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Investigation on the Effect of Production Region and Harvesting Time on the Physico-Chemical and Antioxidant Properties of Natural Honey and Comparing with Fedeed Honey in Khorasan Province

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Abstract

Honey is a natural sweet substance that the bee collects, treats it from the floral nectar and stores it in honeycombs. Honey has many nutritional and medicinal properties. The purpose of this research is to determine the effect of honey production area and its harvest time on the physico-chemical and antioxidant properties of natural honey. Honey samples were collected from three areas of Shirvan, Kashmar and Neyshabour in Khorasan Province in two different seasons, spring and autumn. The honey was completely pure and was made from natural flowers in the region. In this research, some physicochemical, antioxidant and microbial properties of honey samples were evaluated. The results showed that spring honey samples with a moisture content (16.6%) and brix (81.36%) had the highest and lowest moisture content and Brix degree respectively than the samples harvested in the fall. Also, spring honey with a color intensity of 0.005%, had a brighter color than the autumn samples. Also, spring honey had more phenolic compounds (0.067 mg/kg honey) and higher antioxidant and antibacterial properties (respectively 61.1856, 100%) than the fall samples. Among honey samples, Kashmar honey had the highest antioxidant capacity (54.3) and honey Neishabour had the highest amount of phenolic compounds (0.052 mg/kg). Antimicrobial effect of Shirvan honey samples was the highest (83.33%). All honey samples did not contain sulfite reducing bacteria that indicated correct hygienic management in honey processing and showed good microbial quality of honey samples. All of the honey samples did not contain sulfite reducing bacteria, which show proper hygienic management in honey processing and appropriate microbial quality of honey samples.

Key words: Antioxidant Properties, Microbial, Natural Honey, Physico-chemical

AERI

Investigation on the Possibility of Extraction of Natural Red Color from Pomegranate Peel

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Abstract

The research was done for investigating the influence of microencapsulation process on the preservation of pomegranate peels' anthocyanin compounds. In this order, at first the anthocyanin compounds were extracted purely by ethanol – acid solution and then the extract was condensed to 8 percent with rotatryevaporator. Afterward, condensed extract of coloring compounds were mixed with wall material (MDX, dextrose equivalent 16.5-19.5, mixture of 5, 10 and 15 percent with calcium alginate (0.1)(Ca-Alg), with the ratio of 1:5 (extract/ratio) .Then microcapsules were freeze drying. The effect of wall concentration on physic chemical on physical and chemical characteristics of microcapsules (yield of microencapsulation, moisture content, bulk density, color, particle size, anthocyanin content, phenolic compounds, radical scavenging compounds (DPPH), ferric reducing activity of plasma (FRAP), microstructure, glass transitions) during 42 days storage at different Relative Humidity (52.89 ± 0.22 , 75.29 ± 0.12) and different temperatures (4 and 25°C) were analyzes. The results showed that the anthocyanin content in microcapsules prepared with higher MDX were kept better than lower amount of MDX. The microcapsules had uncertain geometry shape and the laminated structure. Also the diameter size of particle of microcapsules containing MDX-Ca- Alg 15 percent was larger than other walls. The Glass transition in all tested samples was lower than ambient temperatures. Microcapsules contain the 15 percent MDX- Ca- Alg in relative humidity 52.89 ± 0.22 and at 4°C had the most antocyanin compounds after 42 days storing.

Keywords: Anthocyanin, Effective Compound, Microencapsulation, Pomegranate Peel, Storage

AERI

The Study on Changes of Quantitative and Qualitative Characteristics of Malts from Barley and other Cereals to Introduce the Best Industrial Applications

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Abstract

Malting is one of the biotechnological processes that includes steeping, germination and killing of cereal in controlled environment in which hydrolytic enzymes are synthesized and cell wall, protein and starch of endosperm are largely digested. This project was carried out with five sub project and seven sections. In the first sub project, the effects of amylases enzymes variation on the malt quantitative and qualitative characteristics obtained from various barley cultivars were investigated and in its first section physicochemical properties of barley and obtained malt grains were studied using of complete randomized design in model of factorial experiments ($2 \times 3 \times 3$) with two levels of barley varieties (Mahoor and Sahra), three levels of germination time (3, 7 and 9 days) and three levels of killing method (A: time of 24-36 h and temperature of 55-60 °C; B: 24 h in 45 °C and then increasing of temperature to 65 °C in 2 h and apply of this temperature for 5 h; C: 20 h in 50 °C and then increasing of temperature to 85 °C in 2 h and using of this temperature for 4 h). All determinations were made in triplicate. The first section results showed that malting yield, thousand kernel weight, total nitrogen content, hot water extract and extract pH of obtained malt from Sahra variety significantly ($P < 0.05$) were higher than those of obtained malt from Mahor variety. But bulk density, α -amylase activity, cold water extract, extract color and soluble nitrogen of obtained malt from Sahra variety were lower. With increasing of germination time, malting yield, thousand kernel weight and bulk density decreased, but cold and hot water extract yield increased. Also α -amylase activity of malt increased and then decreased with increasing of germination time. The highest malting yield, thousand kernel weight, bulk density and cold water extract were related to a method of killing. The Maximum and minimum of α -amylase activity of malt grains obtained from Mahor variety with 7 days of germination (522.63 CU/g Flour) and with B method of kilning, and Sahra with 3 days of germination and with C method of killing, respectively. The highest hot water extract yield obtained of Sahra variety, with 9 days of germination and B method of killing. The results of the second section of the first sub project showed that the effect of all treatments (individual and interactions) on the malting yield, cold and hot water extract yield, total protein content, β -amylase activity and colbach index of obtained malts were significant ($p < 0.01$, 0.05). The maximum of β -amylase activity of malt grains (32.0 CU/g Flour) obtained from Yousef variety with 6 days of germination and with A method of kilning, and the minimum one (13.42 CU/g

Flour) was due to Mahoor variety with 9 days of germination and with B method of killing, Respectively. The results of second sub-project which carried out of the aim of investigation on malting properties of superior barley lines and other cereals (wheat, triticale) showed that malting process caused increasing of diastatic power, cold water extract, β -glucanase activity, fiber and protein content, but decreasing of thousand kernel weight, ash, moisture, β -glucan content and terminal velocity in under investigation of superior barley lines. Due to the fact that Malt with high water extract used in malting beverages industry and Malt with high diastatic power is used as adjuncts, so that malt derived from superior lines of EBYT-88-6, EBYT-88-17 and EBYT-88-20 could be used in nonalcoholic malt beverage and malt derived from lines EBYT-88-2 and EBYT-88-14 could be used as suppliers of enzymes, odour, flavor and color in the baking and confectionery industry. The results of the second section of second sub-project showed that hot and cold water extract, β -glucanase activity and colbach index of triticale malt was higher than that of wheat and barley malt. In the third sub-project which was implemented in two sections, at the first section the the effects of steeping and germination time on β -glucan content and quantitative and qualitative characteristics (moisture content, hot water extract, diastatic power, total and soluble protein, green malt yield, colbach index, wort colour, pH and Brix) of malts obtained from two barley varieties (MAHOOR and YOUSOF) were investigated. Results showed that with increasing of germination time, β -glucan content, malting yield, thousand seed mass and kernel density decreased and diastatic power and wort color increased. The least β -glucan content was observed in malt obtained from MAHOOR cultivar under conditions of 48 hours steeping and 7 days of germination. Malt obtained from Yousof variety showed maximum hot water extract (50.71%) in 48 hours of steeping and 5 days of germination. In second section, the effects of steeping and germination time on the β -glucanase activity and malts quantitative and qualitative characteristics obtained from barley superior lines EBYT-88-17 and EBYT-88-20 were investigated. Results showed that malt obtained from line EBYT-88-20 had malting yield, thousand seed mass, kernel densities, nitrogen content and β -glucanase activity, hot water extract and wort brix significantly ($P < 0.05$) higher than that of malt obtained from the line EBYT-88-17. With increasing of steeping time, β -glucanase activity increased and then decreased dramatically. EBYT-88-20 showed maximum β -glucanase activity and hot water extract (60.87%) in 36 hours of steeping and also 5 days of germination treatment and 24 hours of steeping and 5 days of germination, respectively. In the fourth sub-project the Starch content and physicochemical properties of malts obtained from barley variety (YOSOF) and barley superior line (EBYT-79) were investigated. The experimental condition included 2 variety of barley (EBYT-79 Line and YOSOF cultivar), 3 steeping time (24, 36 and 48 hours) and 3 germination time (3, 7 and 9 days). The results showed that, as the steeping time increased, Starch content, malting yield, thousand seed mass, kernel and mass density decreased, whereas hot water extract increased. The minimum Starch content was obtained from malt of YOSOF cultivar under conditions of 48 hours steeping time and 9 days of germination. Malt obtained from EBYT-79 Line showed maximum hot water extract (%75.36) in 48 hours of steeping and 9 days of germination.

Key Words: Cereal Enzymes, Germination, Kilning, Malting, Quantitative and Qualitative Characteristics, Steeping

Study the Thermal Properties, Stability, Textural Properties and Microscopic Structure of Intermediate Moisture Fig

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Abstract

Discoloration is one of the major problems for the processing of semi-dried fig, which results in wasting the product, reducing its marketing and acceptance. The objective of this study was to produce semi-dried figs using different plasticizers and to investigate the effects of plasticizers on browning kinetics and stability of fig with intermediate moisture content. Semi-dried figs were obtained by adding different plasticizers of sucrose syrup at concentrations of 25, 50 and 75 % (W/V), glucose syrup at concentrations of 25 and 50 % (W/V) and glycerol at two concentrations of 25 and 50 % (V/V). All the samples were kept in airtight containers at three temperatures of 5, 25 and 35°C. Thermal properties of the samples were measured using differential scanning calorimetry (DSC). The results showed that the glass transition temperature (T_g) of the rehydrated fig with water (control) was lower than those of other plasticized figs, which shows that water is the most effective plasticizer for food systems. Then, color changes, browning index and firmness of the figs were measured at specific time intervals for 4 to 6 months. Firmness of the control fig was lower than those of other samples and the flesh firmness increased gradually in all the samples and control over the whole storage period. Browning index and the values of color differences rose significantly during storage time. Furthermore, by increasing storage temperature, the values of browning index and color differences increased significantly. The values of color differences were higher for the control compared to the other plasticized samples and control figs were darker than treatments over the whole storage time. Regression analysis showed that a combinational model was better than the first order model for describing the experimental data for browning index and color differences of plasticized figs. Finally, the shifted temperature parameter ($T-T_g$) was used to account for the effects of storage temperature (T) and plasticizers (through T_g) on the changes of fig browning index. The overall results showed that 50 % glucose syrup and 50 % sucrose syrup are the most effective treatments to control the browning of fig fruit.

Keywords: Browning Index, Fig, Firmness, Plasticizer, Shifted Temperature

AERI

Evaluation of The Correlation between Biophysical and Chemical Characteristics of Different Olive Varieties in order to Determination of Optimum Harvest Time

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Abstract

Harvesting time in oily olive varieties effects on quantity and quality of oil extraction and in table olive varieties effects on the physical and chemical properties and also the quality of produced canned. The aim of this project were determination of optimum harvest time of olive varieties and application of biophysical and chemical properties correlations in order to determination of the optimum harvest time. At first, six predominant varieties of Tarom station collection including three oily varieties including Arbequina, Koroneiki and Zard and three table olive varieties including Conservolia, Manzanilla and Zard were harvested in three different times. Harvest index was determined based on color. The biophysical and chemical characteristics of different cultivars including mass, length, width, thickness, , projection area, length, arithmetic and geometric mean diameter and equivalent, sphere volume (oblate & eliipsoid), calculated volume, shape factor, sphericity index, firmness, color indices (L^* a^* b^*), flesh to the core, percentages of oil, acidity, peroxide and total soluble solids, moisture content, pH, the extinction coefficients (K232, K270) were determined at different harvest time. The best relations between the coefficients of linear regression with one, two and three variables using the measured parameters (WinArea-UT-10) were classified, respectively. According to the results, the best harvesting time of oily cultivars was on November 1 with harvest index of 1.51, 1.83, and 1.8 for Arbequina, Koroneiki and Zard respectively and on September 18 with harvest index of 0.05, 0.19, and 0.93 for Conservolia, Manzanilla and Zard respectively. And based on this, the best regression simple and economic models for prediction of mass, total soluble solid and moisture content of canning cultivars and oily cultivars with the highest coefficient of determination ($R^2=1$) were perposed. By using these models, the estimation of complex attributes with simple measurements without the need for machine tools is easily accomplished.

Keywords: Biophysical and Chemical Characteristics, Correlation, Harvest Time, Olive

Production of Functional Sack from Aloe Vera by using Infusion of Phenolic By-product from Grape (Argol) during Osmotic Dehydration

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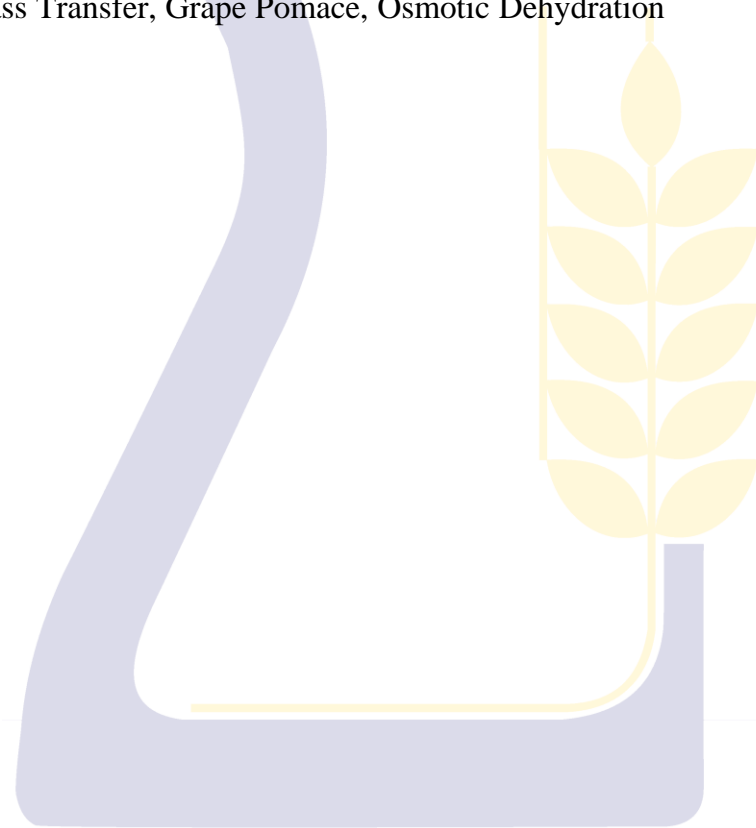
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Abstract

This project was completed with the goal of producing functional snacks of Aloe Vera gel by adding phenolic compounds extract from grape pomace (Argol), through an osmotic process, in two steps. In the first step, the Aloe Vera jell was formed by Agar and shaped into cylindrical shape (20 × 20 mm). Afterwards the pieces were floated in a solution of sucrose with different concentrations (40, 50 and 60) percentage and Argol (10, 20 and 30 percentage at 50 °C for periods of 30, 60, 90 and 120 minutes. After treatment, apple cylinders were washed with tap water and water loss, solids gain, total phenolic compounds (TPC), scavenging activity of DPPH (DPPH), ferric reducing-antioxidant power (FRAP), tissue evaluation (firmness, chewing and springiness) and color parameters (L^* , a^* and b^*) of the samples were measured. After analysis of data, and assessing regression the ideal conditions for the osmotic process were chosen. Results showed that in all of the studied conditions, levels of water loss and solids gain had a non-linear increase with increasing immersion time. The Azuara model proved to be effective at anticipating the balanced amounts of water loss and solids gain. In addition, the coefficient of effective diffusivity displayed that different levels of sucrose and Argol had a significant effect. High levels of solids gain results in the increased absorption of phenolic and antioxidant substances. Higher Sucrose concentration caused less brightness and stronger shades of redness and yellowness of the samples. The analysis of the profile tissue suggested that with higher sucrose and Argol concentrations, the sample becomes less firm. The sample floated in a solution with 50% sugar was selected for the second step. In this step, the effects of ultrasound treatment on the penetration of phenolic substances were observed and compared with those of the ideal sample from the first phase. Treatments include: ultrasound-water (immersion of Aloe Vera pieces in an isotonic sugar solution at 50 °C for 15 minutes whilst receiving ultrasound followed by immersion the pieces for another 45 minutes in a solution of 50% Sucrose and 20% Argol) and ultrasound-osmosis (immersion in a 50% Sucrose + 20% Argol solution and using a probe system for 60 minutes in which the samples receive ultrasound each 15 minutes). Subsequently, the refined aforementioned samples and a sample that had not gone through the osmosis process were dried with a cabin dryer at 50 degrees Celsius. The dried products were then measured and evaluated for water loss, increase in solid substance absorption, shrinkage percentage, and tissue structure and color factors. The results were statistically analyzed by a random

pattern. According to the results, levels of water loss and substance absorption rose by employing the ultrasound process, and the ultrasound-osmosis procedure caused greater water and solid gain. The ultrasound process also had a significant effect in the final shrinkage of the product as well as firmness and tissue structure. Due to this process, the samples became brighter, with the color turning toward red. Results gathered by the sensory evaluation of the samples suggest that ultrasound helps better preserve color, tissue and physical shape.

Keywords: Aloe Vera, Infusion, Mass Transfer, Grape Pomace, Osmotic Dehydration



AERI

A Comparison of Native Gums (Teragagacnt, Balangu and Cress with Guar Gum to Improving Rheological Properties and Quality of Bread Made from Insect Damaged Wheat Flour

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Abstract

The major part of wheat waste is due to insect attack on wheat, which reduces the quality of flour. If more than 5% of the wheat grain is damaged, it comes from loose and insoluble, which shows little resistance to mixing, and the resulting bread is less volatile and has poor sensory properties and is unusual in appearance. Increasing demand and the need to produce high-volume bread in the country, on the other hand, low quality of bread, shortage of wheat and the need for high import, the need to adopt methods that can be produced high quality bread with indigenous facilities of the country. The widespread use of hydrocolloids in the food industry and the high cost of these compounds is a reason to pay attention to gum from native plants. Considering that the effect of wheat age on the production of proteinase enzyme can disrupt the structure of the gluten network in bread,; it possible to be strengthened gluten network by the using gum, or an alternative network, and ultimately produce better quality bread. As a result, it saves money for wheat imports and all kinds of commercial gums such as guar, xanthan gum, Arabic gum, and carrageenans. The aim of this study was to compare the effect of native gum (Teragagacnt, Balangu and Cress on three levels of 0.5, 0.7 and 0.9%) With 0.5% guar gum and 200 ppm ascorbic acid on the correction of rheological and qualitative characteristics of bread made from age wheat. After preparing bread the test (rheological, physical and sensory) was measured and the data were analyzed based on completely randomized design and Duncan's mean comparisons. The results showed that Balangu and cress gum at the level of 0.7% improved texture properties, specific volume, porosity and color. The effect of Balangu gum in the level of 0.7 had the highest score of sensory properties. Comparison of native gum with guar gums at a significant level of 95% showed that cress and Balangu had a greater effect from guar gum at improving the quality of bread made from age wheat. According to the results of quality and sensory tests, finally, the bread containing 0.7% Balangu gum and 200 ppm ascorbic acid was introduced as an optimal treatment.

Keywords: Ascorbic Acid, Barbari Bread, Balangu, Seed, Tragacanth and Wheat Bug

AERI

Comparison of Drying Kinetics, Energy Consumption and Quality Properties of Tomatoes Slices Dried by Refractance Window™ Method with other Drying Methods

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Abstract

In this study, the drying kinetics, energy consumption and qualitative properties of tomato dried by refractance window (RW) method, were compared with microwave, hot air and sun drying methods. In this regard, the tomato slices were dried with mentioned four methods. During drying, drying kinetics and energy consumption, were determined. After drying, some qualitative properties of dried product were determined. According to the results, there were only a Falling rate period in the drying curves in the RW and microwave methods. The lowest and highest energy consumption belonged to the microwave and hot air method respectively. The results of statistical analysis of the data showed that the lowest (11.97%) and the highest (17.62%) shrinkage were in the samples dried by RW and hot air methods, respectively. The amount of vitamin C in RW and microwave drying samples was about 66-67% higher than that of sun-dried and hot air methods. The rehydration ratio of the hot-air dried samples was 11 to 20 % less than that of other dried methods. The highest optical density (2.24) and the lowest color score (1.75 of 5) belonged to the samples dried by microwave method. The highest values of L^* , b^* and a^* (65.73, 46 and 63.48, respectively) and score of color (5 of 5) and the lowest optical density (0.36) and total color changes (18.69%) belonged to the samples dried by refractance window. Also the lowest amount of acidity (3.66%) and the highest total color changes (36.34%) were observed in sun-dried samples. Although the drying time of tomato slices and energy consumption in microwave method was much lower than that of the RW, colorimetric properties of the samples prepared by microwave were significantly lower than the RW method. Therefore, the RW method can be recommended as an alternative to drying tomato slices in hot air and microwave methods.

Keywords: Hot-air drying, Microwave, Refractance Window, Sun Drying, Tomato

AERI

Selection of Triticale Variety and Superior Lines and its Admixing Values and Seed Gum for Production of Bakery Products

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Abstract

The growing population and their need to provide food, lack of water resources to produce enough wheat, low quality of bakery products and its high waste is one of the major problems of the flour and baking industry. In recent years, the improvement of the nutritional properties of bakery products has been very much taken, which was done by mixing different flours and increasing the mineral composition, vitamins, proteins and dietary fiber in the final product. Triticale is a human-made product from wheat and rye that has high potential yields of grain and forage. The aim of this study was to select appropriate lines of triticale flour, the effect of adding different percentages of triticale and native gum (seed gum) to bakery products (bread, cake, biscuit and donuts). In the first step, the effect of triticale flour on three levels (10, 15 and 30) and three lines (84, 85 and Sanabad) in combination with three levels of seed gum (0.3, 0.6 and 1%) on the quality of semi-bulk Barbari bread, the second stage, the effect of three triticale in three levels (10, 15 and 30) and three lines (84, 85 and Sanabad) in combination with three levels of seed gum (0.3, 0.6 and 1%) on the quality of Lavash bread, The third stage the effect of triticale flour on three levels (15, 30 and 45) and two lines (84 and 85) in combination with two levels of gum (0.3 and 0.6%) on the quality of donuts, the fourth stage the effect of triticale flour In three levels (15, 30 and 45) and two lines (84 and 85) in combination with two levels of gum (0.3 and 0.6%) on the quality cake, the fifth stage of the effect of triticale flour in four Levels (25, 50, 75 and 100) and two lines (84 and 85) on biscuit quality, The results were evaluated based on the factorial design the first factor, line and the amount of triticale flour and the second factor the amount of gum. The results of the first stage that both additive on the qualitative and quantitative characteristics of Barbari bread showed that the combination of triticale flour at 15% level and line Sanabd with seed gum in 0.6% level improvement texture, increased volume and porosity and total acceptance. The results of the second stage on Lavash bread indicated that the combination of triticale flour at 15% level and line sanabad with 0.6% seed gum improvement of texture, color components and total acceptance had the highest score. The results of the third step on donuts showed that the combination of triticale flour at 30% level in line 85 and seed gum at a 0.6% level increased texture, specific volume, porosity, color components and total acceptance. The results of the fourth stage on the cake showed that the combination triticale flour at 30% level in line 84 with 0.3% seed gum improved the texture, specific volume, porosity, color components and highest total acceptance. The results of the fourth stage on biscuit showed that the replacement of

triticale flour was possible up to 50% in line 84, and the final product had an acceptable score in terms of texture, color components and sensory characteristics.

Keywords: Bakery Products, Bread, Biscuit, Cake, Donuts, Replacement and Triticale Flour



Study the Kinetics of Browning Reactions in Intermediate moisture Fig (Cv.Sabz, Estahban) Fruit Treated by Allowed Additives

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Abstract

Fig fruit, very nutritional and a healthy food, contains high amounts of carbohydrates (65-70%), minerals (Fe, Ca, Mg, Cu), vitamins (A, B1, B2 and C) and dietary fibers. Estahban (Fars province, southern Iran), with an annual production of 30,000 t and 38,000 hectares under cultivation, is the largest dried-fig producing province in Iran. Intermediate-moisture figs (Pressi figs) obtained by soaking of dried figs in water followed by conditioning. The main problem with this product is the rapid change of color after production which caused the product failure and may have a negative impact on the marketability and consumer acceptability of this valuable agricultural commodity. Thus, research on control and prevention of its browning and improving the product quality in line with national production and increasing its export has considerable importance. The objective of this study is to investigate the kinetics of browning reactions by different treatments under different storage conditions. To investigate the influence of allowed additives on color parameters of intermediate moisture fig, citric acid (0.5, 1, 2 and 3 %), calcium chloride (0.6, 1, 1.5 and 2 %), cysteine (0.05, 0.07, 0.2 and 0.5 %) and sodium meta bisulfite (500, 800, 1000 and 1200 ppm) in the optimum temperature and time of immersion (4 min at 60°C) were used in preparing intermediate moisture fig samples. Addition of 1, 2 and 3 % citric acid and 1.5 calcium chloride caused a decrease in L*, a* and b* values. In the next step, the interaction effect of different additives on color parameters was investigated using a central composite randomized design (CCRD). It has been shown that only the interactive effect of calcium chloride and citric acid on L* and b* were significant and highly significant and those of calcium chloride and cysteine and also calcium chloride and sodium metabisulfite on a* were highly significant. The runs number 16 (450 ppm, 2.25 %, 0.45 % and 1.5 %), 22 (300 ppm, 3 %, 0.3 % and 1 %) and 24 (600 ppm, 1.5 %, 0.3 % and 1 %) including sodium metabisulfite, citric acid, cysteine and calcium chloride; respectively, showed the least total color difference (ΔE). In the next step to study the kinetics of browning reactions, different additives (including 1 % citric acid, 1.5 % calcium chloride, 500 ppm metabisulfite and 0.07 % cysteine at 60 °C/4min) were used. Then the following intermediate-moisture figs were stored at 4, 15, 25 and 35 °C and at regular time intervals the kinetic of color, browning index, total phenols, HMF and sugars were determined. Using the first-order kinetic model to study the following changes showed that, in all treatments, with increasing storage temperature from 4 to 35 °C, the kinetic rate

constant of L-value, Hue, total color difference, browning index, HMF and total phenols significantly increased and this increase was stronger at higher temperatures. This implies that in all treatments the storage temperature, even more important than additives, has the major role in controlling browning reaction in intermediate-moisture figs. Comparison of kinetic rate constant of L-value, Hue, total color difference, browning index, HMF and total phenol of samples treated with additives with a control sample at a constant temperature showed a significant decrease in the samples treated with additives; respectively. These results indicated a significant role of additives in preventing browning at examined temperatures (35, 25, and 15°C). A significant increase in the total phenol content of control samples during storage at temperatures of 15, 25 and 35 °C could be due to an increase in complex polyphenol from later phase of browning reaction. However, the rate constant levels in samples treated with additives, relative to the control sample, showed a significant decrease at 25 and 35 °C. Results of investigation of carbohydrate changes over time showed that the glucose (and fructose) increased over time at 35 °C (in parallel to decreased area of sucrose curve) in the control and sample treated with additives. However, at temperatures of 25, 15 and 4°C the amount of glucose reduced that the rate of reduction was more rapidly at temperatures 15°C compared to 25 °C. It might be due to the inversion of sucrose simultaneously with consumption of glucose and fructose in browning reactions occurred at 35 and 25° C. Lower values of activation energy and Q10 calculated for the parameters L-value, Hue, total color difference, browning index, total phenols and HMF in the samples treated with additives compared with control samples represents that intermediate-moisture figs treated with additives have significant lower temperature sensitivity of color changes, HMF and browning index.

Keywords: Browning Kinetic, Browning Index, HMF, Fructose, Glucose, Total Phenol



AERI

Investigation on the Methods of Packaging and Processing Garden Products in the Field Gardens of Razavi Khorasan Province

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Abstract

The research was aimed at increasing the shelf life and reducing the losses of some fresh fruits. For this purpose, wrapping operations containing 100 and 200 cavities for containers containing one and two rows of apricots and apple, a row of peaches and grapes, and two and three rows of cherries were carried out. Grapes were transferred to a refrigerator at 1 and 3 °C, and other fruits were transferred to a refrigerator at a temperature of 3 and 5 °C. According to the results of the first phase, it was noted that the apricot, arranged in single-row containers with a wrap containing 100 cavities and a storage temperature of 3 °C, had the least mold and the best texture and color of the fruit. The results of the second phase showed that the best temperature for peaches was at 3 °C with 200 cavities in the package. The results of the third phase indicated that samples containing two rows of cherry fruit, with a wrap containing 100 cavities and a storage temperature of 3 and 5 °C, provided consumer expectations. The results of the fourth phase showed that both selectable temperatures were better than the refrigerator temperature for storing grapes. This was while the casing contained 100 cavities suitable for grape packing. In the fifth phase of this study, potassium permanganate treatment, temperature 3 and 5 °C, and two apex height (single and double row) were used. The results showed that potassium permanganate had a positive effect on the physicochemical and tissue properties of the fruit. It should be noted that the samples stored at 3 °C, which were arranged in single row and under the potassium permanganate treatment, remained in the third month without any significant changes at a statistical level of 5%, but after three months Maintenance has increased the amount of moldy weight and reduced the stiffness of the texture, luminosity and taste and color.

Keyword: Fruit Height, Mildew, Packaging, Refrigeration Temperature, Texture

Effect of Chitosan, Pectin and Glycerol Coatings on Browning Control of Intermediate Moisture Fig Fruits

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Abstract

Fig is a nutritional fruit and an important source of carbohydrate. It has a high commercial value. Iran is one of the most important fig producer countries in the world. Intermediate moisture fig is a processed product. The main problem with this product is the rapid change of color after production which causes the product failure and may have a negative impact on its marketability. The objective of this research was to study the effect of biodegradable coatings (chitosan, pectin, and glycerol) on color and texture changes and to decrease undesirable changes. Treatments included: control samples, fig coated with pectin 3%, fig coated with chitosan 1%, fig coated with pectin 3%+ 50% glycerol and fig coated with chitosan 1%+ 50% glycerol. Color parameters (L, a, b and ΔE), moisture and texture parameters were measured during storage and sensory analysis was done. Results showed that L*, b* and moisture content decreased while a* value and firmness increased. In control samples and fig coated with chitosan 1%+ 50% glycerol, L value decreased from 73.09 to 40.33 and 71.16 to 57.24; respectively. Regression equations confirmed decreasing trend for L* value while that of a* value increased during storage period in all treatments ($p < 0.01$). The highest and the lowest increase in a* value was related to control samples and fig coated with chitosan 1%; respectively. Increasing and decreasing trends were observed in texture changes and moisture content; respectively ($p < 0.01$). Significant difference ($p < 0.01$) was observed in color and texture parameters of all samples, while flavor and taste didn't show significant difference. Results indicated that edible coatings (pectin and chitosan) and glycerol improved color, texture and sensory attributes of the product and decreased its browning. Chitosan and pectin treatments were more effective in improving the color and texture of the product, respectively.

Keywords: Browning, Chitosan, Glycerol, Pectin, Semi-Dehydrated Fig

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Study the Effect of Rehydration time and Temperature on Color and Textural Characteristics of Intermediate Moisture Fig Fruits

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Abstract

Fig, one of the earliest cultivated fruits, has a great importance in nutrition due to being important source of carbohydrates (67-70%). Iran has approximately 10% of the total production of the world, and about 90% of this crop is sold as dried fruit. Therefore, dried figs have a high economic value for Iran agriculture. Most of the figs in Iran are produced in the Fars region mainly Estahban town. One way to increase the consumer acceptability of this valuable agricultural commodity is the production of intermediate moisture figs (Pressi figs) in fig factories obtained by soaking of dried figs in water followed by conditioning. The main problem with this product is the rapid change of color after production which cause the product failure and may have a negative impact on its marketability. Rehydration, a part of industrial processing step for production of this new commodity, can be effective in controlling the browning and texture of the final product. The objective of this study was to evaluate experimentally the color and textural changes of dried fig during rehydration at different temperatures (25-90°C) to find the optimum time and temperature. Different kinetic equations along with their corresponding coefficients were also studied in order to describe color and textural changes occurring during immersion of dried fig in water. Rehydration kinetic was monitored by measuring fig weights at defined intervals. Rehydrated samples were stored at ambient condition for one week in sealed plastic pouches and then their moisture content, color and texture parameters were measured. Rehydration was examined using the four most frequently used empirical models, namely Weibull, Peleg, first-order, second-order and exponential association models. Analysis of variance (one-way ANOVA) of model parameters for rehydration, color and texture of samples rehydrated at different temperatures was performed to determine the presence of significant differences between the means and Duncan multiple range test was used to compare among the means. Factorial analysis in a completely randomized design was used to study the influence of independent factors (time and temperature) on color and texture characteristics. Results showed that the rate of water absorption was highly followed by a decrease in rehydration rate. Higher temperatures led to an increase in water absorption rate and in the amount of water absorbed. Moreover, according to the results obtained during the rehydration process, the optical and textural properties of dried figs also change, which were found to be highly dependent on moisture content (i.e. rehydration time) and rehydration temperature. The higher the temperature of

rehydration, the greater the rate of change in color and textural properties. Using the empirical models of Weibull, Peleg, first order and exponential kinetics, the rehydration kinetics of dried figs can be accurately predicted, where the Weibull model with the highest R² and the least amount of RMSE, SSE and χ^2 found to be the best. The weibull shaped parameter measures the velocity of water absorption at the beginning of the process; the lower its value, the faster the water absorption rate at the beginning. Its value ranged between 0.914 and 1.052, which was within the reported value for food stuffs (0.2-1.0). Parameter b, which represents the time needed to accomplish approximately 63% of the process, ranged between 10.12 and 56.11 min at 25-90°C for dried figs. The reduction in lightness/yellowness and increase in redness with time, as in indication of browning, could suitably be described by a combined-kinetic model which implies the higher rate color formation compared with color destruction. As indicated by total color difference, there exists a maximum browning rate for samples rehydrated at higher temperatures over longer time periods. Results indicated that among different kinetic models, a combined kinetic model provided the best fit. Comparing both constants of combined model, it can be concluded that K₀ value is notably higher than K₁ for parameters L, b and a values. This implies that among the two stages supposed by this model, the rate of color formation is higher than the color destruction for all rehydration temperatures. To affirm the effect of temperature on color changes, the constant obtained from the best fitted model (combined kinetics) were fitted to Arrhenius type equation. An activation energy for total color difference ΔE was 13.6 j/mol for the zero-order and 21.32 j/mol for the first-order stage. Results showed that the hardness, compression energy, gradient, gumminess and chewiness of the samples decreased with moisture content exponentially, whereas the trends of springiness and cohesiveness with change of moisture content was nearly constant. Moreover, in the texture profile analysis of rehydrated figs, the presence of negative area is an indication of adhesiveness which was zero in controlled dried figs. The results of the texture profile analysis tests proved the existence of a critical moisture content of about 18.4%, above which no significant effect of moisture content on textural parameters was found. Texture kinetics analysis indicated that the hardness of dried figs decreased with time during the rehydration process due to the plasticization effect of water absorbed. Textural kinetics over all temperature studied was satisfactorily modeled by a first order kinetic model. The microstructure of the dried and rehydrated figs were also examined which may contribute to understanding of the rehydration process. SEM images of rehydrated figs indicated porous structure proposing the presence of free water.

To determine the optimum rehydration time and temperature for producing a sample with lower darkness and proper texture, the L value of fig samples rehydrated at 60 and 80°C was measured after two weeks. Results showed that higher temperature and longer rehydration time produced a softer texture while the color was darker and the fruit external membrane was broken; therefore rehydrating of fig fruits at 60°C for 4min or 80°C for 3 min was recommended.

Keywords: Color and Texture Changes, Combined Model, Fig, Rehydration, Peleg Model, Weibull Model

Introducing the Most Suitable Formulation of an Spreadable Walnut Product and Evaluating its Qualitative Properties

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Abstract

Walnut is one of the nuts, full of energy, protein, minerals and other nutrients. It also has about 64-72% of oil, and that's why it can be turned into spreadable products. In this study, the production conditions and formulation of walnut spread was optimized. At first, we roasted the walnut kernels at temperatures of 10, 125 and 150 °C for 10, 20 or 30 minutes. The optimization was conducted based on the amount of oil separation, peroxide value, acidity and thiobarbituric acid value of the samples and accordingly, roasting at 116°C for 12 minutes was determined as the optimized conditions for roasting. At the second stage, the formulation of walnut cream was optimized. We mixed different levels of starch, pectin and sodium alginate (0, 5, and 10%) with sugar powder (20, 25, and 30%) and the roasted walnut kernels were added to the formulation up to 100%. The produced product was stored for 60 days at room temperature and then the properties such as oil off, peroxide value and acidity as well as sensory characteristics were determined. The results were analysis by central composite design method and after the optimization process, the optimized formulation was determined as 20% sugar powder and 10% starch.

Key words: Formulation, Nuts, Oxidation, Spreads, Walnut Cream

AERI

Measurement of the Physical and Mechanical Properties of White Garlic (*Allium Sativum* L) Bulbs of Hamedan for Estimating Physical Damage

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Abstract

In order to identify the factors causing physical damage because of cracking of outer skins or separation of cloves, a research project was carried out in two years in both laboratory and field experiments. In the first phase, with the harvesting of large, medium and small bulbs in different time intervals after cut off irrigation, the indices affecting the physical damage of the garlic were determined. The results showed that with increasing the interval between cut off irrigation to garlic harvesting, moisture content of soil and outer skins, geometric dimensions, bulb neck diameter, outer skin thickness, force to clove separation and resistance to penetration of the bulbs decreased significantly. In moisture content less than 7.4 percent for soil and 20 percent for outer skin, diameter less than 12 mm for garlic neck and the penetration values less than 500 N, physical damage of garlic increased significantly while harvesting. In the results of the second phase of the project, the physical damage of farms during harvest and after storage were measured. Analysis data by principal components showed that farms with more than 55 percent healthy bulbs and less than 38 percent of damaged bulbs were in the best management and farms with less than 32 percent healthy bulbs and more than 60 percent of damaged bulbs were the most unfavorable management. After transporting, handling and curing, damaged bulbs increased 14 to 17 percent. The results of regression analysis showed that the variables included area under cultivation, plant density, fertilizer application, interval between cut off irrigation to harvest and harvesting method were effective in causing physical damage to garlic.

Keywords: Clove Separation, Mechanical Damage, Physical Damage, Skin Breakage

AERI

Optimization of Rheological, Textural and Sensory Characteristics of the Iranian White Cheese Produced by Ultrafiltration Technique using Some Hydrocolloids

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Abstract

Existence of whey proteins in Iranian white cheese produced by ultrafiltration method, causes disadvantages in both the texture and sensory properties of this type of cheese. One of the ways to improve its textural properties is to use hydrocolloids. The purpose of this study was to optimize the rheological, textural and sensory properties of UF white cheese using tragacanth and xanthan gums and basil seed and Linseed mucilage using the response surface method. The treatments were including the tragacanth and xanthan gums each in the range of 0-0.1%, and the basil seed and flaxseed mucilage each in ranged of 0-0.2%. The results showed that moisture content increased with increasing xanthan gum, but decreased with increasing basil seed mucilage. Also pH increased with increasing basil seed mucilage. Overall acceptance score of the samples increased with the increasing tragacanth and xanthan gums, but decreased with the increasing flaxseed and basil seed mucilage. Among the treatments, nine treatments that were preferred by the panel group for sensory properties were selected and evaluated. According to the results, G' and G'' increased with increasing frequency in all samples, that G' at any frequency higher than G'' . The amount of G' , G'' , Hardness, Cohesiveness were the highest in treatments containing 0.05% tragacanth and xanthan and 0.1% basil seed mucilage and containing 0.05% xanthan and 0.1% basil seeds and flaxseed mucilage with the least difference and treatments containing 0.1% xanthan and 0.2% linseed mucilage and containing 0.1% tragacanth were the lowest. With increasing basil mucilage, Hardness, Cohesiveness, Gumminess and chewiness of the samples increased significantly compared to the control sample ($p < 0.01$). According to the results of this study, using 0.05 % tragacanth and xanthan gums and 0.1 % flaxseed mucilage for preparation of Uf cheese, is recommended.

Keywords: Basil Seed Mucilage, Linseed Mucilage, Tragacanth, Xanthan, UF Cheese

Determination of the Most Appropriate Packaging to Increase Shelf Life of The Prepared Greenhouse Cucumbers using Vermicompost Tea instead of Chemicals Fertilizers on Open Hydroponics Culture

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Abstract

Today, greenhouse products such as tomatoes, cucumbers and bell peppers are abundantly grown in the greenhouse but excessive use of fungicides to increase the shelf life of these products is one of the major problems in the health of the community. Also, the residual pesticides and chemical fertilizers used in greenhouse products have been threatening the health of consumers. However, after preparing greenhouse products, the use of suitable packaging can increase their shelf life. Therefore, this research was conducted with the aim of investigating and determining the appropriate packaging for greenhouse cucumbers prepared from compost tea instead of conventional fertilizers in formulating hydroponic culture. In the first phase of this study, greenhouse cucumbers were produced on a culture bed fed with solutions containing 0, 25, 50, 75 and 100% vermicompost tea during open hydroponic culture in greenhouse under completely normal conditions. After harvesting, on the first day and during storage in cold storage, quantitative and qualitative traits of fresh and packed cucumbers were measured. In the second phase of the study, the effect of the type of packaging material, the active and inactive modified atmosphere and the use of moisture absorbent on the shelf life of cucumber greenhouse was investigated. Three packaging materials including polyethylene, polypropylene and nanofilms in combination with absorptive pad and without absorptive pad, along with two active atmospheric conditions G1 (3% O₂, 15% CO₂, 82% N₂) and G2 (3% O₂, 15% CO₂, 92% N₂) and one passive atmospheric were used. The 36 experimental units in three replications were stored at 6 and 8°C for 4 weeks. The results showed that vermicompost-fed samples had the least weight loss compared to the control sample and 50% vermicompost fertilizer treatments had the best yield after treatment. The measured fruit quality related traits were relatively superior for the following treatments. 1) storage at 6°C with polypropylene cover, G1 atmospheric gas and without humidity absorptive pad 2) storage at 6°C with both polyethylene and polypropylene covers, G2 gas composition and with or without absorptive pads 3) storage at 8°C, with polyethylene or polypropylene cover and passive atmospheric gas with or without absorptive pads.

Keywords: Absorptive Pad, Active Atmosphere, Greenhouse Cucumber, Packaging Film, Passive Atmosphere, Vermicompost

Investigation of the Appropriate Packaging to Shelf Life Extension of the Prepared Greenhouse Bell Peppers using Vermicompost Tea Instead of Chemicals Fertilizers on Open Hydroponics Culture

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Abstract

Nowadays, the production of organic products, especially in greenhouses is a significant and significant issue and has a good economic status and justification due to its health issues and the production of healthy products (not using toxins and chemical fertilizers). In greenhouse culture of bell pepper (*Capsicum annuum* L.) as a fruit vegetable, the use of fungicides to prolong the shelf life of this product is one of the major problems in the health of the community. While using the factors such as suitable substrate and packaging may increase its shelf life. Therefore, this research was conducted to investigate the effect of appropriate packaging method on the greenhouse bell pepper prepared from the substrate containing tea compost. In this project, bell peppers from hydroponic culture of the institute greenhouse containing 0, 25, 50, 75 and 100% vermicompost tea were packaged in two film types using the modified atmosphere method. Some mechanical (texture test), chemical (total soluble solids, pH, titratable acidity, vitamin C), and physiological (respiration) properties were measured immediately after harvesting and during storage time with three replications in accordance with standard methods. Then, the data obtained from the above tests were analyzed in a completely randomized design with factorial arrangement (three factors: substrate, type of packing material, and storage time) using the SPSS software. The results showed that, in terms of the substrate factor, definite conclusion is not possible, since in several tests, different levels of substrates did not have the same results. But it is obvious that the results of different characteristics of the bell peppers grown on the substrate containing different amounts of compost tea are in the domain of information recorded for these characteristics. In terms of storage time, most of the tested characteristics had a decreasing trend, but was still lies within the range of information recorded for these features due to the use of modified atmosphere packaging. In terms of the type of film, with a slight difference, nano film was superior to polyethylene film.

Keywords: Bell Pepper, Cold Storage, Compost Tea, Packaging, Physicochemical Characteristics, Shelf Life

Evaluation of Cooking Systems and Different Hydrocolloids on Physicochemical and Textural Properties of Roti (Indian Leavened Flat Bread) for Industrial Production

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Abstract

In recent years, synchronous with the development and diversification of bread production, have expanded various processing methods, as well as the co processes (additives). One of the traditional products that have been welcomed by consumers for many years in eastern asia due to the simplicity of raw materials and ease of using is roti bread. Therefore, in the present study, has been investigated the use of baking systems, such as hot-electric plates and rotary oven and compare them with the traditional method and so on is evaluated using of guar, carboxymethylcellulose and Carrageenan hydrocolloids (each one 0.5%) in roti bread formulation. After production, the properties of final product such as moisture content, water activity, texture, color and sensory properties were evaluated in a completely randomized double factorial arrangement test that the first factor was the baking methods and the second one was the kind of hydrocolloids. The results of this study clearly showed that application of hot-electric plates for baking along with addition of both carboxymethylcellulose and guar gum in the formulation, have effect on the moisture content and color component of L* value and in this regard the effect of carboxymethyl cellulose gum was higher than guar gum. Also, based on the results, it was found that the sample produced by the hot-electric plates containing carboxymethyl cellulose gum had the least firmness of the tissue at the time of 2 and 72 hours, as well as one week after baking ($P \leq 0.05$). Finally, tasting the samples, the panelists introduced the samples produced with hot-electric plates containing carboxymethyl cellulose gum and samples produced with hot-electric plates containing guar gum as the best samples. According to the results of this study, using hot-electric plates and addition of 0.5% carboxymethyl cellulose gum is recommended to improve the quality parameters and sensory properties of roti bread.

Keywords: Baking Methods, Carboxymethyl Cellulose, Carrageenan, Guar, Roti Bread

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Investigation of The Appropriate Packaging to Shelf Life Extension of The Prepared Greenhouse Tomato using Vermicompost Tea instead of Chemicals Fertilizers on Open Hydroponics Culture

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Abstract

Nowadays, the production of organic products, especially in greenhouses is a significant and significant issue and has a good economic status and justification due to its health issues and the production of healthy products (not using toxins and chemical fertilizers). In greenhouse culture of tomato (*Solanum lycopersicum*) as a fruit vegetable, the use of fungicides to prolong the shelf life of this product is one of the major problems in the health of the community. While using the factors such as suitable substrate and packaging may increase its shelf life. Therefore, this research was conducted to investigate the effect of appropriate packaging method on the greenhouse tomato prepared from the substrate containing tea compost.

In this project, tomato from hydroponic culture of Agricultural Engineering Research Institute greenhouse containing 0, 25, 50, 75 and 100% vermicompost tea were packaged in two film types using the modified atmosphere method. Some mechanical (texture test), chemical (total soluble solids, pH, titratable acidity, vitamin C), and physiological (respiration) properties were measured immediately after harvesting and during storage time with three replications in accordance with standard methods. Then, the data obtained from the above tests were analyzed in a completely randomized design with factorial arrangement (three factors: substrate, type of packing material, and storage time) using the SPSS software.

The results showed that, in terms of the substrate factor, substrates with compost tea were more effective on tomato's characteristics compared with the substrate without compost tea. However, in terms of different levels of substrates with compost tea, definite conclusion is not possible, since in several tests, different levels of substrates containing compost tea did not have the same results. In terms of storage time, most of the tested characteristics had a decreasing trend, but was still lies within the range of information recorded for these features due to the use of modified atmosphere packaging. In terms of the type of film, with a slight difference, nano film was superior to polyethylen film.

Key words: Cold storage, Packaging, Physicochemical characteristics, Shelf life, Tea compost, Tomato

Investigation of Green Food Color Production from Mulberry (*Morus Alba L.*) Leaves

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Abstract

Mulberry (*Morus alba*) is a native to Iran with low water requirement and due to resistance to vegetable pests is not sprayed by pesticides. Mulberry extract is a rich source of chlorophyll, which, in addition to its coloring properties, is also the source of natural antioxidants. In this study, mulberry leaves extract was studied for its ability to produce color and antioxidant properties. The colored extract of the leaves of the berries harvested at three different times (beginning, middle and end of the production season) was extracted by ethanol solvent with different percentages (80 and 100%). Regarding the color extraction, with the solvent at 80% concentration, higher extraction rates were reached. Leaves harvesting took place in three periods of April, May and June. In April and May, the amount of extracted chlorophyll and carotenoids was about 6 and 0.7 $\mu\text{g} / \text{ml}$ respectively that was statistically significantly greater than those in June (about 3.5 and 0.45 $\mu\text{g} / \text{ml}$ respectively) at significance level $\alpha = 0.05$. The amount of phenolic compounds extracted in April was statistically higher than that of two months later (approximately 24 $\mu\text{g} / \text{ml}$ and 19 $\mu\text{g} / \text{ml}$, respectively) at the level of significance $\alpha = 0.05$. Color stability decreased with decreasing pH and temperature rise. The drop in pH from 6 to 3 reduced significantly the levels of chlorophyll and carotenoids from 33.97 to 6.858 and 3.01 to 1.634 $\mu\text{g} / \text{ml}$, respectively at the level of significance $\alpha = 0.05$. All results were compared to the control sample with a pH of 6. Increasing the temperature from 50 to 90 $^{\circ}\text{C}$ reduced 80% of chlorophyll pigments and 50% of carotenoid pigments compared to the control sample at ambient temperature. A reduction of 80% of the color intensity of the carotenoid stored in the ambient light conditions of the laboratory was observed comparing with that stocked in dark conditions.

Key Words: Antioxidant, Chlorophyll, Food Color, Mulberry

AERI

Study on the Effects Modified Atmospheres on Quantitative and Qualitative Characteristics of Malts Obtained from Barley, Wheat and Other Cereals

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Abstract

Grain storage can decrease germination viability of malting barley and wheat resulting in production of poor quality malt. Main standard quality parameter requires malting industry to maintain at least 98% germination percentage (GP). In view of the fact that conventional methods of storage namely: storage in ordinary warehouses or other structures exposed to changing atmospheric conditions are not conducive to maintaining such high degree of germination, the aim of present investigation was to evaluate effect of Commodity Modified Atmospheres (CMA) and Modified Atmospheres (MA) for maintaining high percentage of germination in stored barley and wheat. Initial disinfestation was carried out using dry ice in airtight Polyethylene bins each with the capacity of about 2000 Kg. Two levels of moisture content (12 and 14 %), three levels of storage periods (3, 6 and 9 months) and two levels of atmospheres (Commodity Modified Atmospheres and atmospheres containing 95 % CO₂ + 5% O₂) were the experimental conditions. During the course of investigation every three months changes in percent moisture content, O₂ and CO₂ percentage, germination capacity and protein content was measured. Results showed that germination capacity of barley, from its initial value of 97% was dropped to 95.67%, at the end of 3, to 93.42% at the end of 6 and 90.50% at the end of 9 months storage periods respectively. Whereas germination capacity of wheat from its initial value of 96% was dropped to 95.58% after 3, to 91.17% at the end of 6 and to 88.83 at the end of 9 months storage periods respectively. Other results indicated that a 2 percentage increase in moisture content resulted in lowering of germination capacity of barley and wheat. Results also showed that modified atmospheres containing 95% CO₂ + 5% O₂ were superior to commodity modified atmospheres for control of germination in Barley and wheat under investigation. Finally it can be concluded that airtight polyethylene bins with capacity of 2 tons may be considered a viable alternative to conventional warehouse bag storage and can effectively be used to preserve the germination capacity of barley and wheat destined for malting purposes.

Keywords: Airtight, barley, Commodity, Industry, Malt, Modified Atmosphere, Storage, Wheat

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