholesterol, HDL cholesterol, LDL cholesterol, triglycerides, glucose,

insulin, homocysteine and C-reactive protein. To estimate colonic fermentability, 0.5 g concentrated oat beta-glucan was incubated in a batch model intestinal fermentation system, using human fecal inoculum to provide representative microflora. Fecal donors were not involved with the beta-glucan feeding trial. Inulin and guar gum were also incubated in separate serum bottles for comparison.

Oat beta-glucan produced significant reduction from baseline in total cholesterol (-0.3 ± 0.1 mmol/l) and LDL cholesterol (-0.3 ± 0.1 mmol/l), and the reduction in LDL cholesterol were significantly greater than in the control group ($P>0.03$). Concentrated oat beta-glucan was a fermentable fibre and produced total short-chain fatty acids and acetate concentrations similar to inulin

and guar gum. Concentrated oat beta-glucan produced the highest concentrations of butyrate at 4, 8 and 12 hours. Thus, six grams concentrated oat beta-glucan per day for six weeks significantly reduced total and LDL cholesterol in subjects with elevated cholesterol and the LDL cholesterol reduction was greater than the change in the control group. Based on a model intestinal fermentation, this oat beta-glucan was a fermentable, producing higher amount of butyrate than other fibres. Therefore, a practical dose of beta-glucan can significantly lower serum lipids in a high-risk population and may improve colon health [Queenan KM, Stewart ML, Smith KN, Thomas W, Fulcher RG and Slavin JL, Concentrated oat beta-glucan, a fermentable fibre, lowers serum cholesterol in hypercholesterolemic adults in a randomized controlled trial, *Nutr J*, 2007, **6**, 6].

Effect of dietary fibre addition in cookies

A variety of fibres from plant sources have been used in cookies to improve the texture, colour and aroma with a reduced energy of the final product.

The scientists at Turkey worked on to partially replace wheat flour in the formulation of wire-cut cookies with different sources of dietary fibre on the

levels of 15, 20 and 30% (w/w, based on the wheat flour used) when used with 0.4% xylanase enzyme and to measure the nutritional properties of resulting cookies

(i.e. *in vitro* protein digestibility, phytic acid content, total antioxidant capacity and total phenolic compounds). Cookie samples were prepared with 0-30% of the wheat flour substituted with fibres from

apple, lemon, wheat and wheat bran. It was found that increasing fibre from apple, lemon and wheat sources did not change the nutritional status of the samples to a great extent ($P < 0.05$). However, addition

of wheat bran significantly reduced the nutritional properties of the cookie samples [Bilgiçli Nermin, Ibanoglu Senol and Nur Herken Emine, Effect of dietary fibre addition on the selected nutritional properties of cookies, *J Food Eng*, 2007, **78**(1), 86-89].

Production of drum-dried jackfruit powder with soy lecithin and gum arabic

Jackfruit (*Artocarpus heterophyllus* Lam.) is widely grown in Thailand, Indonesia, Myanmar, India, Philippines and Malaysia. During harvesting, the fruit is sometimes allowed to fall and must be collected daily as it has a shelf-life of only 2-3 days. Mature undamaged fruit can be stored at 12°C for about 3 weeks and ripen for 3-7 days. Jackfruit is usually eaten fresh and is also preserved. Double drum drying is extensively used in commercial drying of starchy food products. It is a continuous contact drying method for drying liquids products. The availability of different feed flow rates ensures that solutions, suspensions and pastes with a wide range of viscosities can be dried. This type of drying is suited to many heat sensitive products since exposure to high temperature is limited to a few seconds. Typical examples of food products successfully dried on drum dryers include products which are viscous in their natural state after concentration, such as apple sauce, milk, precooked cereals, mashed potatoes, gelatinized starch, molasses and honey, fruit pulps, etc. The purpose of

drying food products is to extend shelf-life of products with minimum packaging requirements and reduced shipping weights.

Lecithin is used in many food products, such as chocolate and confectionary products, margarines, bakery goods and pasta products. It is one of the member of a very small group of emulsifiers that is 'generally recognized as safe' (GRAS) by the US Food and Drug Administration. Gum arabic is a commonly recognized hydrocolloid emulsifier and exists in nature as a neutral or slightly acidic salt of a complex polysaccharide containing calcium, magnesium and potassium cations. Its major use as a food additive is to provide desirable properties that affect viscosity, body and texture of foods. It is widely used in the soft drinks industry for emulsifying flavour oils under acidic conditions. Response surface methodology (RSM) is currently the most popular optimization technique in food science, probably because of its comprehensive theory, reasonably high efficiency and simplicity. The scientists at Malaysia did studies to

determine the optimum concentration of soy lecithin and gum arabic in producing drum-dried jackfruit powder using RSM. During experiment jackfruit puree was dried using a double drum drier set at 1rpm, drum clearance of 0.01in and steam pressure of 2.3bar. Soy lecithin and gum arabic were incorporated into jackfruit puree at different concentrations ranged from 1-5% and 5-15%, respectively. Soy lecithin and gum arabic were significant factors (at 95% confidence level) for moisture content, bulk density, Hunter *L*, *a*, *b* values and hedonic test during drum drying of jackfruit. A second-order polynomial model was found for each of the significant response. The jackfruit puree formulation to produce a good quality powder could be obtained by incorporating 2.65% of soy lecithin and 10.28% of gum arabic into the jackfruit puree (40% v/w water) [Pua CK, Abd Hamid N Sheikh, Rusul G and Rahman R Abd, Production of drum-dried jackfruit (*Artocarpus heterophyllus*) powder with different concentration of soy lecithin and gum Arabic, *J Food Eng*, 2007, **78**(2), 630-636].

Effect of sugar-beet fibres on bread characteristics

Consumption of food rich in fibres can weaken or even prevent some diseases hence they can be considered as functional food. Food with high content of fibres causes hunger alleviating effect and, at the same time, does not cause binding minerals like calcium, magnesium and zinc. The recommendations for dietary fibres intake range from 25 to 30g/day. In sugar-beet technology, pulp is remaining after sugar extraction as a waste product. In comparison with cereal bran, sugar-beet (*Beta vulgaris* Linn.) fibres are characterized: (i) by low phytate, which is of particular concern to nutritionists because of its possible adverse effects on mineral absorption and (ii) by better water binding and retention capacity, which is of particular interest for the baking industry. The scientists at Faculty of Technology, Carbohydrate Food Technology, Bul. Cara Lazara, Novi Sad, Serbia and Montenegro investigated the effects of non-modified and modified sugar-beet fibres on dough and bread

yield, bread volume and bread crumb quality. Dry sugar-beet fibres were ground, sieved through a laboratory sieve and a fraction with particles less than 95µm was used for further treatment. It was hydrated for 24 hours and pressed for removing excess water. In such a way hydrated but non-modified fibres were obtained. Part of the non-modified fibres was exposed to a further treatment with H₂O₂ at the pH values: 3.5, 7 and 11 for the additional 24 hours. Treated blends were neutralised, washed with tap and distilled water, pressed and blended to a homogenous mass with fine particles. In such a way modified fibres were obtained. Dough and bread were made from white flour, powdered vital gluten, salt and yeast (as it is used in regular bread production), without fibres, with non-modified fibres and with modified fibres. Experiments were planned so that the quantity of the applied fibres in the blends varied from 0 to 15%, while gluten quantity varied from 0 to 5%. Controlling characteristics of the product were: yield of dough and bread,

volume and crumb quality. By applying the regression analysis method on the measured data, mathematical models for both fibres application were defined. Based on the experimental results as well as on the mathematical considerations following conclusions were drawn: increase of content of both fibres (non-modified and modified) increases yield of dough and bread but decreases volume of bread and bread crumb quality. On the other hand, increase of gluten quantity increases the volume of bread at small amounts of fibres; when fibres quantity increases, gluten proved ineffective. By the comparison of non-modified and modified fibres, the advantage is given to the non-modified fibres. An enrichment of bread with less than 10% of non-modified fibres, accompanied with a few percents of gluten, is highly recommended [Filipovic Nada, Djuric Mirjana and Gyura Julianna, The effect of the type and quantity of sugar-beet fibres on bread characteristics, *J Food Eng*, 2007, 78(3), 1047-1053].

Effect of heat processing on milling of black gram and its end product quality

Black gram (*Phaseolus mungo* Linn.) is grown in India, Pakistan and Sri Lanka. Processing of black gram has several problems as black gram is difficult to mill due to the presence of vitreous layer of gums and mucilages, which makes it difficult in dehusking. Dehusking is a process that reduces the fibre content and improves appearance,

texture, cooking quality, palatability and digestibility of grain legumes. For proper dehusking of black gram, premilling treatments are given to ease the removal of husk from black gram. Premilling treatments are given to affect the gums present in-between seed coats and cotyledon in order to (a) loosen the husk, (b) ease milling, (c) reduce breakage, and

(d) improve the quality of split. The scientists at Paddy Processing Research Centre, Thanjavur, India did study to optimize the oil treatment and suitable drying temperature for proper dehusking of black gram and also studied the effect of drying temperature on fermentation of black gram. The effect of different concentrations of oil, viz. 0.0, 0.2, 0.4,

0.6, 0.8 and 1.0% and different drying temperatures of 40, 50, 60, 70 and 90°C on the removal of husk was evaluated. It was observed that 85.25 and 85.5% of dehulling were obtained at 0.4 and 0.8% oil and at drying temperature of 90°C, respectively, and the powdering loss was 7.15 and 6.98%, respectively. Further studies were conducted to examine the

batter volume of above treated samples and it was found that the unfermented batter volume was 1120 and 825 ml at 40 and 90°C, respectively; after fermentation period of 24 hours, the increase in the batter volume was found to decrease from 69.84 to 26.66%, i.e. the unfermented batter and fermented batter volume decreases as drying temperature increases.

Decrease in batter volume and fermentation level at elevated temperature may be due to the denaturation of heat labile muco-protein and inactivation of enzymes, which are responsible for fermentation [Tiwari BK, Jagan Mohan R and Vasani BS, Effect of heat processing on milling of black gram and its end product quality, *J Food Eng*, 2007, **78**(1), 356-360].

Effect of soapwort extract on physical and sensory properties of sponge cakes

Soapwort (*Gypsophila arrostii* Guss.) extract yields relatively stable, soap-like foam in aqueous solution because of its saponin content. Researchers at Department of Food Engineering, Pamukkale University, Çamlık, Denizli, Turkey carried out investigations with objective to utilize the advantage of the high foam forming capacity of soapwort extract in the production of sponge cakes. Egg white proteins were partially replaced with soapwort extract in the sponge cake

formulation. The effects of soapwort extract addition on the rheological and physical properties of cake batters and on the physical and sensory properties of sponge cakes were determined. Replacing egg white proteins with soapwort extract, up to 75% by weight, did not have any significant influence on the specific gravity of batters ($P > 0.05$). Addition of soapwort extract into the cake mixture did not influence the flow behaviour indices (n) of cake batters nor the consistency indices (K) of cake batters. Replacing egg

white proteins with soapwort extract had no unfavourable influence on the sensory properties of sponge cakes. Indeed, sponge cakes formulated with soapwort extract received significantly higher chewiness scores than did control cakes. This study showed that egg white proteins could be partially replaced with soapwort extract [Ilyas Çelik, Yusuf Yılmaz, Fatma Isik and Özlem Üstün, Effect of soapwort extract on physical and sensory properties of sponge cakes and rheological properties of sponge cake batters, *Food Chem*, 2007, **101**(3), 907-911].

Functional properties of Rohu proteins during iced storage

Proteins are functional components in processed food, where they contribute to texture and sensory characteristics besides the nutritional properties. Fish is a highly perishable commodity and are generally kept in ice prior to processing to minimize spoilage. Degradation of muscle protein is a major

problem associated with fish during storage.

The effect of iced storage on functional properties, viz. solubility, emulsion activity index (EAI), viscosity and foaming of muscle proteins from fresh water fish Rohu (*Labeo rohita*) was evaluated by scientists of Biochemistry and

Nutrition Division, Central Institute of Fisheries Technology, Matsyapuri, Cochin, Kerala, India. Myofibrillar protein (MFP) solubility showed an increasing trend up to 11 days of storage followed by a decrease. Solubility of sarcoplasmic protein (SPP) showed a decreasing trend through out the storage period. A 44%

drop in emulsion activity index (EAI as m^2/g) was observed in the case of MFP on storage. MFP showed foam volume stability (FVS) of 94% and a 22% loss in stability was recorded on the 25th day. Viscosity of SPP remained relatively stable through out the duration of study while that of MFP showed an increasing trend during the first week and then decreased. Influence of protein concentration on different functional properties were also

studied. The data are discussed in relation to protein conformational changes as indicated by changes in hydrophobicity, and reactive sulphhydryl groups. Reactive sulphhydryl groups increased gradually attaining a maximum on the 6th day and a gradual decline towards the end. Hydrophobicity of myofibrillar fraction showed a decrease till the 11th day and thereafter it increased gradually. *K*-value was taken as an index of quality which

shot-up from 0.2% to 59.80% during the storage of fish in ice. This study indicates that Rohu was acceptable till the 21st day of pre-process storage in ice. *K*-value of Rohu on the 21st day approached the limit of acceptability. The changes taking place after the 21st day could be due to microbiological contamination [Mohan Mukund, Ramachandran Dhanya and Sankar TV, Functional properties of Rohu (*Labeo rohita*) proteins during iced storage, *Food Res Int*, 2006, 39(8), 847-854].

Dietary fibre from coconut flour: A functional food

The Philippines is the second largest coconut producer in the world and the largest exporter of coconut products. About 85% is processed into copra, 5% into desiccated coconut and 10% is for home use and manufacturing coconut products. One by-product of the coconut milk industry is the coconut residue taken after extraction of the coconut milk. The coconut residue is made into coconut flour and believed to contain dietary fibre. Dietary fibre has been shown to have important health implications in the prevention for risk of chronic diseases such as cancer, cardiovascular diseases and diabetes mellitus. To determine the effectiveness of dietary fibre present in coconut flour as a functional food, the following studies were conducted by scientists at Philippines: (a) dietary fibre composition and fermentability of coconut flour; (b) effect of coconut flour on mineral availability from coconut flour supplemented foods; (c) glycemic index of coconut flour supplemented foods in normal and diabetic subjects; and (d)

cholesterol lowering effect of coconut flakes in moderately raised cholesterol levels of humans. The dietary fibre content of coconut flour was 60.0 ± 1.0 g/100 g sample, 56% insoluble and 4% soluble. Fermentation of coconut flour produced short chain fatty acids with butyrate (1.73 ± 0.07 mmol/g fibre isolate) > acetate (1.40 ± 0.12 ; $P < 0.05$) > propionate (0.47 ± 0.01 ; $P < 0.05$). Iron and zinc availability were highest for carrot cake (Fe, $33.3 \pm 0.7\%$; Zn, $12.6 \pm 0.1\%$) supplemented with 20% coconut flour while multigrain loaf supplemented with 10% and macaroons with 25% coconut flour were highest for calcium availability ($63.4 \pm 8.0\%$ and $38.7 \pm 1.1\%$, respectively). Increasing concentrations of dietary fibre from coconut flour did not affect mineral availability from all test foods. The significantly low glycemic index foods (< 60 mmol \times min/l) investigated were: macaroons (45.7 ± 3.0), carrot cake (51.8 ± 3.3) and brownies (60.1 ± 5.4) with 20–25% coconut flour. The test foods containing 15% coconut flour has

a glycemic index ranging from 61 to 77 mmol \times min/l. Among the test foods, *pan de sal* (87.2 ± 5.5) and multigrain loaf (85.2 ± 6.8) gave significantly higher glycemic index with 5% and 10% coconut flour. On the other hand, granola bar and cinnamon which contained 5% and 10% coconut flour, respectively gave a glycemic index ranging from 62 to 76 mmol \times min/l and did not differ significantly from the test foods containing 15% coconut flour ($P < 0.05$). A very strong negative correlation ($r = -85$, $n = 11$, $P < 0.005$) was observed between the glycemic index and dietary fibre content of the test foods supplemented with coconut. There was a significant reduction (%) in serum total and LDL cholesterol for: oat bran flakes, 8.4 ± 1.4 and 8.8 ± 6.7 , respectively; 15% coconut flakes, 6.9 ± 1.1 and 11.0 ± 4.0 , respectively; and 25% coconut flakes, 10.8 ± 1.3 and 9.2 ± 5.4 , respectively ($P < 0.05$). Serum triglycerides were significantly reduced for all test foods: corn flakes, $14.5 \pm 6.3\%$; oat bran flakes, $22.7 \pm 2.9\%$; 15% coconut

flakes, $19.3 \pm 5.7\%$; and 25% coconut flakes, $21.8 \pm 6.0\%$ ($P < 0.05$). The results of this study serve as a basis in the development of coconut flakes/flour as a

functional food justifying increased production of coconut and coconut by-products [Trinidad Trinidad P, Mallillin Aida C, Valdez Divinagracia H, Loyola Anacleto S, Askali-

Mercado Faridah C, Castillo Joan C, Encabo Rosario R, Masa Dina B, Maglaya Angelica S and Chua Modesto T, Dietary fiber from coconut flour: A functional food, *Innov Food Sci Emerg Technol*, 2006, 7(4), 309-311].

Effect of heating condition and starch concentration on the structure and properties of freeze-dried rice starch paste

Pregelatinized starches are widely used in the food industry because of their functionality to form viscous solutions, gels, films and encapsulating matrices. The functionalities depend on the physico-chemical properties of gelatinized starches, and by changing of raw materials and process parameters it is possible to obtain pregelatinized starches with different functional characteristics. Among the modification methods, a physical modification is one of the important treatments for preparing of starch with functionally desirable attributes.

Therefore, scientists at Korea conducted experiments with the objective to study the freezing/freeze-drying technique for the production of solid starch matrices under gel-forming concentration, and to investigate the differences in the solid starch matrices' microstructure and physical properties

according to various process parameters (rice starch concentration, heating temperature and time). The influence of process parameters on the structure and physical properties of samples was analyzed by Surface Response Methodology. The structure and characteristics of freeze-dried rice starch paste were investigated at low starch concentrations (1, 3 and 5%). The microstructure of samples made at 1% of starch concentration showed a loose filamentous network compared to other concentrations (3 and 5%). The samples prepared at processing conditions above 110°C and 3% were appeared a coarse honeycomb-like structure. Crystallinity of samples calculated by intensities of X-ray diffraction peaks was very low values (3.3-9.8%). The mechanical properties (hardness, cohesiveness and springiness) of the samples were highly influenced by starch concentration and heating

temperature. The relative increment of water absorption index (WAI) according to increasing of heating temperature showed the highest value at 1% of starch concentration and the heating temperature was analyzed to the important factor affecting WAI and WSI (water solubility index). The digestibility of samples showed an increasing trend with heating temperature regardless of starch concentration. Overall, the important factors influencing the properties of freeze dried rice starch paste were starch concentration and heating temperature. Using adequate combination of processing conditions, it can be possible to obtain a solid rice starch matrix of desirable properties [Leea Seog-Won and Rhee Chul, Effect of heating condition and starch concentration on the structure and properties of freeze-dried rice starch paste, *Food Res Int*, 2007, 40(2), 215-223].

Effect of soybean varieties on the content and composition of isoflavone in *rice-koji miso*

Soybeans are massively consumed in Asian nations and in Japan, soybeans are used for various soybean products including *miso* (soybean paste), soybean curd and fermented soybean. In recent health-consciousness trends, *miso* (a traditional Japanese fermented food), which has played an important role in Japanese diet, has become important as a source of isoflavone. To clarify the effect of soybean varieties on isoflavone, a useful component for human health, in soybean products, scientists at Japan investigated changes in the isoflavone content and composition in *rice-koji miso*, after fermentation/ageing for 6 or 12 months using cultivars of soybeans ('Tohoku-126', 'Tohoku-135', 'Tohoku-139', 'Suzuyutaka'



and Chinese soybeans), by high performance liquid chromatography. In soybeans, the total isoflavone content in 'Tohoku-126' was 444 mg/100 g, which was 1.2–2.0 times the content in the other soybean varieties. The malonyl glycosides and aglycones in soybeans accounted for more than 60% and only a few per cent, respectively. As for *rice-koji miso*, the total isoflavone and aglycone contents were

the highest in *miso* prepared from 'Tohoku-126'. The ratios of glycosides to aglycones (80.1-92.6%) in *miso* were higher than those in the original soybeans. The time course of the isoflavone composition during the fermentation/ageing process of *rice-koji miso* indicated that glycosides decreased from 86.4% to 44.9% after 6 months but aglycones increased from 9.6% to 53.3%. Thus, utilization of soybeans containing abundant isoflavone, such as 'Tohoku-126', for soybean products is expected [Yamabe Shigeo, Kobayashi-Hattori Kazuo, Kaneko Kentaro, Endo Hiroshi and Takita Toshichika, Effect of soybean varieties on the content and composition of isoflavone in *rice-koji miso*, *Food Chem*, 2007, **100** (1), 369-374].

Extraction, purification and characterization of globulin from common buckwheat seeds

Amongst the existing crops, common buckwheat (*Fagopyrum esculentum* Moench), an under-utilized pseudocereal, assumes special importance because of the short growth span and high nutritive value of its grains. Buckwheat proteins have a high biological value due to well-balanced amino acid composition and are rich in lysine and arginine. The salt-soluble globulin represents the major Osborne fraction of buckwheat seed proteins and has been classified as a legumin-like storage

protein. Buckwheat globulin (BWG) can be a potential source of nutritive food ingredient for human consumption. In order to develop dietary proteins for utilization as ingredients in the food industry, it is



necessary to determine the physico-chemical and functional properties of the proteins, since the ultimate success for utilization depends largely upon desirable functional characteristics. Hence, researchers at Food Science Laboratory, Department of Botany, The University of Hong Kong, Hong Kong extracted salt-soluble globulin from common buckwheat seeds and its chemical composition was determined.

The protein content of buckwheat globulin was over 90%.

Anion-exchange chromatography (with stepwise salt gradient elution) was used to obtain two fractions of BWG, corresponding to the basic and acidic polypeptides, respectively, at a ratio of approximately 1:2. Sodium dodecyl sulfate polyacrylamide gel electrophoresis showed that the acidic and basic polypeptides were linked by disulfide bonds. The basic polypeptide has an estimated molecular weight of 23-25 kDa, an isoelectric point

in slightly alkaline region (pH 8-9), and showed a high degree of homology with other legumin-like proteins. Disulfide and sulfhydryl contents in BWG were estimated as 36.4 and 3.20 $\mu\text{M/g}$ of protein, respectively. BWG was found to possess some favourable functional properties such as relatively high solubility, water holding and fat binding capacity, as well as emulsifying activity and emulsion stability when compared to a widely used

commercial soy protein product. Thus, BWG may have potential applications in fortified food products by virtue of its high solubility, fat binding capacity and good emulsifying properties [Choi Siu-Mei and Ma Ching-Yung, Extraction, purification and characterization of globulin from common buckwheat (*Fagopyrum esculentum* Moench) seeds, *Food Res Int*, 2006, **39** (9), 974-981].

Influence of fibre from different cereals on wheat flour dough and biscuit quality

Demand for health oriented products such as sugar-free, low calorie and high fibre products is increasing. One such recent trend is to increase the fibre content in food products to overcome health problems such as hypertension, diabetes and colon cancer, among others. Consumption of high fibre products consisting of indigestible cellulose, hemicellulose, lignin and gums have several health benefits. Apart from these benefits, β -glucan-rich fibres have the benefit of reducing the absorption of glucose. Scientists at Flour Milling, Baking and Confectionery Technology Department, Central Food Technological Research Institute, Mysore, India carried out investigations to find the potential use of fibre sources from four cereals (wheat, rice, oat and barley) on the rheological properties of wheat flour dough and on the quality of biscuits. Ash, total protein



Oat seeds

and dietary fibre content of bran samples ranged between 4% and 10%, 12% and 14% and 20.4% and 49.5%, respectively. Farinograph characteristics of the wheat flour-bran blends showed increase in water absorption from 60.3 to 76.3% with increase in the level of bran from 0 to 40%. The resistance to extension values as well as extensibility of the dough decreased with increase in the bran level.

The spread ratio of the biscuits prepared from wheat, rice and oat bran blends decreased from 8.38 to 7.52, whereas the same increased to 9.3 for biscuits prepared from barley bran blends. The breaking strength values of biscuits ranged between 1.34 and 3.83 kg. Highly acceptable biscuits could be obtained by incorporating 30% of oat bran or 20% of barley bran in the formulation. The dietary fibre composition of these biscuits showed that fibres, which play a very important role, could be used for enriching the fibre content of biscuits. These studies have shown the potential of developing fibre-rich biscuits in order to increase the dietary fibre intake [Sudha ML, Vetrimani R and Leelavathi K, Influence of fibre from different cereals on the rheological characteristics of wheat flour dough and on biscuit quality, *Food Chem*, 2007, **100** (4), 1365-1370].

Bread from composite cassava-wheat flour

Bread has become the second most widely consumed non-indigenous food products after rice in Nigeria. Till date, most Nigerians have not been introduced to other types of bread apart from that made from 100% wheat flour. To cut the nation's expense on wheat importation and find wider utilization for the increasingly produced cassava roots, the Federal Government mandated the use of composite cassava-wheat flour for baking by adding minimum of 10% cassava flour to wheat for a start. To ensure the commercial success of this composite cassava-wheat flour technology, systematic studies need to be conducted to fully understand the best way to formulate product and to determine the optimal processing conditions required to realize high quality baked products.

The use of composite cassava-wheat (CCW) flour for commercial bread making purposes and consumption of

CCW bread are relatively new in Nigeria. Thus, scientists at Nigeria investigated the effect of baking temperature and time on some physical properties of bread from composite flour made by mixing cassava and wheat flour at ratio of 10:90 (w/w). A central composite rotatable experimental design was used while the baking temperature and time investigated ranged from 190 to 240°C and 20 to 40 min, respectively. Loaf volume, weight and specific volume varied significantly ($P < 0.001$) from 440 to 920 cm³, 162 to 183 g and 3.31 to 5.32 cm³/g, respectively. The tristimulus colour parameters such as L* (lightness) and brownness index (BI) of the crust varied significantly ($P < 0.01$) from 31 to 72 and 68 to 123, respectively. Moreover, fresh crumb moisture, density, porosity and softness as well as the dried crumb hardness were also significantly ($P < 0.01$) affected by both the baking

temperature and time with values ranging from 34 to 39%, 0.16 to 0.20 g/cm³, 0.69 to 0.80, 13.00 to 18.05 mm and 0.90 to 2.05 kgf, respectively. This study has been able to show that varying temperature-time combination during baking leads to significant differences in the quality of composite cassava-wheat bread produced. The influence of baking temperature was specifically more significant on loaf volume and crumb moisture while baking time had more significant influence on loaf weight, dried crumb hardness and density. Therefore, further studies are required to accurately determine the response of sensory and storage properties of the CCW bread to changing baking temperature and time as they are more important for optimizing consumer acceptability [Shittua TA, Rajib AO and Sannia LO, Bread from composite cassava-wheat flour: I. Effect of baking time and temperature on some physical properties of bread loaf, *Food Res Int*, 2007, 40(2), 280-290].

Effect of milling on colour and nutritional properties of rice

Mature rice is harvested as a covered grain, designated as paddy rice. The hull, the outer covering, corresponds to 18-20% of the weight of paddy rice. It is removed from the brown rice by dehulling. White rice can be obtained by milling brown rice to remove the germ (2-3% of brown rice weight) and the bran layers (5-8% of brown rice weight) from the underlying starchy endosperm.

Different markets require different degrees of bran removal. The colour of rice is an important sensory parameter. Generally, the whiter the milled rice, the more value it has in the market place.

Researchers at Belgium conducted studies with a purpose to add existing knowledge on the effect of milling on the colour and the composition of long-grain rice. Brown rice (long-grain

cv. 'Puntal') was abrasively milled (0-100 s) to various degree of milling (DOM, 0-25%). The non-linear relationship between milling time and DOM indicated a variability in hardness within the different rice fractions. The hardness of the bran layers increased from outer to inner bran layers, while the different endosperm fractions were of comparable hardness. The colour

parameters L^* , a^* and b^* and extinction measurements of water-saturated butanol extracts of flour, from rice with different DOM, indicated that bran contained much more yellow and red pigment than endosperm. The levels of yellow and red pigment decreased from the surface of the brown rice to the middle endosperm (DOM = 15%). Once bran (DOM = 9%) and outer endosperm (additional DOM = 6%) were removed, the yellowness and redness of the middle endosperm of the raw rice remained constant, indicating that the pigments were uniformly distributed in the middle endosperm. Cooking of rice containing residual bran layers (DOM <

9%) increased rice brightness (L^*) and decreased its redness (a^*) and yellowness (b^*), as expected from a dilution effect resulting from the uptake of water, as well as from leaching of pigments in the cooking water and diffusion of bran pigments to the endosperm. Cooking of rice with DOM > 9% resulted in products of constant brightness and redness but with yellowness which decreased as a function of DOM. Proteins, minerals and starch were not uniformly distributed in the brown rice kernel. The endosperm (DOM > 9%), contained most of the rice kernel proteins (84.2%), and proteins were mostly concentrated in the outer

endosperm (9% < DOM < 15%). Bran (0% < DOM < 9%) contained most of the minerals (61.0%) and starch (84.6%) was concentrated in the core endosperm fraction (DOM 25%). The study of the effect of milling on the nutritional properties confirmed that the level of proteins and minerals decreased from the surface to the endosperm of brown rice and that the level of total starch increased from the surface to the endosperm [Lamberts Lieve, Bie Els De, Vandeputte Greet E, Veraverbeke Wim S, Derycke Veerle, Man Walter De and Delcour Jan A, Effect of milling on colour and nutritional properties of rice, *Food Chem*, 2007, **100** (4), 1496-1503].

Fruit

Effect of pre-treatments on drying, density and shrinkage of apple slices

The scientists at Brazil studied the effects of different pre-treatments on convective drying of apple slices and compared to drying without pre-treatments. An impregnation with starch, an high temperature/short time (HTST) process, and a combination of the two were used. When HTST was applied, air drying at mild (conventional) temperatures was used to finish the drying process. The HTST process had high mass

transfer rates, however, when it ceased, the drying rate returned to the behaviour observed on mild temperature curves, at all air velocities studied. The apparent density was also investigated and showed lower values for several conditions applied. Analysis of variance (ANOVA) indicated which factors are significant to the observed decrease in apparent density. The Duncan test highlights experimental situations where these variables have an

influence. Apparent density is almost constant as dimensionless moisture content diminishes, but it decreases when values are below around 0.2. Volume variations showed a linear behaviour with the moisture content changes at the studied conditions [Schultz EL, Mazzuco MM, Machado RAF, Bolzan A, Quadri MB and Quadri MGN, Effect of pre-treatments on drying, density and shrinkage of apple slices, *J Food Eng*, 2007, **78**(3), 1103-1110].