Microwave drying characteristics of spinach

The effect of microwave drying on characteristics of spinach was investigated by the scientists at Uludag University, Turkey. During experiment spinach leaves (*Spinacia oleracea* Linn. cv. ‘Meridian’) with 50g weight and 9.01 humidity on dry weight basis were dried in microwave oven using eight different microwave power levels ranging between 90 and 1000W, until the humidity fell down to 0.1 on dry weight basis. Drying processes were completed between 290 and 4005 seconds depending on the microwave power level. Energy consumption remained constant within the power range of 350-1000W, whereas 160 and 90W resulted in significant increase in energy consumption. In this study, measured values were compared with predicted values obtained from Page’s thin layer drying semi-empirical equation. The best quality in terms of colour and ascorbic acid values were obtained in the drying period with 750W microwave power. Microwave power of 750W for 350 seconds produced the least energy consumption and the energy requirement for drying was only 0.12kWh [Ozkan I Alibas, Akbudak B and Akbudak N, Microwave drying characteristics of spinach, *J Food Eng*, 2007, 78(2), 577-583].

Effects of heat treatment on the quality and storage life of sweet potato

The effects of heat treatment (50°C) on the sprouting inhibition and spoilage of sweet potato roots (curing temperature: 29°C) stored in wrapper-type cold store (WTCS) were determined during year-long storage. The quality attributes of sweet potato were also evaluated jointly by the scientists at China and Japan. The results indicated that hot water treatment significantly inhibited sprouting and decay of sweet potato for the storage period. It also showed that there were no significant differences in starch properties in terms of pasting properties, enthalpy and temperatures onset (*T*<sub>0</sub>), peak (*T*<sub>p</sub>) and endset (*T*<sub>e</sub>) of gelatinisation of sweet potato starches among all the treatments, especially between heat-treated and without-heat-treated samples. Also, hot water treatment did not have any significant impact on the internal components’ quality of the roots: less than 4% of the year-long stored roots were discarded due to spoilage. Heat treatment supplied a lethal dose of heat to surface pathogens and cauterised the eyes without damaging the nutritional and processing qualities of sweet potato. The success of storage experiments in prolonging sweet potato stored in WTCS by heat treatment was obtained from the effective control of weight loss, sprouting and decay without influence on quality characteristics. This new technique opens a new avenue to prolonging the storage life of sweet potato with good quality and minimal loss [Wenzhong Hu and Shun-Ichiro Tanaka, Effects of heat treatment on the quality and storage life of sweet potato, *J Sci Food Agric*, 2007, 87(2), 313-319].

Ingestion of potato starch decreases chymotrypsin in rats

Adaptation of digestive enzymes in the pancreas was evaluated by the scientists at Japan in rats, fed diets composed of potato starch as a carbohydrate source. During experiment male Sprague-Dawley rats, at 7 weeks were fed 4 different diets containing 60% sucrose, cornstarch, or 2 kinds of starch derived from different potato varieties. Enzyme activity in the pancreas of rats was determined at 0, 1, 3, and 5 weeks. Although amylase activity slightly increased...
Minimally processed potatoes are susceptible to a variety of physiological and microbiological phenomena during storage. Enzymatic browning of the cut surfaces, leading to serious quality deterioration, has been a matter of concern for the food industry searching for efficient ways to inhibit this reaction. Enzymatic reactions, leading to the appearance of pink, grey or brown colour, can appear within minutes if the tissues are not treated with inhibitors. Several chemical browning inhibitors in different concentrations and combinations have been studied for this purpose. Among them, citric acid (CA), ascorbic acid (AA) and l-cysteine (LC) in concentrations ranging from 0.5 to 2% have been the most commonly used substances. However, little is known on the possible physiological effects of the application of these substances to metabolic active tissues. The scientists of various institutes at Italy, Chile and Sweden worked jointly to investigate the effect of anti-browning treatments on colour changes, metabolic activity and sugar composition of fresh-cut potatoes. Metabolic activity was quantified by measuring metabolic heat production with isothermal calorimetry. The effect of anti-browning substances on the colour of potato slices was assessed by computerized image analysis and the results evaluated comparing their chromatic characteristics with those of the non-treated samples. The results revealed that the use of citric acid, ascorbic acid and l-cysteine for browning prevention of fresh-cut potatoes increased their metabolic heat production as measured by isothermal calorimetry. This effect was particularly high after treatment with l-cysteine, which also proved to be the most effective substance for inhibiting enzymatic browning. This increase in metabolic activity was concentration dependent and correlated with a decrease in the concentration of reducing sugars in the tissue, showing evidence that substances used in the prevention of enzymatic browning may have physiological effects in the tissue [Roccu Pietro, Gómez Galindo Federico, Mendoza Fernando, Wadsö Lars, Romani Santana, Dalla Rosa Marco and Sjöholm Inggered, Effects of the application of anti-browning substances on the metabolic activity and sugar composition of fresh-cut potatoes, Postharvest Biol Technol, 2007, 43(1), 151-157].

Effects of anti-browning substances on the metabolic activity and sugar composition of fresh-cut potatoes

The scientists at Italy investigated ten genotypes belonging to *Lactuca sativa* Linn., *Cichorium intybus* Linn., *Plantago coronopus* Linn., *Eruca sativa* Mill. and *Diplotaxis tenuifolia* (Linn.) DC., which are used in fresh mixed salads for their polyphenol contents. Flavonoids and hydroxycinnamic acids were characterized by high-performance liquid chromatography (HPLC)/diode array detection/mass spectrometry. Quercetin, kaempferol, luteolin, apigenin and crysoeriol derivatives were identified; hydroxycinnamic acids were all caffeoyl derivatives. The total polyphenol content was obtained through the Folin-Ciocalteu test and from the HPLC data. The amounts...
ranged between 0.9 and 4.7 mg/g fresh weight. The antiradical activity was determined by the reaction with the stable DPPH radical. The Fe²⁺ chelating activity was determined with a spectrophotometric test. A cultivated C. intybus cultivar exhibited the highest polyphenol content, while a wild C. intybus genotype exhibited the highest antiradical activity. In every case, the characteristics of the different salads as functional foods have been pointed out [Heimler D, Isolani L, Vignolini P, Tombelli S and Romani A, Polyphenol content and antioxidative activity in some species of freshly consumed salads, J Agric Food Chem, 2007, 55(5), 1724-1729].

Microbiological quality of hot water-washed broccoli florets and cut green beans

Ready-to-use vegetables are bought for their convenience but it is also important that they should maintain a fresh-like quality and contain only natural ingredients. However, heat treatment may alter the ability of the vegetable tissue to support growth of micro-organisms as it can inactivate plant defences and damage cell membranes which may release nutrients. The scientists at Institute of Food Research, Norwich Research Park, Colney, Norwich UK studied the effect of highest heat treatment applicable to fresh-like vegetables and examine its effect on the microbiological safety and spoilage of the resulting product. A treatment of 52°C for 90 seconds was selected as it was the highest temperature and time combination shown to have a positive effect on the sensory qualities of cut beans and broccoli florets stored refrigerated for up to 2 weeks in a preliminary trial. They examined both the behaviour of the natural flora on broccoli florets and cut beans stored at 7 and 10°C and the ability of the treated product to support growth of the pathogens Listeria monocytogenes, Bacillus cereus and Escherichia coli 0157:H7 inoculated post heat treatment to mimic post-process contamination. Using a hot wash treatment improved the initial appearance of the vegetables and resulted in a small, but significant, reduction in populations of all groups of endogenous flora measured. The number of yeast and moulds on the vegetables washed at 52°C remained below the levels observed on the 20°C washed vegetables throughout the observation period, but Pseudomonas spp., lactobacilli and Enterobacteriaceae were better able to grow on the hot-washed vegetables such that the counts at the end of storage were greater on hot-washed than ambient-washed vegetables. All three of the pathogens tested were better able to grow on hot-washed broccoli and beans than on equivalent product washed at 20°C [Stringer SC, Plowman J and Peck MW, The microbiological quality of hot water-washed broccoli florets and cut green beans, J Appl Microbiol, 2007, 102(1), 41-50].

Multi-stage vacuum cooling process of cabbage

Precooling is used to lower the temperature of the harvested agricultural products while vacuum cooling is usually adopted in the precooling of the leafy vegetables. However, when the usually known vacuum cooling technology is applied to the cabbage, its complex internal structure which is tightly wrapped. Thus, it often causes the cooling effect on the interior center to be rather poor. The studies conducted by the scientists at Department of Air-conditioning and Refrigeration and Engineering, National Taipei University of Technology, Taiwan on the effect of multi-stage vacuum cooling process proved that the multi-stage vacuum pressure reserving process is able to lower the surface and interior temperature of the cabbage effectively and uniformly. Additionally, in general vacuum cooling, when the vacuum chamber recovers the atmospheric pressure during the pressure-restoring process, the temperature of the cooled objects rises again. It is usually due to the entry of the high-temperature air from the external into the vacuum chamber. It is concluded that this problem could be effectively relieved by cooling the external air with a condenser and inducting the cooled air into the vacuum chamber during the pressure-restoring process. The experimental objects, besides the cabbage, also include the water spinach of the stem vegetables for comparison [Cheng HP and Hsueh CF, Multi-stage vacuum cooling process of cabbage, J Food Eng, 2007, 79(1), 37-46].
Optimization of osmotic dehydration of potato using response surface methodology

The scientists at Ege University, Faculty of Engineering, Department of Food Engineering, Bornova, Turkey used Response surface methodology to determine the optimum processing conditions that yield maximum water loss and weight reduction and minimum solid gain and water activity during osmotic dehydration of potatoes. Temperature (20-60°C), processing time (0.5-8 hours), sucrose (40-60% w/w) and salt (0-15% w/w) concentrations were the factors investigated with respect to water loss (WL), solid gain (SG), weight reduction (WR) and water activity ($a_w$). Experiments were designed according to Central Composite Rotatable Design with these four factors each at five different levels, including central and axial points. Experiments were conducted in a shaker (Thermoshake-Gerhardt) with constant agitation of 200rpm and solution to sample ratio of 5/1 (w/w). With respect to water loss, solid gain, weight reduction and water activity, both linear and quadratic effects of four variables were found to be significant. For each response, second order polynomial models were developed using multiple linear regression analysis. Analysis of variance (ANOVA) was performed to check the adequacy and accuracy of the fitted models. The response surfaces and contour maps showing the interaction of process variables were constructed. Applying desirability function method, optimum operating conditions were found to be temperature of 22°C, sucrose concentration of 54.5%, salt concentration of 14% and treatment time of 329min. At this optimum point, water loss, solid gain, weight reduction and water activity were found to be 59.1 (g/100g initial sample), 6.0 (g/100g initial sample), 52.9 (g/100g initial sample) and 0.785, respectively [Eren Ismail and Kaymak-Ertekin Figen, Optimization of osmotic dehydration of potato using response surface methodology, J Food Eng, 2007, 79(1), 344-352].

Textural and pasting properties of potatoes as affected by storage temperature

The scientist at New Zealand and India worked to examine the effect of storage temperature on their textural and pasting properties of five potato (Solanum tuberosum Linn.) cultivars. Fresh tubers were stored at different temperatures (4, 8, 12, 16 and 20°C) and 80-90% relative humidity for 18 weeks after harvest. Texture profile analysis was performed on raw and cooked potatoes using an Instron universal testing machine to measure textural parameters such as fracturability, hardness, cohesiveness, adhesiveness and springiness. Both raw and cooked potato tubers showed a considerable reduction in all textural parameters upon storage, irrespective of the storage temperature employed. Raw potatoes showed a decrease in fracturability and hardness with increasing storage temperature, whereas their cooked counterparts showed the opposite trend. The extent of change in the textural properties of both raw and cooked potatoes also varied among the different cultivars. Fresh and stored tubers from all cultivars were freeze-dried, ground into flours and analysed for amylose content and pasting properties. The amylose content of flours prepared from potatoes stored at 4 and 8°C was observed to be considerably lower than that of flours prepared from potatoes stored at 16 and 20°C. Pasting characteristics such as peak viscosity, setback and final viscosity increased with increasing storage temperature, while the reverse was observed for pasting temperature, when studied using a rapid visco analyser. Breakdown in viscosity of the flour pastes from all cultivars was considerably reduced during storage, irrespective of the storage temperature employed [Kaur Lovedeep, Singh Jaspreet, Singh Narpinder and Ezekiel Rajrathnam, Textural and pasting properties of potatoes (Solanum tuberosum L.) as affected by storage temperature, J Sci Food Agric, 2007, 87(3), 520-526].
**Identification of cherry tomatoes growth origin by MRI**

Magnetic Resonance Imaging (MRI) spectroscopy is a promising non-invasive and non-destructive analytical technique in food science, since it offers the opportunity of studying vegetables and fruits in their wholeness without any manipulation. The scientists at Agriculture Research Council, Experimental Institute for Plant Nutrition, Rome, Italy did preliminary study to demonstrate the possibility of assessing unambiguously the place of origin of fresh cherry tomatoes by means of MRI experiments. The innovative approach has been successfully used to distinguish PGI (Protected Geographical Indication) cherry tomatoes from non-PGI ones, as well as cv. Naomi from cv. Shiren samples. The method determines informative physical and morphological parameters, transverse relaxation times and thicknesses, respectively, which can be combined into four empirical equations; two of them are used to determine the cultivated variety and the other two to assess the place of origin. This approach has successfully recognize the cultivated variety of c. 90% of the analyzed samples and the geographical origin of c. 80% of the investigated cherry tomatoes [Sequi Paolo, Teresa Dell’Abate Maria and Valentini Massimiliano, Identification of cherry tomatoes growth origin by means of magnetic resonance imaging, J Sci Food Agric, 2007, 87(1), 127-132].

**Phenolic acids in potatoes, vegetables and some of their products**

The scientists at MTT Agrifood Research Finland, Biotechnology and Food Research, ET-talo, Finland conducted studies to determine the distribution and contents of soluble and total phenolic acids in a wide range of vegetables consumed in Finland. The determinations were performed from the pooled samples (14 potato and 45 other vegetable samples). Soluble phenolic acids were extracted with methanolic acetic acid and a tentative quantification was performed by HPLC. The contents of total phenolic acids were determined by HPLC after alkaline and acid hydrolyses. Chlorogenic acid derivatives were the most dominant soluble phenolic acids, while caffeic acid was the most dominant phenolic acid aglycone in the samples studied. Highest contents of soluble phenolic acids were found in raw and cooked potato peels: 23-45mg/100g fresh weight calculated as aglycones. In addition, pot-grown lettuces, Chinese cabbage, broccoli, carrot, aubergine, Jerusalem artichoke, peanut and most of the boiled and peeled potato tubers contained more than 5mg/100g of soluble phenolic acids calculated as aglycones. Among the best vegetable sources of total phenolic acids were potatoes, with contents varying from 7.9mg/100g (cooked and peeled Rosamunda variety) to 52mg/100g (cooked peel of Van Gogh variety) and red cabbage, carrot, aubergine, Jerusalem artichoke, broccoli, pot-grown lettuce, spinach, radish and red beet, with contents from 11mg/100g (spinach) to 52mg/100g (pot-grown lettuce Lollo Rosso) [Pirjo Mattilaa and Jarkko Hellström, Phenolic acids in potatoes, vegetables, and some of their products, J Food Comp Anal, 2007, 20(3-4), 152-160].

**Influence of post-harvest UV-C treatment on refrigerated storage broccoli**

The scientists at Argentina treated minimally processed broccoli (Brassica oleracea Linn. var. italica) with UV-C light (8 kJ m⁻²) and subsequently stored for 21 days at 4°C for investigating influence of post-harvest UV-C treatment on refrigerated storage. The UV-C treatment delayed yellowing and chlorophyll degradation during storage. Treated broccoli florets displayed lower electrolyte leakage and respiratory activity, indicating higher tissue integrity. Treated samples showed higher phenolic and ascorbic acid contents as well as higher antioxidant activity than controls. Treated samples also had a higher content of soluble sugars, but no differences in the content of soluble proteins between control and treated samples were detected. The UV-C treatment also affected bacterial and mould populations. After 21 days at 4°C the number of colony-forming units of both populations was lower in treated than in control broccoli florets. The results suggest that UV-C treatment reduces tissue damage of minimally processed broccoli during storage at 4°C, thus maintaining nutritional quality and reducing microbial growth [Lemoine Maria I, Civello Pedro M, Martínez Gustavo A and Chaves Alicia R, Influence of post-harvest UV-C treatment on refrigerated storage of minimally processed broccoli (Brassica oleracea var. italica), J Sci Food Agric, 2007, 87(6), 1132-1139].