

**RESEARCH REPORT 2023-2024**  
**ON**  
**POSTHARVEST TECHNOLOGY OF CROPS**

**Postharvest Technology Division**



## **EFFICACY OF CLOVE ESSENTIAL OIL AND CARNAUBA WAX IN EXTENDING SHELF LIFE OF MANGO**

M.M. RAHMAN, M.G.F. CHOWDHURY, M.H. H. KHAN

The effects of clove essential oil, gibberellic acid and carnauba wax coating for controlling stem end rot and anthracnose caused by *Botryodiplodia theobromae* and *Colletotrichum gloeosporioides*, respectively of mango to extend shelf life was investigated. BARI Aam-3 (Amrapali) was collected from farmers' orchard in Naogaon District and transported to the laboratory of Postharvest Technology Division (PHTD), BARI. No fruits had been treated with a fungicide after harvest. Fruits were sanitized with calcinated calcium ( $1\text{gmL}^{-1}$ ). Again, clove essential oil was extracted in the laboratory of PHTD using steam-distillation apparatus. Surface sterilized fruits were arranged in rotating wax coating machine. Clove EO  $1\text{ mL L}^{-1}$  premix with ethanol ( $1\text{ mL L}^{-1}$ ) as stabilizer and Triton-X100 ( $40\text{ mg L}^{-1}$ ) as surfactant was applied by hand spraying on the rotating fruits and at the same time Carnauba wax coating was also sprayed after the spraying of EO. Then, the treated fruits were placed in the plastic foam packaging cup liner and kept in  $24^{\circ}\text{C}$ . Fruits were also treated with GA (@400 ppm). Clove EO extracted in the laboratory by steam-distillation method yielded approximately 5% oil. According to Ratri et al. (2020) eugenol (85%), caryophyllene (1.14%) and humulene (0.18%) are the main compounds in clove oil. . Clove essential oil at  $1\text{ mL L}^{-1}$  premixed with ethanol ( $1\text{ mL L}^{-1}$ ) as stabilizer and Triton-X100 ( $40\text{ mg L}^{-1}$ ) as surfactant in combination with carnauba wax has shown potential inhibition of the fungi with shelf life extension of mango. To identify the exact causal component of clove EO for inhibiting stem end rot and anthracnose of mango the *in vitro* test and effect of temperature and relative humidity will be investigated next year.

## **SHELF-LIFE EXTENSION OF FRESH GUAVA FRUITS THROUGH POSTHARVEST TREATMENTS**

M.M. RAHMAN, M.G.F. CHOWDHURY, M.H. H. KHAN

The experiment was conducted to evaluate the effect of gibberellic acid and cling wrap packaging on the quality and shelf life of guava. Commercial matured guava 'BARI Peyara-2' commonly known as "Thai Peyara" was obtained from local grower's orchard (Jhikargacha, Jessore, Bangladesh) and transported to the laboratory of PHTD, BARI, Gazipur. Each batch of fruit was randomly distributed into the required number of treatment units with 15 fruits per unit with three units/replicates assigned to each treatment. Each replicate was prepared and treated separately. The required number of fruits were dipped in gibberellic acid solution (@400 ppm) for 10 minutes. The control fruits were dipped only in water. After dipping all the fruits were kept on the table for 30 minutes for surface drying. Then, one group of the treated fruits were wrapped with cling wrapping cellofen and the other group kept unwrapping. A group of non-dipping fruits also wrapped with the cling wrapping cellofen as a control of farmers' practice. Another group of gibberellic acid treated fruits also kept without cling wrapping. Then, the treated fruits were placed in the plastic foam packaging cup liner and kept in  $25^{\circ}\text{C}$ .

The guava fruits treated with gibberellic acid and wrapped in cling wrap cellofene resulted in the most firmness (120.20N and 102.48N) compared to the control (71.12N and 37.11N) and other treatments throughout the storage periods. GA in combination with cling wrap maintained the qualitative characteristics of guava fruit by reducing the ripening rate by acting as an excellent ethylene inhibitor. During storage, changes in firmness, TSS, ascorbic acid, and beta carotene decreased in treated fruits which might be due to an altered atmosphere around the fruit and decrease in water loss. This altered atmosphere also can reduce the changes in pectin materials and the activity of cell wall degrading enzymes, which finally maintains the fruit firmness. This study implies that gibberellic acid in combination with cling wrap has potential to extend the shelf life of guava. Fruits pre-treated with gibberellic acid then packing with cling wrap gave comparatively acceptability quality and shelf life for

14 days of storage at 25° C. However, this is a first year trial and some more treatments will be added to the current treatments in the next year.

## **EFFECT OF POSTHARVEST TREATMENT AND EDIBLE WAX COATING ON IMPROVING QUALITY RETENTION AND SHELF LIFE OF BARI AAM-3**

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This experiment was conducted to study the effect of different postharvest treatments and fruit coatings that stimulate the fruit antioxidant system and will maintain postharvest quality of mango at ambient storage condition. BARI Aam-3 was collected and then washed with 1000 ppm thiabendazole and 0.1% calcinated calcium and then treated with hot water at 55°C for 5 mins. After that, food grade wax coating (Endura fresh <sup>TM</sup>9000 & Endura Fresh <sup>R</sup>2400) and another commercial postharvest treatment such as multi-fresh ethylene absorber and antimicrobial agent (Greenpod lab, India) were applied. Treated mango were washed appropriately by required amount of detergent conc. in the BARI fabricated brush pad @8-10 rpm for few seconds and then washed again with ambient water. For uniform surface coating a hand sprayer was used to apply wax @500 fruit/L on the fruit peel.

On Day-1, treatment Endura Fresh <sup>TM</sup>9000 combined with an antimicrobial agent exhibited the highest respiration rate (61.31 ml CO<sub>2</sub>/kg-hr.), which was significantly higher (p<0.05) than all other treatments. In contrast, Endura Fresh <sup>R</sup>2400 combined with an antimicrobial agent demonstrated the lowest respiration rate 16.21 ml CO<sub>2</sub>/kg-hr.), marking a significant difference (p<0.05) from the other treatments. In case of weight loss, control treatment exhibited the highest weight loss percentage (4.30%), which was significantly higher (p<0.05) than other treatments at Day-1. Among the treated samples, Endura fresh <sup>TM</sup>9000 and Endura Fresh <sup>R</sup>2400 found the lowest weight loss percentages (2.11% & 1.85%, respectively). The analysis of Total Soluble Solids and ascorbic acid content across various treatments reveals distinct trends in fruit quality over time. Titratable Acidity for all treatments, except for Carnauba wax 9000 with its unusual value on Day-8, generally exhibited a decreasing trend in acidity over time. Antioxidant Activity for treatments Endura Fresh <sup>R</sup>2400, Carnauba 9000+Antimicrobial treatment; and Endura Fresh <sup>R</sup>2400+ Antimicrobial treatment observed the highest levels of antioxidant activity. Mango treated with carnauba wax combined with antimicrobial agents was effective in reducing both respiration rate and weight loss, suggesting potential for extending the shelf life and maintaining quality.

## **STANDARDIZATION OF DOSES OF ETHYLENE GAS FOR UNIFORM RIPENING OF TOMATO IN LOW-COST RIPENING CHAMBER**

M.G.F. CHOWDHURY, M.H.H. KHAN, M.M.MOLLA, R.ISLAM

The experiment was conducted to standardize the doses of ethylene for uniform ripening of tomato (*Solanum lycopersicum* L.) in low-cost ripening chamber. Udayan variety tomato at breaker stage was harvested at HRC field of BARI and treated with 0, 50, 100, 150 and 200 ppm concentration of exogenous ethylene gas at BARI developed low-cost ripening chamber at PHTD, Gazipur where temperature maintained at 20±2°C and 80±5% RH. Udayan varieties of tomatoes turned to breaker stage were collected and washed and then exposed to different ethylene gas concentrations such as 0, 50, 100, 150 and 200 ppm for overnight in a fruit ripening chamber of PHTD, BARI. After that, the fruits were kept at 20±2°C with 80±5%RH and at ambient temperature for 12 days. Physical appearance and nutritional quality with shelf life were evaluated.

Textural properties of fried pineapple chips were determined to estimate resistance by a texture analyzer. The application of exogenous ethylene significantly influences the ripening process of tomatoes. Tomato treated with 50 ppm C<sub>2</sub>H<sub>4</sub>, respiration increased from 20.64 ml CO<sub>2</sub> /kg-hr. on Day-1 to 44.59 ml CO<sub>2</sub> /kg-hr. by Day-4, indicating accelerated ripening. Higher concentrations, such as 100 ppm, showed a rise from 24.85-61.15 ml CO<sub>2</sub> /kg-hr., while 200 ppm peaked at 68.86 ml CO<sub>2</sub> /kg-hr., demonstrating a more

pronounced effect. The stabilization of respiration rates from Day-4 suggests a saturation point in the ripening process, where ethylene receptors may be fully activated. Besides, Weight loss was lowest at Day-8 in 200 ppm treated tomatoes but it is similar for 100 ppm treatment. Firmness and carotene were better in 100 ppm treated tomatoes. Overall, 100 ppm was the optimum doses of ethylene gas for uniform ripening of tomatoes. Optimum ripening of tomato achieved after 4 days of ripening at 20°C through exogenous ethylene gas concentration at 100 ppm.

## **STANDARDIZATION OF DOSES OF ETHYLENE GAS FOR UNIFORM RIPENING AND POSTHARVEST QUALITY OF BANANA DURING STORAGE**

M.G.F. CHOWDHURY, M.H.H. KHAN, M.M.RAHMAN, R.ISLAM

The experiment was conducted to evaluate the effect of ethylene for standardization of doses exogenous ethylene gas concentration for uniform ripening of banana (*Musa spp.*) in low-cost ripening chamber at PHTD, BARI. Uniform with physiologically matured green banana (BARI kola-1) were collected and treated with 0, 50, 100 and 150 ppm concentration of ethylene gas at BARI developed low-cost ripening chamber (L3.5m×W2m×H2m) where temperature maintained at 20±2°C & 80±5% RH. The respiration rate in the control treatment shows a gradual increase from initially (Day-1) (20.18 ml CO<sub>2</sub>/kg·hr.) to Day-6 (136.09 ml CO<sub>2</sub>/kg·hr.). This treatment consistently states the lowest respiration rates across all days during the study. Ethylene production in the control treatment (0 ppm) steadily increases from Day-1 (92.73 nmol/kg·s) to Day-4 (323.52 nmol/kg·s), followed by a decrease on Day-6 (120.82 nmol/kg·s). This is the lowest ethylene production across all treatments. Control treatment exhibits the highest physiological weight loss (PWL) on both Day-4 (3.11%) and Day-8 (5.77%), indicating significant weight loss in the absence of ethylene treatment. Total soluble solids (TSS) increases in all treatments over time, indicative of the ripening process where starch is converted into sugars. The titratable acidity decreases across all treatments over time, which aligns with the typical reduction of organic acids during fruit ripening. Ascorbic acid levels decline for all treatments during storage, reflecting the natural degradation of vitamin C as the fruit ripens. Exogenous ethylene treatments, particularly at higher concentrations of C<sub>2</sub>H<sub>4</sub> gas (100-150 ppm), significantly enhance the ripening process in bananas by increasing TSS and reducing weight loss.

## **STANDARDIZATION OF DOSES OF ETHYLENE GAS FOR UNIFORM RIPENING AND POSTHARVEST QUALITY OF MANGO DURING STORAGE**

M.G.F. CHOWDHURY, M.H.H. KHAN, M.M.RAHMAN, R.ISLAM

The experiment was conducted to standardize the doses of exogenous ethylene gas for uniform ripening of mango (*Mangifera indica* L.) in BARI developed Low-Cost Ripening Chamber. Uniform with physiologically matured mango (BARI Aam-2) were collected from Bagha, Rajshahi and treated with 0, 50, 100 and 150 ppm of exogenous ethylene gas at PHTD, BARI where temperature maintained at 20±2 °C with 80±5% RH. Three replications of selected clusters were taken at initially and 2 days interval up to 8 days for respiration rate 4 days interval up to 12 days for physicochemical analysis. The study involved treating mature green mangoes with different concentrations of exogenous ethylene gas application to evaluate ripening responses and shelf life. Mangoes were stored at ambient temperature (26±2°C and 75±5%RH) and nutritional composition were recorded initially and 4 days interval up to 12 days.

Initially (On Day-1), 100 ppm and 150 ppm exhibited the highest respiration rates (39.93±3.93 CO<sub>2</sub>/kg.hr. and 39.95±0.52 ml CO<sub>2</sub>/kg.hr., respectively), significantly surpassing control and lower concentrations. The control treatment (0 ppm) exhibited the highest PWL by Day-12 (11.78%), indicating substantial moisture loss. In contrast, T<sub>2</sub> (50 ppm), T<sub>3</sub> (100 ppm), and T<sub>4</sub> (150 ppm) exhibited lower PWL

initially, suggesting that ethylene treatments assist to reduce moisture loss by modulating transpiration rates. The highest TSS levels were observed in 100 ppm and 150 ppm by Day-12 (18.16 °B & 18.17 °B, respectively), indicating enhanced carbohydrate metabolism due to ethylene. In case of titratable acidity (TA), treatment 50 ppm maintained higher acidity levels until Day-8 (0.20%) but observed a decline trend by Day-12 (0.05%). Similarly, vitamin A content, a critical nutritional parameter, was significantly influenced by ethylene application. Among the treatment, mango treated with 100 ppm performed better quality and noted optimum ripening at ambient condition ( $26\pm 2^{\circ}\text{C}$  &  $75\pm 5\%$  RH).

### **EFFECT OF MALTODEXTRIN AND SODIUM CHLORIDE ON THE QUALITY ATTRIBUTES AND STORAGE LIFE OF VACUUM FRIED MANGO CHIPS**

M.G.F. CHOWDHURY, M.H.H. KHAN, M.M. MOLLA, P.SEN, R.ISLAM

The aim of the study was to evaluate vacuum fried mango chips processing using BARI developed vacuum fryer at suitable frying temperature and time. Early harvested green mangos (unknown commercial) were collected from Gazipur and peeled and then thinly sliced (2-3 mm). Six treatments such as 20% maltodextrin (MD), 20% MD with 10% NaCl, 20% MD with 10% NaCl and freezing ( $-14^{\circ}\text{C}$ ), 20% MD and direct frying, preserved 10% salted mango (>6 months storage) and without any treatment were examined. Raw mango slices were vacuum fried at  $105^{\circ}\text{C}$  for 30 mins was used for frying and then were de-oiled at 1400 rpm for 2-3 mins. Final products were packed in metalex foil packet (3 layer, ~60 micron) and nutritional quality with storage life was observed for 3 months.

Control treatment exhibits an increase from 3.94% initially to 7.84% after 3 months of storage, while 20% maltodextrin (MD) presents a significant increase from 1.038% initially to 3.65% after 2 months and then decreases to 3.16% after 3 months of storage. Preserved mango maintains a higher moisture content from 1<sup>st</sup> month to 3<sup>rd</sup> month compared to other treated samples. In case titratable acidity (TA) values treatment 20% MD and 20% MD with 10% NaCl, remain relatively stable, with slight fluctuations over time. Similarly, ascorbic acid content varies significantly among the treatments. Treatment control observes high initial values (69.07 mg/100g), while treatment preserved salted mango starts with the lowest value (21.47 mg/100g). The use of certain preservatives appears to help retain some antioxidant properties. 20% MD with direct frying) tends to retain more energy over time compared to other treatments. Mango treated with 20% MD, 10% NaCl and freezing includes both freezing and salted mango, exhibits significant energy losses initially but stabilizes somewhat after 2 months where the energy value range from 951 to 709 kcal/100g. Among the treatments, 20% MD with 10% salt and then freezing performed better in terms of nutritional quality and 3 months of ambient storage ( $26\pm 2^{\circ}\text{C}$  &  $75\pm 5\%$  RH).

### **EFFECT OF MALTODEXTRIN ON NUTRITIONAL AND BIOACTIVE COMPOUNDS OF FREEZE-DRIED MANGO CHIPS**

M.G.F. CHOWDHURY, M.H.H. KHAN, S. PERVIN, R.ISLAM

The aim of the study was to standardize the freeze-dried mango chips processing protocol by application of maltodextrin (MD) as food additives for cell integration. Mango chips were prepared from matured semi-ripe mango. The harvested mango (Fazli) was collected from Bagha, Rajshahi to PHTD, BARI. Then mangoes were washed and cut into slices about 3-5 mm thickness and treated with different concentration such as 1.5%, 3%, 4.5% & 6% of MD then kept in high density polyethylene packet (HDPE) (~60 micron) and frozen at  $-18^{\circ}\text{C}$  for 24-36 hrs. The frozen slices were dried in freeze dryer at  $-55^{\circ}\text{C}$  for 48-72 hrs. and the dried mango chips were packaged in foil (~50 micron) packet without nitrogen flashing.

Control treatment exhibited the highest moisture at 9.77% where 1.5% MD and 3% MD found moisture 8.41% and 9.42%, respectively. In case of titratable acidity, control found the highest titratable acidity at 2.41%. 1.5% MD and 3% MD were significantly lower ( $p < 0.05$ ) titratable acidity levels compared to control treatment. In case of the phenolic content, with addition of MD up to 3% (9.19 mg GAE/100g), it slightly decreased in treatment 4.5% MD (8.32 mg GAE/100g) and treatment 6% MD (7.57 mg GAE/100g). Treatment 3% MD was the most effective ( $p < 0.05$ ) in enhancing phenolic content. The antioxidant activity varies among treatments, with treatment 1.5% MD (58.09%) and treatment 6% MD (56.18%) had the highest inhibition percentages, indicating strong antioxidant properties. Treatment 4.5% MD had the lowest energy value (553.07 kcal/100g) while treatment 6% MD had the highest (579.79 kcal/100g). It can be concluded that 6% MD treated mango chips exhibited better quality in terms of physical appearance and nutritional quality in metal foil packet. Improper freeze-drying of mango chips the product may reduce its crispiness or increase moisture of the product.

### **PHYSICOCHEMICAL PROPERTIES AND BIOACTIVE COMPOUNDS OF COFFEE BEAN AND COFFEE POWDER AT MADHUPUR OF TANGAIL**

M.G.F. CHOWDHURY, M.H.H. KHAN, M.A. HOSSAIN, R. ISLAM

This study examines the physicochemical composition and nutritional properties of selected coffee bean and coffee powder. Coffee bean and coffee powder were collected from Madhupur, Tangail and transferred to PHTD Lab, BARI, Gazipur. Physicochemical and bioactive compounds were evaluated through laboratory analysis. A significant ( $p < 0.05$ ) decrease in moisture content was observed, from 8.76% in raw beans to 2.68% after roasting, which is expected due to the high temperatures involved in roasting that drive off water. The ash content decreased from 2.81% in raw beans to 1.89% in roasted coffee, while the total soluble solids (TSS) showed a minimal increase from 2.93 °B to 2.97°B, indicating that roasting slightly affects the soluble solids that contribute to coffee's flavor and aroma. Anthocyanin content which has antioxidant properties, increased from 0.29 mg/100g to 0.90 mg/100g. The calorific value (Energy) increased from 756.91 Kcal/100g in raw beans to 794.84 Kcal/100g after roasting, probably due to moisture loss and chemical transformations such as Maillard reactions that make some compounds more caloric. Vitamin C content significantly decreased from 21.60 mg/100g in raw beans to 10.21 mg/100g in roasted coffee. The pH levels remained stable, with a slight increase from 6.76 to 6.77. Besides, the titratable acidity increased significantly from 0.61% to 1.85%, indicating a higher acid profile in roasted coffee. Beta-carotene increased from 18.42 mg/100g to 32.21 mg/100g. In contrast, the total carotenoid content slightly decreased from 2.72 mg/100g to 2.34 mg/100g after roasting. The roasting process leads to various chemical changes in coffee beans, including moisture reduction, changes in antioxidant compounds, and variations in energy and nutrient content. These transformations affect the coffee's flavor, aroma, and health-related properties.

### **CONSUMERS PREFERENCE AND COMPARISON OF NUTRITIONAL QUALITY OF SELECTED FRESH-CUT VACUUM FRIED CHIPS IN SELECTED LOCATIONS OF BANGLADESH**

M.G.F. CHOWDHURY, M.M. RAHMAN, M.H.H. KHAN, M.M. MOLLA, R. ISLAM

The assessment was conducted to evaluate the consumer preference of selected vacuum fried (VF) chips and comparison of nutritional quality of existing real chips at selected locations of Bangladesh for improving quality to marketable the products. The organoleptic test was conducted to assess VF jackfruit, banana, mango and potato chips by the entrepreneurs. Ten experts panel members were participated and nutritional quality were examined both entrepreneurs developed and existing market sample of real chips.

Jackfruit chips was the most favored chips among consumers group in most locations, particularly in Rajshahi, Tangail, and Bogura. They received the highest scores in several sensory attributes, including color (8.4), taste (8.2), flavor (8.4), and overall acceptance (8.4). However, in Jashore, the scores were moderate, ranging from 7.6 to 7.8 across all attributes, indicating a slightly lower preference. Banana chips observed a generally favorable response, especially in Tangail, where they were highly rated in taste (8.7), flavor (8.6), crispiness (8.6), and overall acceptance (8.6). It also performed well in Bogura with overall acceptance at 8.4, although the crispiness was rated slightly lower at 8.1. Rajshahi consumers rated the color (8.5), flavor (8.4), and overall acceptance (8.6) highly but gave lower scores for taste (6.4) and crispiness (6.8). In Jashore, banana chips received moderate ratings in taste (8.0) and flavor (7.8), but lower in oiliness (7.4) and overall acceptance (7.6), reflecting a mixed response. Mango chips consistently received lower scores across most locations. Rajshahi consumers gave low scores for taste (6.8), flavor (6.6), and overall acceptance (7.2). In Tangail, the scores were mixed, with a high rating for flavor (8.0) and crispiness (8.2) but lower for taste (6.5). Overall acceptance was moderate at 8.2. In Bogura, mango chips received the lowest scores, particularly for color (6.4), taste (6.4), and overall acceptance (6.9). In Jashore, the chips scored moderately to well, with taste (7.4) and overall acceptance (7.6). Potato chips was varying levels of acceptance, with Bogura group rated the strongest preference and Jashore the weakest. In Rajshahi, potato chips scored moderately across all attributes, with overall acceptance at 7.8. Tangail consumers gave high ratings for taste (8.3) and oiliness (8.1) but lower scores for color (6.9). In Bogura, potato chips were well-received, with consistent scores ranging from 8.2 to 8.4. In Jashore, they received lower ratings across several attributes, with taste (7.6) and crispiness (7.0) being the most notable, indicating a less favorable. Jackfruit, banana and potato chips were accepted for marketable except mango chips require a bit improvement for color, crispiness and proper seasoning. The energy values were found a ranged from 480 to 577.52 Kcal/100g and acrylamide were observed also below TDI.

### **EFFECT OF DIFFERENT ORGANIC ACIDS ON FERMENTATION OF VEGETABLES AND POMACES AS PROBIOTIC PICKLE**

M.M. Molla, M.H.H. Khan, B.C. Dey, M.G.F. Chowdhury, M.M. Rahman, S. Pervin and P. Sen

The present investigation was undertaken to find out the effect of organic acids for increasing the shelf life of selected vegetables and enhances fermentation of the stored vegetables under different strain of the selected bacteria. No data on fermentation were recorded due to time limitation. The vegetables were treated with three different organic acids namely  $T_1$ = lactic acid,  $T_2$ = acetic acid and  $T_3$ = apple cider vinegar. The experiment was laid out in complete randomized design (CRD) with 3 replications. The vegetables treated with different organic acids were shelf stable 9 months more. Results indicate that the acidity level of the stored vegetables were increased due to increasing total acidity of the treated samples. The decreased acidity might be due to an inverse relation with acidity. In opposition, the increasing acidity level by the organic acid treated vegetables might be due to formation of acid and breakdown of pectic substances over the storage periods. Vitamin C and  $\beta$ -carotene was gradually changed entire the storage periods due to leaching behavior of vitamin C into water solution, light intensity of the stored room and oxidation during long concentration steps in room temperature and atmospheric pressure. The highest vitamin C and  $\beta$ -carotene content was retained by the apple cider vinegar compared to lactic acid and acetic acid.

## **EFFECT OF SALT CONCENTRATION ON PRESERVATION OF VEGETABLES AS PROBIOTIC PICKLE**

M.M. Molla, M.H.H. Khan, B.C. Dey, S.Pervin, M.G.F. Chowdhury and M.M.Rahman

The purpose of the study was to find out the effect of salt concentration on increasing the shelf life of vegetables and determination of proper concentration of salt how much salt penetrated in the preserved sample in light of sensory evaluator preferences. There were three treatments namely  $T_1 = 4\%$  salt + 0.10% acetic acid + 0.01% KMS+ 94.90%  $H_2O$ ,  $T_2 = 6\%$  salt + 0.10% acetic acid + 0.01% KMS+ 92.90%  $H_2O$  and  $T_3 = 8\%$  salt + 0.10% acetic acid + 0.01% KMS+ 90.90%  $H_2O$ . The experiment was laid out in complete randomized design (CRD) with 3 replications. The vegetables treated with different salt concentration were stored for 12 months in food grade plastic container at ambient condition. Results confirm that vegetables treated with 4%, 6% and 8% salt concentration were slightly penetrated into the vegetables (2.12-3.57%) whereas most of the salt were present into  $H_2O$  solution (2.95-5.30%). Vegetable treated with 4% salt under cooking condition was acceptable by the sensory evaluator.

## **UTILIZATION OF PINEAPPLE POMACES TO DEVELOP BAKERY PRODUCTS (CAKE) FOR ITS PHYSICOCHEMICAL, NUTRITIONAL, TEXTURAL AND FUNCTIONAL PROPERTIES**

M.M. Molla, M.H.H. Khan, B.C. Dey, M.M. Rahman, S. Pervin, P. Sen, M.G.F. Chowdhury

The purpose of the study was to utilize the pineapple pomace to develop by-product especially pomace cake using different proportions of pomace flour. The study was laid out in complete randomized design (CRD) with five treatments viz.  $T_1 = 100\%$  wheat flour (control),  $T_2 = 25\%$  pineapple pomace flour + 75% wheat flour,  $T_3 = 50\%$  pineapple pomace flour + 50% wheat flour,  $T_4 = 75\%$  pineapple pomace flour + 25% wheat flour and  $T_5 = 100\%$  pineapple pomace flour with 3 replications. The developed cake was stored in pouches at ambient condition to observe nutritional changes, texture, color, shelf life and sensory attributes. Results check that 25-75% pomace flour ( $T_2$ - $T_4$ ) treated cake was acceptable more by the panel members as compared to 100% wheat ( $T_1$ ) and pomace flour ( $T_2$ ).  $T_5$  (100% pomace flour) treated pomace cake found to be the best results to retain more nutritional compositions than others. These finding could be the best way to apply this technology by the agro-food processing industries for utilization of pineapple pomace as a by-product.

## **DEVELOPMENT OF MIXED DRY FRUIT PRODUCTS AND ITS PACKAGING TECHNIQUE**

M.M. Molla, M.H.H. Khan, B.C. Dey, P. Sen, S. Pervin, M.G.F. Chowdhury and M.M. Rahman

The study explored to develop mixed dry fruit using blanching, sugaring and sulphuring process. The study was laid out in complete randomized design (CRD) with three replications. There was three treatments viz.  $T_1 =$  Blanching + sugaring,  $T_2 =$  Blanching + sulphiting and  $T_3 =$  without blanching + sugaring + sulphiting (control). The developed mixed dry fruit was stored in food grade mini plastic boxes at ambient condition to observe microbial studies, nutritional changes, shelf life studies and sensory attributes. Results reveal that blanching and sugaring treated fruit ( $T_1$ ) lost their vitamin C and  $\beta$ -carotene content compared to non-blanching, indicates that blanching involves thermal processing that might be contributed to decrease the vitamin C and  $\beta$ -carotene content. The sugar treated fruit found to be maximum total and reducing sugar content than control whereas it was gained maximum score by the sensory evaluator. Blanching and sugaring ( $T_1$ ) improved the fruit color with maximum hardness that was more acceptable by the evaluator. Further study needs to be continued to be continued by preservation of

papaya fruit into brine solution before processing and commercial preservation and marketing of the papaya tutifrutti without any quality deterioration.

### **PRESERVATION OF BARI MOTORSHUTI 1 BY APPLICATION OF HURDLE TECHNOLOGY**

M.M. Molla, M.H.H. Khan, B.C. Dey, S. Pervin, M.M. Rahman, P. Sen and M.G.F. Chowdhury

The present study was undertaken to find out the effect of hurdle technology to preserve the BARI Motorshuti-1 for long time. The harvested motorshuti were treated with four treatments viz. T<sub>1</sub>= salt 1% + sugar 6% + citric acid (CA) 0.05% + potassium metabisulphite (KMS) 0.1% (control), T<sub>2</sub>= salt 1% + sugar 6% + CA 0.05% + KMS 0.1% + ascorbic acid (AA) 1%, T<sub>3</sub>= salt 1% + sugar 6% + CA 0.05% + KMS 0.1% + AA 1% + potassium sorbet (KS) 0.1% and T<sub>4</sub>= salt 1% + sugar 6% + CA 0.05% + KMS 0.1% + AA 1% + KS 0.1% + UV treatment and 3 replications. The experiment was laid out in complete randomized design (CRD). Results revealed that pH, total sugar and reducing sugar were insignificantly differed entire the storage periods. The TSS were significantly different on the day of storage and after 6 months of storage. Although the insignificant differences were observed but the pH, total sugar and reducing sugar of the stored motorshuti were increased over the storage periods. The highest vitamin C content was recorded in fresh motorshuti where a non-significant difference was observed on the day of storage. After 6 months of storage, the vitamin C were drastically decreased. The addition of ascorbic acid and hurdle technology contributed to achieve the highest vitamin C content than control. The microbial activities also stopped by the hurdle technology that contributed to increase the shelf life of BARI Motorshuti compared to others.

### **DEVELOPMENT OF LEMON JUICE BY APPLICATION OF THERMAL AND NON-THERMAL TREATMENTS**

M.M. Molla, M.H.H. Khan, B.C. Dey, S. Pervin, M.G.F. Chowdhury, P. Sen, M.M. Rahman and P.C Sarker

The study explored to develop lemon juice by application of thermal and non-thermal UV treatment. The study was laid out in complete randomized design (CRD) with three treatments namely control sample (T<sub>1</sub>), thermal treatment (T<sub>2</sub>) and non-thermal UV treatment (T<sub>3</sub>) with 3 replications. The developed juice was stored in PET bottles at ambient condition to observe microbial studies, nutritional and bioactive compound analysis, shelf life and sensory attributes. Results reveal that all the treated juice contained bacteria, yeast and molds. No fungus, bacteria, yeast and mold activities were detected by pasteurized (T<sub>2</sub>) and UV (T<sub>3</sub>) treated juice as compared to control during the study periods. Control sample (T<sub>1</sub>) contained highest nutritional composition than others. UV treated juice (T<sub>3</sub>) contained higher vitamin C than pasteurized treatment (T<sub>2</sub>). But increasing UV time decreased the vitamin C content. Further observation may be need to increase the marketable life for its commercial application to the stake holders.

### **NUTRITIONAL, PHYSICOCHEMICAL AND BIOACTIVE COMPOUNDS ANALYSIS OF DEVELOPED FORTIFIED EXTRUDED LENTIL CHIPS**

M.M.Molla, M.H.H.Khan, M.G.F. Chowdhury, M.M.Rahman, S.Pervin, B.C.Dey, P.Sen, M.S.Zaman, R.Podder, P.Bhowmik and A.Khatun

This study sought to explore the fortification of the developed lentil chips using hot extrusion technology. There were five treatments viz. developed chips without fortification (control sample: T<sub>1</sub>), fortification

with FAO recommended vitamin and mineral mixtures (T<sub>2</sub>), fortification with carrot powder (T<sub>3</sub>), fortification with pumpkin powder (T<sub>4</sub>) and fortification with carrot + pumpkin powder (T<sub>5</sub>). The experiment was laid out in complete randomized design (CRD) with 3 replications. All the analysis was performed using HPLC and UV-Vis Spectrophotometer. Results revealed that the vitamin C and  $\beta$ -carotene of the control sample of the treated lentils were 3.52 mg/100 g and 18.27 mg/100 g but after fortification the vitamin C was increased from 5.81 to 7.49 mg/100 g and 5.04 to 25.54 mg/100 g by all the treatments, indicates that the level of vitamin C and  $\beta$ -carotene was increased after fortification into chips as compared to the control. Likely the processing loss of vitamin C and  $\beta$ -carotene was also recorded as 17-36 % and 2-40 % during fortification but actually the fortification process increased the vitamin C and  $\beta$ -carotene than the control sample.

## **DESIGN AND FABRICATION OF SMART PACKAGES IN TERMS OF STORAGE AND MARKETING OF THE DEVELOPED LENTIL CHIPS**

M.M.Molla, M.H.H.Khan, M.G.F. Chowdhury, M.M.Rahman, S.Pervin, B.C.Dey, P.Sen, M.S.Zaman, R.Podder, P.Bhowmik and A.Khatun

The study was conducted to develop 3D attractive smart package to increase the marketable life of the product and cost-benefit ration of the developed lentil chips under smart packages. The packages has been developed with the technical assistance of the Quality Management System Certified Company “Phoenix” (ISO 9001:2015), Naya Paltan, Dhaka. The smart packages was printed under the the BDS code 1556 approved by the Bangladesh Standard and esting Institute (BSTI) with nutrition facts and detailed information of the manufacturer. The packet was designed in favor of ‘South Asian Agro Products (brand RESCO)’ as ‘Chips Dal’ as net weight 15 g of chips during packing. In commercial aspect, the chips were packed with nitrogen flash and were stored at ambient conditions to record their marketable life and cost-benefit ratio of the chips. The mmarketable life of the chips was monitored at 15 days of intervals until the chip’s loss of their crispiness due to the leaching of nitrogen and mechanical error over the storage periods. No crispiness and odd flavor were recorded up to 5 months. The better crispiness and good appearances without deteriorating any quality is considered as maximum marketable life limit.

## **EFFECT OF BLANCHING ON THE QUALITY AND SHELF LIFE OF BARI PANIKOCHU**

S. PERVIN, M.H.H KHAN, M.G.F. CHOWDHURY AND M.M. MOLLA

Panikochu (*Colocasia esculenta*) is an important tropical root crop, widely grown and consumed in Bangladesh for its rich nutritional content and culinary applications. Despite its popularity, fresh panikochu are highly perishable, creating challenges in terms of storage and distribution. Panikochu is a starchy vegetable with a mildly sweet flavor and a potato-like texture. Its high fiber content and essential nutrients offer various health benefits, such as improved blood sugar regulation and enhanced gut and cardiovascular health. Blanching, a vital pre-freezing step, is employed to deactivate endogenous enzymes in vegetables, which helps preserve their quality during storage. The present study aims to assess the physicochemical properties of frozen panikochu and to examine the shelf life of blanched panikochu during extended storage.

Fresh Panikachu of two varieties BARI Panikachu 4 and 5 were obtained from local farmers and prepared through sorting, grading, washing, and cutting. The cut panikochu were soaked in a potassium

metabisulfite (KMS) solution (1g/L) for 10 minutes. Blanching was performed using both water and steam for durations of 0, 1, 2, and 3 minutes, followed by immediate cooling. The treated panikochu were packed in high-density polyethylene bags and stored in a deep freezer.

The effects of blanching and storage on the quality and shelf life of two panikochu (*Colocasia esculenta*) varieties, BARI Panikochu-4 and BARI Panikochu-5 were observed. Blanching times of 0, 1, 2, and 3 minutes were used to determine their impact on antioxidant, energy, and phenolic content during six months of storage. Results showed that extended blanching (3 minutes) significantly improved antioxidant, energy, and phenolic retention in both varieties. BARI Panikochu-5 blanched for 3 minutes demonstrated the highest antioxidant and energy values, while BARI Panikochu-4 blanched for 3 minutes had the highest phenolic content. Blanching time and variety play crucial roles in maximizing nutrient retention and extending shelf life. Longer blanching times are recommended for enhanced quality and shelf life.

### **KINETICS OF DRYING AND REHYDRATION ON GREEN PEAS USING CABINET DRYER**

S. PERVIN, M.M. RAHMAN, M.G.F. CHOWDHURY, AND P. SEN

Green peas (*Pisum sativum*), a leguminous vegetable, have long been a staple in human diets due to their rich nutritional profile. They are a valuable source of protein, vitamins, and minerals, while being low in fat, high in fiber, and free from cholesterol. However, fresh green peas, containing approximately 78% moisture, are highly perishable. To extend their shelf life, various preservation techniques, including drying, canning, freezing, and cold storage, are commonly employed (Doymaz and Kocayigit, 2011). Among these methods, drying is increasingly popular as it enhances shelf life, improves handling and transportation, and preserves palatability (Jadhav et al., 2010). The study of rehydration kinetics for dried food products has been explored in previous research (Madamba and Liboon, 2011). In this context, the present study aims to evaluate traditional methods for processing green peas, investigate their drying kinetics, and identify optimal drying parameters for efficiency. Additionally, the study assesses the rehydration characteristics of the dried green peas. Fresh green peas were sourced directly from local farmers and underwent sorting, washing, and cleaning. Following this, water blanching was performed and immediately followed by cooling. The peas were then dried using a cabinet dryer. Once dried, the peas were packed in high-density polyethylene (HDPE) bags and stored at ambient temperature for duration of 12 months.

Drying and rehydration kinetics of green peas using a cabinet dryer at three different temperatures (48°C, 58°C, and 68°C). Fresh green peas were either blanched or unblanched before drying, and the experiment followed a completely randomized design (CRD). The moisture ratio (MR) and rehydration properties were analyzed. Results indicated that higher temperatures led to quicker drying rates, with blanched peas demonstrating superior rehydration ratios. The highest rehydration ratio (2.36) was observed in blanched peas dried at 48°C ( $T_2$ ), while the highest coefficient of reconstitution (10.90) occurred in blanched peas dried at 58°C ( $T_4$ ). This study emphasizes the importance of blanching and appropriate drying temperatures for producing high-quality, dehydrated green peas with better shelf life and rehydration characteristics.

### **STANDARDIZATION OF OSMOTIC DEHYDRATION PROCESS FOR TODDY PALM**

S. PERVIN, M.H.H KHAN, M.M. RAHMAN AND B.C. DEY

The toddy palm (*Borassus flabellifer*) is a highly valued fruit, renowned for its medicinal and nutritional properties. Referred to as the "Wishing Tree" due to its ability to produce a wide range of economically significant products, the palm holds considerable potential for value addition. Despite this, processed toddy palm products remain scarce in the market, representing an untapped opportunity for diversification. Osmotic dehydration, a promising preservation method particularly suited for small-scale

processing, can extend the shelf life of seasonal toddy palm products while maintaining their quality. This study aims to optimize the osmotic dehydration process for toddy palm, with a focus on preserving its physicochemical qualities. By doing so, it seeks to minimize post-harvest losses, increase availability, and meet consumer demand throughout the year. Toddy palm were collected from the farmer's field. Fruits were sort, wash and clean. After preparation of osmoses palm by osmotic dehydration method and kept into glass jar. All packaged products were properly labeled and stored at ambient temperature (25-35°C). Osmotic dehydration is a process for toddy palm to enhance its physicochemical qualities and extend shelf life. Six treatments with varying sugar concentrations (0%–25%) were applied. The texture, energy content, and overall acceptability were evaluated over a six-month storage period. Results showed that the higher sugar concentrations improved texture firmness and energy content, with the 25% sugar treatment (T<sub>6</sub>) exhibiting the best performance. However, overall acceptability decreased over time, particularly in samples with lower sugar concentrations. Osmotic dehydration proved effective in extending the shelf life of toddy palm while maintaining its physicochemical properties, making it a promising method for small-scale processing and value-added product development.

### **STANDARDIZATION OF PROCESSING METHOD FOR GREEN COCONUT WATER JELLY** S. PERVIN, M.H.H KHAN, M. M. MOLLA AND M.G.F. CHOWDHURY

Coconut (*Cocos nucifera* L.) is a vital commercial crop in tropical regions, often referred to as the "tree of heaven" or "tree of abundance." It is a versatile crop with uses ranging from foods to cosmetics (Prasad *et al.*, 2011). Coconut water jelly is a product made by boiling coconut water with sugar, pectin, and acid to create a gelatinous consistency containing fruit pieces suspended in the jelly. The aims of this study were to standardize processing method for green coconut water jelly and to evaluate its nutritional quality and storage life. Green coconuts were collected from local farmers. The coconut water jelly was prepared and stored in plastic jars under refrigeration.

Green coconut water jelly was prepared using six different formulations, with varying amounts of sugar and citric acid. The physicochemical properties, including total soluble solids (TSS), phenolic content, and overall acceptability, were evaluated over 15 days of refrigerated storage. Treatments with higher sugar content (T<sub>3</sub>, T<sub>6</sub>) maintained higher TSS, while citric acid-containing treatments (T<sub>4</sub>, T<sub>5</sub>, T<sub>6</sub>) retained more phenolic content. The overall acceptability of the jelly decreased during storage, with sugar and citric acid contributing to better sensory properties. Formulations with higher sugar and citric acid showed better preservation of TSS, phenolic content, and sensory acceptability over a 15-day storage period, indicating their importance in maintaining product quality.

### **STANDARDIZATION OF PROCESSING METHOD FOR OSMO DEHYDRATED SUGAR COATED PLUM**

S. PERVIN, M.H.H. KHAN, M. M. MOLLA AND M.G.F. CHOWDHURY

Plum (*Prunus domestica*) is a valuable spice crop known for its antioxidant properties and mild laxatives. However, postharvest losses due to perishability are significant in Bangladesh. The release of the high-yielding variety "BARI Alu bukhara-1" offers potential to enhance plum production. Osmotic dehydration, a promising preservation method, improves quality and reduces drying time. The study aims to enhance plum utilization, minimize losses, and extend shelf life through value-added product development. The present study standardizes and produces high-quality osmo-dehydrated plum products. Plum (*Prunus domestica*) with optimal ripeness was collected from local farmer. Fruits were sorted, washed and cleaned. Then, the fruits were dipped in 40, 50 and 60 °Brix sugar syrup for 24 h and then it boils for 15 min. The drying temperature was maintained at 60 °C. After drying, the plum was preserved in a glass container.

Plum fruits were treated with 40, 50, and 60 °Brix sugar syrup and sugar coating. Texture analysis revealed a decrease in firmness during storage due to cell structure breakdown and enzymatic activity. Color intensity decreased significantly over 12 months of storage, while total phenolic content declined with increasing brix and prolonged storage. Osmo-dehydrated plum exhibited excellent energy content. The highest overall rating was given to plum treated with 50 °Brix sugar syrup and sugar coating. Osmotic dehydration with sugar coating at 50 °Brix showed the most promising results for preserving plum, enhancing overall quality and energy content. This technique presents an effective method for extending plum shelf life and creating value-added products for commercial use.

## **OPTIMIZATION OF PROCESSING METHOD FOR DRAGON FRUIT JAM**

S. PERVIN, M.H.H KHAN, M.M. MOLLA AND A.S.M.H. RASHID

Dragon fruit (*Hylocereus undatus*) is a tropical fruit that has become increasingly popular in recent years. Processed dragon fruit products are rarely available in our markets and very little work has been done on processing of dragon fruit in our country. A number of locally processed fruit products are now available in the market. If quality products from dragon fruit are developed, it might be welcomed by the consumers who have affinity for dragon fruit round the year. Therefore, the present study was carried out to optimize the processing method for dragon fruit jam and to evaluate its quality parameters for long time storage at ambient temperature.

There were five treatments employed, varying the sugar content in the dragon fruit pulp. The pH, acidity, TSS (%), color, microbial growth, and sensory evaluation were conducted over a storage period of six months. The results revealed that higher sugar content led to lower initial pH and higher acidity in the jam. TSS values were highest in treatment T<sub>5</sub> (100% sugar in pulp). Color intensity decreased during storage, and microbial growth remained within acceptable limits. Sensory evaluation indicated that jam with 80% sugar in pulp (T<sub>4</sub>) received the highest overall rating. The research outcomes contribute to enhancing the production of high-quality dragon fruit jam with improved shelf life and consumer acceptance.

## **EFFECTS OF DIFFERENT DRYING METHODS ON PHYSICOCHEMICAL AND FUNCTIONAL PROPERTIES OF BARI SWEET POTATO 17**

B.C. Dey, M.M. Rahman, M.H.H.Khan, M.G.F. Chowdhury, M.M. Molla, S. Pervin, A.A. Sabuz, P. Sen, and M.S. Alam

The main objective of our study was to investigate the effects of various drying techniques on the physicochemical and functional characteristics of BARI sweet potato 17. Three distinct techniques of drying sweet potatoes (i.e., sun drying, cabinet, and freeze drying) were used, and the changes in food components were evaluated. In this experiment, the initial moisture content of fresh sweet potatoes was found to be 67.22 %, whereas the moisture content of dried sweet potatoes varied from 4.89 % to 7.78 %. The findings corroborate with the observation of Rodrigues et al., 2016. The ash content in fresh sweet potatoes was 1.01% which was increased for all drying methods and the values varied from 1.89 %, 2.20 %, and 2.42 % for sun, cabinet, and freeze-dried sweet potatoes, respectively. These experimental observations for ash content were close to the values reported by Mohammad et al., 2016. The present study reveals that the anthocyanin content of freeze-dried sweet potatoes (0.63 mg/100 g) was significantly higher than other samples. Our findings were lower than the previous study by Rodríguez-Mena et al., 2023. Results also showed that freeze-dried sweet potatoes' β-carotene and ascorbic acid content were significantly higher than sun and cabinet-drying samples. The total phenolic content for sun drying, cabinet, and freeze drying was 18.49, 19.49, and 25.07 mg/100 g, respectively. The carotenoid

content of freeze-dried sweet potatoes (2.79 mg/100 g) was significantly higher than sun and cabinet-dried samples (2.18, 2.42 mg/100 g respectively). Compared to other samples, sun-dried sweet potatoes had higher losses of nutritional content. The color attributes for sun drying, cabinet, and freeze drying were significant, and the findings were consistent with a former study by Bakar et al., 2022. The results revealed that the water absorption capacities of the sun, cabinet, and freeze-dried sweet potatoes were 130.89, 154.89, and 181.33 % respectively and oil absorption capacities were 121.22, 130.56, and 162.67 % respectively. Our findings stated that the water and oil absorption capacities (WAC/OAC) of freeze-dried samples were significantly ( $p \leq 0.05$ ) higher than those of sun and cabinet drying. These functional properties are useful in structure interaction in food, especially in flavor retention, palatability improvement, and shelf-life extension, particularly in bakery products (Adebawal and Lawal, 2004). Therefore, it could be concluded that freeze-drying techniques produced superior quality sweet potato flour with retaining color and nutrients than cabinet and sun drying.

## **DEVELOPMENT OF BAKERY PRODUCTS FROM SWEET POTATO FLOUR AND EVALUATION OF ITS QUALITY**

B.C. Dey, M.M. Molla, M.H.H.Khan, M.M. Rahman, M.G.F. Chowdhury, S. Pervin, A.A. Sabuz, P. Sen, and M.S. Alam

The blending of wheat flour with sweet potato flour (SPF) in five different formulations (10 %, 20 %, 30 %, 40 %, and 50 %) was used to produce composite biscuits, and control was considered without the addition of sweet potato flour. The physical properties of composite biscuits in weight, diameter, and thickness were changed with the enhancement of sweet potato flour. The weight of the control and developed biscuits ranged from 11.28 to 11.85 g with a maximum value in T<sub>6</sub>. The diameter of biscuits sample T<sub>3</sub> was found slightly higher and other samples were lower than that of control biscuits. The thickness of the biscuits ranged from 0.79 to 0.85 cm. The changes in diameter and thickness were reflected in the spread ratio. The spread ratio of the control biscuit was 7.91, whereas T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub>, and T<sub>6</sub> showed lower spread ratios. The energy content of the T<sub>6</sub> biscuits was significantly higher than other treatments. The quality of the biscuits is primarily defined by color and textural profile. Results revealed that the color of the biscuit samples was significant. The trend of diminishing the color of biscuits with higher incorporation of that composite flour. Control biscuits had a hardness value of 21.97 N which increased to 23.71 N in T<sub>2</sub>, 24.68 N in T<sub>3</sub>, 26.17 N in T<sub>4</sub>, 27.09 N in T<sub>5</sub>, and 34.25 N in T<sub>6</sub>. Among all formulations, T<sub>6</sub> biscuit samples showed more hardness (34.25 N) indicating that hardness increased with the increase of substitution and provided significantly higher amounts of energy than other formulations. The control and developed biscuits were subjected to evaluate sensory attributes according to a nine-point hedonic scale. Results also depicted that overall acceptability for composite biscuits achieved the maximum score for T<sub>6</sub> followed by T<sub>5</sub>, T<sub>4</sub>, T<sub>3</sub>, and T<sub>2</sub> as compared to the control (T<sub>1</sub>). Sensory attributes of composite biscuits also revealed that there was a significant difference ( $P \leq 0.05$ ) in color, flavor, taste, texture, and overall acceptability.

## **EFFECT OF COATINGS ON THE PHYSICOCHEMICAL PROPERTIES OF AIR FRIED JACKFRUIT CHIPS**

P. Sen, M.H.H. Khan, M.G.F. Chowdhury, M.M. Molla

Jackfruit (*Artocarpus heterophyllus*), the world's largest edible fruit, is celebrated for its rich nutritional value and is the national fruit of Bangladesh. But despite being the second largest producer country in the

world, 45% of national fruits are wasted every year in Bangladesh. The high rate of wastage presents a critical challenge, emphasizing the urgent need for innovative solutions to harness the fruit's full potential. Nowadays the popularity for fried products increased considerably. The mounting health concerns regarding the consumption of fried product due to its fat content has raised an alarm to search for an alternative way in frying mechanisms. Air fried Jackfruit bulb chips can be that wanted option as low fat snacks with traditional flavor and texture characteristics. The objectives of the experiments were; to evaluate the effectiveness of different coatings on air fried jackfruit chips, to assess and compare the quality characteristics of the prepared air fried jackfruit chips.

This study investigated the effectiveness of different coatings like maltodextrins, sugar, rice flour, corn flour; to assess and compare the various physicochemical properties of air fried jackfruit chips. Five treatments were evaluated for their moisture content (MC), ash content, pH, total soluble solids (TSS), acidity, vitamin C, energy content, carotenoid, phenol levels, and color attributes ( $L^*$ ,  $a^*$ ,  $b^*$ ) were analyzed. Results revealed significant variations across treatments. Control samples exhibited the lowest moisture content (3.46%) and ash content (1.21%), with moderate pH (6.13) and TSS (3.70). It also had the lowest acidity (0.51%) and vitamin C (3.66 mg). Maltodextrin treatment showed the highest moisture content (7.12%) and energy (6260.63 kJ), with the highest TSS (4.13) and acidity (1.02%). Sugar flour coating presented high carotenoid levels (21.63 mg) and vitamin C (4.33 mg), alongside a high TSS (4.63) and pH (6.14). Rice flour coatings had the highest ash content (1.60%) and exhibited the highest color parameter  $L^*$  (53.14), indicating a lighter color, while corn flour coated samples displayed the highest vitamin C content (7.33 mg) and lowest color parameter  $b^*$  (28.95), indicating a more intense color. The findings highlight the significant differences in physicochemical properties among treatments, suggesting varying nutritional and sensory profiles that may influence the choice of treatment based on desired product characteristics.

## **STANDARDIZATIONS OF MIXED FOXTAIL MILLET-JACKFRUIT SOURDOUGH BREAD**

P. Sen, M.H.H. Khan, M.M. Molla, S. Pervin

Foxtail millet (*Setaria italica* L. Beauv.); an underused, drought-resistant and nutritionally enriched crop. It can play an important role in an upcoming possibly much warmer and dryer environment. The weather of Bangladesh is also perfect for the delicious and nutritionally enriched jackfruit cultivation. But the current trend of foxtail millet and jackfruit production is declining due to low return and high post-harvest losses, and it is alarming. In this connection, tuning foxtail millet and jackfruit into flour may be appreciated by a wide range of consumers. However, health-conscious people cannot find option to choose bakery products as nutritious snacks due to high level of sugar and oil content. Sourdough bread confides on a combination of wild yeast and lactic acid bacteria to leaven the dough. It is highly nutritious and control blood sugar by reducing the GI of bread. The low gluten content of sourdough bread aids digestibility and sourdough fermentation enhanced the nutrient bio accessibility. For this reason, a sugar and oil free, healthy and value-added foxtail millet-jackfruit sourdough bread technology for all through the year, will be an option to satisfy the cultivars and the consumer's needs.

This study investigated the impact of varying proportions of millet and jackfruit flours on the physicochemical and physical properties of sourdough bread. The standardization of mixed foxtail millet-jackfruit sourdough bread involved six treatments: T1 (100% wheat flour), T2 (100% jackfruit flour), T3 (25% millet:75% jackfruit), T4 (50% millet:50% jackfruit), T5 (75% millet:25% jackfruit), and T6 (100% millet flour). Six formulations ( $T_1$ – $T_6$ ) were analyzed for moisture content, ash, pH, total soluble solids (TSS), acidity, phenol content, carotenoids, energy value, color parameters ( $L^*$ ,  $a^*$ ,  $b^*$ ), and bread dimensions (specific volume, height, diameter, weight, and volume). Results indicated that moisture and carotenoid content increased with jackfruit flour, while millet flour enhanced phenolic content, acidity, and reduced energy value. The combination of millet and jackfruit flour significantly influenced bread structure, with wheat-based bread ( $T_1$ ) showing the highest specific volume, while millet-rich breads were flatter with greater diameter. Jackfruit flour lightened the bread color, contributing to higher yellowness,

while millet darkened it. T<sub>4</sub> (50% millet: 50% jackfruit) offered a balanced profile in terms of flavor, nutrition, and physical attributes. These findings suggest that millet and jackfruit flour can enhance the nutritional value and sensory qualities of gluten-free sourdough bread, making it a viable alternative for health-conscious consumers.

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**Postharvest Technology Section, HRC**



## **DETERMINATION OF MATURITY INDICES AND PROPER HARVESTING TIME OF SWEET ORANGE VAR. BARI MALTA-1**

M.A. RAHMAN, S. ARFIN and Z.H. FAHAD

### **Abstract**

An experiment was conducted to determine the optimum maturity stage and proper harvesting time of sweet orange (*Citrus sinensis*) var. BARI Malta-1 at the Horticulture Research Centre of Bangladesh Agricultural Research Institute (BARI), Gazipur during March to December 2023. Fruits were harvested from the research orchard of BARI at 15 days intervals starting from 15 August and ended on 01 December. Results of this study showed that different harvesting dates had significant effect on the physico-chemical traits and storability of malta fruits. An increasing trend was found in fruit weight and diameter, juice content, total soluble solids and juice content and pH with the advancement of fruit maturity and delaying the harvesting time. On the other hand, fruit tissue firmness, total acidity and vitamin C contents had a gradual decreasing trend with delaying the harvesting time. The colour of fruit skin changed from deep green to yellowish during the maturation time. At  $6\pm 1^{\circ}\text{C}$  and  $65\pm 5\%$  RH, the maximum storage life 98-96 days was found in fruits harvested from 15 September to 01 October. Based on the comprehensive consideration, fruits of BARI malta-1 attained the maximum quality traits, taste and flavour during 01 October to 15 November, and hence should be harvested within this period to get best quality fruits and higher market price.

**Keywords:** BARI malta-1; fruit quality; maturity indices; harvest time; physico-chemical properties, storage life.

## **DEVELOPMENT OF LOW-COST RIPENING CHAMBER AND NOVEL ETHYLENE GENERATOR FOR UNIFORM AND SAFE RIPENING OF JACKFRUIT**

M.A. RAHMAN, M.S. ARFIN and Z.H. FAHAD

### **Abstract**

An experiment was conducted in the laboratory of Postharvest Technology Section, Horticulture Research Centre, BARI, Gazipur, Bangladesh to develop a low-cost ripening chamber along with a novel ethylene gas generator (EG) for uniform and safe ripening of jackfruit. Four simple ripening chambers were made with locally available bamboo sticks, jute rope and high-density polyethylene (50  $\mu\text{m}$ ) film. The volume of each chamber was about one cubic meter ( $1\text{m}^3$ ). To get ethylene gas, novel EG was prepared with small plastic jar, a piece of cotton, 2ml ethephon and 3ml aqueous solution of NaOH. Ten well-matured but unripe jackfruits were placed into each chamber. To standardize the required number of EG; one, two or three EGs were placed around the fruits inside the ripening chamber. Chamber without EG was considered as control treatment. After 24h of treatment application jackfruits were taken out from chambers and allowed for ripening. The developed low-cost ripening chamber and novel EG found highly effective in triggering the ripening process of jackfruit within short time. Almost 100% jackfruits were uniformly ripened after 36h of treatment application even with single EG. In contrast, ripening of jackfruits under control treatment started after 60h of treatment application, increased the number gradually reaching 100% after 120h. The quality of ripe jackfruit was better, and marketable to the local as well distant markets. This is a very simple, economic and effective technology for uniform and safe ripening of jackfruits, and thus jackfruit growers and traders may be used it for proper marketing of fruits.

**Keywords:** Jackfruit, artificial ripening, ripening chamber, ethylene generator, quality

## **NANO-PACKAGING OF EGGPLANT TO EXTEND THE SHELF LIFE MAINTAINING QUALITY AND FOOD SAFETY**

M.A. RAHMAN, M.S. ARFIN and Z.H. FAHAD

### **Abstract**

The effect of polymeric packaging film in extending the shelf life and postharvest quality of 'BARI Eggplant-8' was investigated. Eggplant fruits were harvested at commercial maturity stage and immersed in 0.05% aqueous scallop powder solution, fan-forced air-dried and packed into 0.5% perforated and non-perforated polyethylene, polypropylene, TiO<sub>2</sub> incorrated nano-polyethylene film and open basket (control). The fruits were then stored at ambient room condition (25±1°C and 65±5% RH) for 12 days. The rate of decrease in weight loss, tissue softening and ascorbic acid content delayed in fruit packed into different packaging film. The higher accumulation of CO<sub>2</sub> in non-perforated packaging films (1.06-1.2 ml kg<sup>-1</sup>h<sup>-1</sup>) reduced the respiration rate compared to unpackaged control fruits and consequently extended at least six days extra storage life. In contrast, tissue firmness and ascorbic acid contents of eggplants kept in unpackaged condition quickly decreased during the stipulated storage period along with higher transpiration loss was observed in unpackaged eggplant exhibiting values 14.8% on day 5 of storage resulting completely senescence of fruit. Results of this study demonstrated the efficacy of both perforated and non-perforated packaging films on eggplant quality and postharvest life. Therefore, these packaging films may be used as MA packaging in retail shop to extend the shelf life of eggplant up to 10-11 days at ambient conditions.

**Keywords:** Eggplant, Postharvest shelf life, Nano-packaging film, Delay senescence, Ambient storage

## **NANO-PACKAGING OF TOMATO TO EXTEND THE SHELF LIFE MAINTAINING QUALITY AND FOOD SAFETY**

M.A. RAHMAN, M.S. ARFIN and Z.H. FAHAD

### **Abstract**

The effect of polymeric packaging films in extending the shelf life maintaining the postharvest quality of tomato var. 'BARI tomato-15' was investigated. Tomato fruits were harvested at the breaker-turning stage and immersed in 0.05% aqueous scallop powder solution, fan-forced air-dried, and packed into 0.5% perforated and non-perforated polyethylene, polypropylene, TiO<sub>2</sub> incorrated nano-polyethylene film and open basket (control). After packaging, the fruits were stored at ambient room condition (25±1°C and 65±5% RH) for ripening over 12 days. The rate of decrease in weight loss, tissue softening, surface colour development and ascorbic acid content delayed in fruit packed into different packaging films. The maximum delay occurred in fruits packed in non-perforated polymeric films. The higher accumulation of CO<sub>2</sub> in non-perforated packaging films reduced the respiration rate compared to unpackaged control fruits. In contrast, the hue angle of fruit surface colour, tissue firmness and ascorbic acid contents of tomatoes kept in unpackaged condition quickly decreased during storage exhibiting values 39.3°, 0.49 kgf and 10.9 mg 100g<sup>-1</sup>, respectively resulting completely ripened of fruit on day 6 of storage. Results of this study demonstrate the efficacy of both perforated and non-perforated film on tomato fruit ripening and imply prospects for using as MA packaging in retail shop for to extend the shelf life up to 10-12 days at ambient conditions.

**Keywords:** Tomato, Postharvest shelf life, Nano-polymeric film, Delay Ripening, Ambient storage

## **MATURITY DETERMINATION OF BROCCOLI**

M. S. ARFIN, M.A. RAHMAN, M. F. B. HOSSAIN and Z.H. FAHAD

### **Abstract**

The designed experiment aimed to determine broccoli's optimum maturity stage and shelf life (*Brassica oleracea* L. var. *italic*). The experiment was initiated at the field and laboratory of the Postharvest Technology Section, Horticulture Research Centre, Bangladesh Agricultural Research Institute, Gazipur, in November 2023. BARI Broccoli -1 was selected for the study. The heads were collected as per treatments and brought to the Postharvest Technology Laboratory, stored at ambient conditions ( $23\pm 2$  °C) for physicochemical parameters measure. Quality parameters like color, chlorophyll a, and ascorbic acid content were considered here. The heads were harvested at different harvesting dates 53, 56, 59, 62, and 65 days after transplanting was selected as experimental treatments. After transplanting it was kept for three days at ambient conditions ( $23\pm 2$  °C) for shelf-life study. The experiment design was RCRD at field and CRD at laboratory with three replications. Broccoli harvested at 65 days after transplanting showed slower changes in surface colour ( $a^* -2.96$  to  $-4.84$ ,  $b^* 6.92$  to  $15.58$ ),  $6.18$  mg/100g, and Vitamin C content  $50.41$  mg/100g. Considering all physicochemical parameters, broccoli harvested 65 days after transplanting prolonged the shelf-life by up to three days at ambient conditions.

## **SURVEY ON POSTHARVEST PRACTICES AND LOSSES IN THE GUAVA VALUE CHAIN**

Z.H. FAHAD, M.N. ISLAM, M.A. RAHMAN and M.S. ARFIN

### **Abstract**

A study was conducted to accumulate the scenario of existing postharvest practices and assess postharvest losses in the value chain of guava. The study was conducted by upstream survey in three intensive guava growing areas viz. Pirojpur, Jhalokati, and Chapainawabganj and three city areas, namely, Barisal, Dhaka, and Gazipur. From each site, ten of each value chain actors (grower, faria, bepari, arathdar and retailers) were interviewed to get answers using pre-tested questionnaires. Data on postharvest practices, losses, and other socio-economic features were gathered from January to July 2024 during the harvesting season. The collected data were compiled, analyzed, and presented on a category scale. Postharvest practices included stacking the fruits individually, sorting, grading, storing in shades, using lining or cushioning material, and optimal loading into crates. A substantial part of harvested guava was observed to be overripened in the Jhalokati and Pirojpur areas. As a result, growers harvest guava in bulk with a mixed maturity, which triggers the post-harvest loss. Stacking guava one by one in a crate or an open place is practiced mostly in the retailer and araths while at the grower level, the percentage is lower (30-40%). Sorting was lowest at grower and bepari level (20-30%) and highest at retailer (70-80%). However, Grading was reportedly practiced in retail and arath (40-60%) for price variabilities. The use of banana leaves as lining material was seen at bepari level (50-80%) in Pirojpur and Jhalokati, but in Chapainawabganj, newspapers were used primarily. Loading of guava in crates and baskets (30-60%) was hardly optimum in retailers as they Postharvest losses were reported as 1.81%, 1.68%, 5.51%, 4.99%, and 6.68% at the grower, Faria, Bepari, Arathdar, and Retailer levels; calculated total postharvest loss of guava was 20.67%.

## **OPTIMIZING VAPOR HEAT TREATMENT TEMPERATURE AND TIME TO RETAIN COLOUR AND QUALITY OF LITCHI**

M.S. ARFIN, M.N. ISLAM, M. F. B. HOSSAIN and M. M. RAHMAN

### **Abstract**

The experiment was conducted at the laboratory of Postharvest Technology Section, HRC, BARI Gazipur, to investigate the effectiveness of temperature and time of vapor heat treatment. The experiment was designed with a fixed temperature and variable holding time, such as 47°C for 10, 20, 30, and 40 minutes. The effect was observed with the control by the retention of color and quality of litchi at refrigerated ( $4\pm 1^\circ\text{C}$ ) conditions. The findings of the present study revealed that moist vapor heat treatment had a positive effect on colour and quality retention and shelf life of litchi. 47°C for 30 minutes treatment showed the minimum colour change (chroma 38.17 and hue angle 18.47). The control showed the maximum colour change (chroma 30.54 and hue angle 12.71) in 30 days of storage. The TSS increased with the storage period. Overall, the highest TSS was 20.20%, and the lowest was 18.47% in control after the 30th day of storage. The pH showed a decreasing trend during storage. The pH of 2.7 was observed at 47°C for 30 min treatment in that period, while the control showed the highest pH of 2.9 on the 30<sup>th</sup> day of storage. Considering all physicochemical parameters, 47°C for 30 min vapour heat treatment was effective for retaining skin colour and quality of litchi with 30 days of storage period.

## **PHYSICOCHEMICAL CHARACTERISTICS AND ACCEPTABILITY OF DRAGON FRUIT JAM PREPARED FROM PEEL AND PULP**

Z.H. FAHAD, M.N. ISLAM, M.A. RAHMAN and M.S. ARFIN

### **Abstract**

The sole purpose of the study was to identify suitable formulations in terms of physicochemical and organoleptic properties utilizing the dragon fruit peel in processed jam. The experiment was conducted in the laboratory of the Postharvest Technology Section of HRC, BARI, Gazipur. The raw materials (BARI Dragon Fruit-1) were collected from the farmers' field at the early ripe stage. The designed experiment had five treatments varying pre-selected peel pulp ratios with a fixed sugar percentage of 50% used in the prepared jam. The treatments consisted of T<sub>1</sub> (only pulp), T<sub>2</sub> (25% pulp and 25% peel), T<sub>3</sub> (25% pulp and 25% peel with lemon juice equivalent of the replaced citric acid), T<sub>4</sub> (37.5% pulp and 12.5% peel) and T<sub>5</sub> (12.5% pulp:37.5% peel). The design of the experiment was CRD with three replications. The usable portion of whole dragon fruit was increased from 63.34±5.08 % (Only Pulp) to 90.74 ±1.70% (Pulp and peel) while using peel in a processed jam. Observation of the samples for six months showed that TSS and total sugar increased slightly during storage for all the treatments, and the ascorbic acid content decreased due to thermal and oxidative degradation during storage in ambient conditions. The color stability was stable in T<sub>4</sub>. During storage, it scored 11.84 in redness(a\*), 3.31 in lightness(L\*), and 3.89 in yellowness(b\*). T<sub>5</sub> was not stable in color properties as it initially showed the least redness with high lightness and yellowness. The organoleptic result showed the T<sub>4</sub> (37.5% pulp and 12.5% peel) formulation to be the best in overall acceptability and marketability. The color parameters also showed stability in the storage in T<sub>4</sub> compared to others. T<sub>5</sub> (12.5% pulp:37.5% peel) formulation has the lowest overall acceptability and marketability score. The study provides valuable insight into the alternate use of fruit wastage in commercial dragon fruit jam, such as peel. Jams formulated using such fruit parts may be commercially viable and nutritionally beneficial.

## **OPTIMIZATION OF RECIPE ON THE PRODUCTION OF STRAWBERRY- FLAVOURED ASH GOURD JAM**

Z.H. FAHAD, M.N. ISLAM, M.S. ARFIN and M.A. RAHMAN

### **Abstract**

The primary objective of this study was to optimize the formulation of vegetable jam with strawberry pulp and flavourings to enhance overall acceptance and sustained quality during storage. The experiment was conducted in the laboratory of the Postharvest Technology Section of HRC, BARI, Gazipur. The jam was prepared with a standard procedure, and five treatments were tested for effectiveness. Treatments were T<sub>1</sub>(only ash gourd pulp no additional strawberry pulp), T<sub>2</sub>(10% strawberry pulp, 0.05% flavour, and 0.025% food color), T<sub>3</sub>(10% Strawberry pulp with no food color or flavour), T<sub>4</sub>(10% Strawberry pulp with no food color or flavour but citric acid is replaced with equivalent lemon juice) and T<sub>5</sub>(Only ash gourd pulp with 0.05% flavour and 0.025% food color). The design of the experiment was CRD with three replications. The physicochemical properties of the strawberry-flavoured jam were observed for 6 months. The TSS, acidity, total sugar, and reducing sugar of all the treatments increased with the storage period, whereas the pH and ascorbic acid content decreased. The maximum ascorbic acid content was 5.85±0.13mg/100g in T<sub>4</sub>, whereas the lowest was 2.96±0.13 mg/100g in T<sub>1</sub>. At the initial stage, T<sub>1</sub> showed the highest lightness(L\*), 24.98±0.13, which changed to 27.34±0.22 during storage. The lowest lightness(L\*) was 4.08±0.07 in T<sub>2</sub>, which changed to 13.46±0.05 in the 6<sup>th</sup> month. Although the redness(a\*) of all the treatments except T<sub>1</sub> showed closer values, all significantly differ with T<sub>1</sub>. T<sub>1</sub> showed a negative value of -1.71±0.03 and -0.68±0.04 for redness(a\*) in the initial and 6th months, respectively. The yellowness(b\*) was higher at 17.00±0.07 in T<sub>4</sub> at the initial stage, with no significant difference between the groups. The organoleptic analysis showed an overall acceptability of T<sub>2</sub> with a score of 7.9±0.57 was the highest, while T<sub>1</sub> performed lowest with a score of 5.2±0.92. On the other hand, marketability was also highest for T<sub>2</sub>, followed by T<sub>5</sub>, which ranked second in scoring on overall acceptability and marketability. The study gave insight into the potential use of vegetables in process industries incorporated with fruits.

## **OPTIMIZATION OF DRYING TEMPERATURE FOR RETAINING COLOUR AND BIO-ACTIVE PROPERTIES OF BUTTERFLY PEA AS FUNCTIONAL DRINK SOURCE**

Z. H. FAHAD, M. A. RAHMAN, M. S. ARFIN and N. T. HASAN

### **Abstract**

The sole purpose of the study was to observe the bioactive response and qualitative sustainability of butterfly peas dried at different temperatures. The experiment was conducted at the Laboratory of Postharvest Technology HRC, BARI, Gazipur, during 2023-24. Butterfly pea flowers were collected from the Floriculture division, HRC, BARI. Flowers were washed and dried at 40, 50, 60, and 70°C in a cabinet dryer for 6 hours as treatments T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, and T<sub>5</sub>, respectively. The bioactive and storage properties were observed, and the color was measured. Regarding color and storage properties, the best-suited temperature is 60°C for cabinet drying. The blueness (b\*) remained highest in T<sub>3</sub> and scored -22.4, as well as in the cold-water extraction; it scored -2.00; the total phenolic content was the highest at 16.15±0.19 mg GAE/g sample for T<sub>3</sub>; the lowest value was 14.10mg GAE/g sample in T<sub>1</sub>. The total flavonoid content was 10.76±0.40, 10.46±0.12, 13.61±0.08, 13.06±0.18mg QE/g sample for T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, and T<sub>4</sub>, respectively. The total anthocyanin content was non-significant; the higher value was 9.00±0.08 mg QE/g sample for T<sub>3</sub>, and the lowest was 8.25±0.12 mg QE/g sample for T<sub>4</sub>. The storage is affected by its packaging material. The extraction properties were highest in T<sub>3</sub>. The shrinkage was not observed at high-temperature drying initially so for the browning of the sample. However, slow drying also affected the storage quality as it shrinks and browns quickly in T<sub>1</sub> and T<sub>2</sub>. The study concludes with thermally stable insights into butterfly pea flowers for further functional food-based processing.

## **STUDY ON PREPARATION AND PRESERVATION OF FRUIT DRINK FROM JAMUN**

M.S. ARFIN, M.N. ISLAM, M. F. B. HOSSAIN and M.A. RAHMAN

### **Abstract**

The experiment was conducted at the laboratory of Postharvest Technology Section, HRC, BARI, Gazipur, to investigate the effectiveness of different preservatives such as citric acid, Potassium metabisulphite (KMS), and sodium benzoate in the quality retention of jamun juice in refrigerator ( $4\pm 1^{\circ}\text{C}$ ). The design of the experiment was CRD with three replications. 10% fruit juice was used for preparing drink with preservatives (KMS, sodium benzoate, citric acid), packed in glass bottle and preserved in refrigerator ( $4\pm 1^{\circ}\text{C}$ ). The present study's findings revealed that preservatives had a positive effect on jamun juice. Positive changes occurred in colour and quality of juice during storage period. The lowest colour changes in respect of  $a^*$  value decreased ( $a^* 2.92$ ), and  $b^*$  value increased ( $b^* -2.72$ ), the highest total anthocyanin content 155.4 mg/100g, total flavonoids content 35.4 mg QE/100g, total phenolic content 4.6 mg GAE/100g, vitamin C content 16.7 mg/100g and total viable content at satisfactory level ( $1.4 \times 10^4$ ) was found in KMS treated jamun drink at three month of storage in refrigerator ( $4\pm 1^{\circ}\text{C}$ ). Considering all these physicochemical parameters, KMS was found effective for retaining the food quality of jamun juice for three months of storage at the refrigerator ( $4\pm 1^{\circ}\text{C}$ ).

## **EFFECT OF PRESERVATIVES AND DRYING CONDITION IN RETAINING FOOD QUALITY OF MANGO SLICE**

M.S. ARFIN, M.N. ISLAM, M. F. B. HOSSAIN and Z.H. FAHAD

### **Abstract**

The experiment was conducted at the laboratory of Postharvest Technology Section, HRC, BARI, Gazipur, to investigate the effectiveness of different preservatives such as citric acid, potassium meta bi sulfate (KMS), and ascorbic acid in the retention of semi-solid 'harivanga' mango slice quality prepared through 70% drying. Findings of the present study revealed that preservatives had positive effect on drying of mango slice and positive changes occurred in colour and shelf life of mango slices. In 70% drying, colour saturation increased and hue angle decreased. The changing rate was higher in control slices and lower in KMS-treated slices after 12 months of storage. The maximum colour change was observed in control treatment (chroma 53.70 and hue angle 35.66) and minimum in KMS treated slices (chroma 80.30 and hue angle 59.49). Beta carotene content decreased with the drying condition and storage time. Control treatment showed the lowest value of beta carotene content 64.71 mg/100g and the highest beta carotene content 96.96 mg/100g was observed in KMS treated slices at 70% drying after 12 months of storage. Furthermore, KMS retained the change of colour and beta carotene content of mango slices in 70% drying condition and KMS was found effective for retaining food quality of mango slice at drying condition.

## **SELECTION OF SUITABLE CUTTING SIZE FOR SEMI SOLID DRY MANGO SLICE**

M.S. ARFIN, M.N. ISLAM and M. F. B. HOSSAIN

### **Abstract**

The experiment was carried out at the laboratory of Postharvest Technology Section, HRC, BARI, Gazipur, to find out the effectiveness of three cutting sizes, 2 slices per mango, 4 slices per mango, and cubes from mango for mango slice drying at 70%. Colour saturation increased and hue angle decreased while the changing rate was higher in cubed mango and lower in 4 slices per mango after 12 months of storage. The maximum colour change was observed in cubed mango (chroma 65.21 and hue angle 50.13) and minimum in 4 slices per mango (chroma 80.60 and hue angle 60.49). The total sugar decreased and reducing sugar increased with the storage time. The highest total sugar content was observed in 4 slices per mango (12.71 mg/100g) and the lowest in cubed mango (9.87 mg/100g). On the other hand, lowest reducing sugar content (3.63 mg/100g) was observed in 4 slices per mango and the highest (3.83 mg/100g) in cubed mango. Considering all these, 4 slices per mango were found to be an adequate cutting size for retaining the food quality of mango slice at drying conditions.

## **FRESH-CUT PROCESSING TECHNIQUES OF BROCCOLI USING DIFFERENT ACIDULANTS**

M. S. ARFIN, M.A. RAHMAN, M. F. B. HOSSAIN and Z.H. FAHAD

### **Abstract**

The experiment was conducted at the laboratory of Postharvest Technology Section, Horticulture Research Centre, Bangladesh Agricultural Research Institute, Gazipur. The experiment addressed the influence of ascorbic acid and citric acid on the quality loss of fresh-cut broccoli florets in a refrigerator ( $4\pm 1^{\circ}\text{C}$ ). The florets of broccoli were separated to treat the samples as pre-designed treatments of 1% ascorbic acid, 1% citric acid, only water, and no wash (control), and all samples were packed in a polypropylene (PP) box and kept in a refrigerator ( $4\pm 1^{\circ}\text{C}$ ) for shelf life and quality assessment. The shelf-life varied depending on different acidulants, and biochemical and sensory parameter like phenol, flavonoid,  $\beta$ -carotene, total chlorophyll, carotenoids, vitamin C, appearance, flavor, texture, and overall acceptability were considered here. The results highlighted that fresh-cut broccoli treated with 1% citric acid had the highest score in sensory evaluation, with 6.84 in appearance, 2.7 in flavor, 6.3 in texture, and 6.8 in overall acceptability score along with the biochemical properties of phenol 62.7 mg GAE/g,  $\beta$ -carotene 1.98  $\mu\text{g/gm}$ , total chlorophyll 0.046 mg/g, carotenoids 0.024 mg/g and vitamin C 20.7mg/100g. Considering all biochemical and sensory quality parameters, fresh-cut broccoli treated with 1% citric acid and packed in a polypropylene box prolonged the shelf life by up to six days in the refrigerator ( $4\pm 1^{\circ}\text{C}$ ). The study gives valuable insights into the fresh-cut genre for the prolonging shelf life with quality assurance in refrigerated conditions.

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## **SUITABILITY STUDY OF SRC DEVELOPED PLUM IN FRIED RICE**

M.M. ALAM, M.G.F. CHOWDHURY AND M.Z.H. PRODHAN

The present study was concerned with the acceptability of SRC developed plum variety in Biryani/fried rice and was organoleptically evaluated by the panelists using 1-9 hedonic scale. Fresh plum was collected from the SRC of BARI and were cleaned and washed with tap water and spread on a perforated tray to drain out excess water and subsequently used for preparation. The samples were treated in three ways; T<sub>1</sub>- Processed Plum (salt+ sweetener's+ vinegar+ oil), T<sub>2</sub>- Processed Plum (salt + vinegar + sugar + sweetener's + oil), T<sub>3</sub>- Processed Plum (salt + vinegar+ oil). Among three two treated products were selected as ingredient for biryani compared to imported variety of plum. A panel of 20 judges evaluated the color, smell/flavor, pungency, texture, taste and overall acceptability of the Biryani with plum. The evaluation was conducted after 12 months of storage.

For color the highest score (8.10) was given by sample T<sub>1</sub> and T<sub>2</sub> which was followed by T<sub>3</sub> with score 6.5, and sample T<sub>1</sub> was equally acceptable as sample T<sub>2</sub>. In case of flavor preference sample T<sub>1</sub> secured the highest score, 8.0 and was closely followed by sample T<sub>2</sub> and T<sub>3</sub> securing 7.60 and 6.7 and samples T<sub>1</sub> and T<sub>2</sub> are equally acceptable at 1% level and statistical insignificance. It was found that the highest score (8.20) for texture was given by sample T<sub>2</sub> and is closely followed by sample T<sub>1</sub> securing 7.80 and these samples are equally acceptable. In case of pungency preference sample T<sub>2</sub> secured the highest score, 8.10 and was closely followed by sample T<sub>1</sub> securing 8.0 and the lowest score (6.50) was given by sample T<sub>3</sub> and statistically different from sample T<sub>1</sub> and T<sub>2</sub>. For taste the highest score (8.70) was given by sample T<sub>2</sub> which was closely followed by T<sub>2</sub> and T<sub>3</sub> with score 8.3 and 6.70 and among the samples T<sub>1</sub> and T<sub>2</sub> were equally acceptable though there is little bit difference in scoring but T<sub>3</sub> statistically different from them. For overall acceptability preference the highest score (8.5) was given by sample T<sub>2</sub>. The Biryani; processed by SRC developed plum variety was most acceptable as well as imported plum. The study thus shows that SRC developed plum variety can be used as spice item as like as imported plum variety in Biryani and other for food processing.

## **NUTRITIONAL AND MICROBIOLOGICAL STUDY OF SRC DEVELOPED SPICES POWDER COMPARED TO FRESH SAMPLE**

M.M. ALAM, M.G.F. CHOWDHURY AND M.Z.H. PRODHAN

This study was concerned with the development of export-oriented quality garlic powder using dehydration technology with attractive organoleptic and nutritional properties. Uniform size garlics were sorted then were peeled manually with stainless steel knife. The garlic cloves were treated for few minutes. Dehydration of samples was done in 45-50<sup>0</sup>C in mechanical dryer up to 6-8% moisture content. After dehydration, the dehydrated garlic cloves were crushed and finely grounded to form garlic powder. Then garlic powder were packed and stored in room and refrigerated temperature.

The energy content of fresh and dehydrated garlic powder were found 44.02 and 362.35 kcal/100g. The protein content of fresh and dehydrated garlic was 5.23 and 11.55%. The fat content of fresh and dehydrated garlic powder were found 0.15 and 1.01 %. The ash content of fresh and dehydrated garlic powder were found 0.95 and 2.40%. Ash is composed of all mineral salts. The P and Ca in fresh garlic were found 0.35 and 0.05mg/100g and K, P, Na, Zn and Ca in dehydrated garlic powder were observed and 651.92, 20.8, 51.71, 35.64, 69.87 mg/100g, respectively. Total carbohydrate content of fresh and dehydrated garlic was found 11.63 and 72.39%, respectively. The vitamin C is moderately available in fresh and dried garlic (11.20 mg and 19.6 mg/100g). It was exhibited that a bit bacteria was in garlic powder after long time storage which can be destroy in cooking time but Salmonella spp. and E coli were near about absent. The study thus shows that high quality shelf-stable garlic powder can be developed utilizing available low-cost dehydration processes. When market rates of garlic are fluctuating, garlic powder can be prepared as alternative source of many culinary preparations in the off season which may save precious time, money and energy.

## **EFFECT OF DIFFERENT PRESERVATIVES, PACKAGING MATERIAL AND TEMPERATURE ON ONION PASTE**

M.M. ALAM, M.G.F. CHOWDHURY AND M.Z.H. PRODHAN

This experiment was undertaken to study the paste behavior of BARI Piaz-2. The fresh, peel and sliced onion were crushed in blender and onion paste was prepared using 100 ml water per kg sliced onion. The onion paste treated with 10% NaCl +1% Citric acid (CA)+ 1000 ppm Sodium benzoate (SB) (T<sub>1</sub>), 10% NaCl +1% CA+ 1000 ppm KMS (T<sub>2</sub>) and 1% CA alone (T<sub>3</sub>) and another onion paste (control-T<sub>4</sub>) was collected from Dhaka super shop. All the samples were stored in glass bottle (GB) and food grade plastic pot (PP) and kept in room (RT; 25-30<sup>0</sup>C) and refrigerated temperature (RFT;10<sup>0</sup>C). The effects of packaging material (GB and PP) and storage conditions (room and refrigerated condition) on the composition and keeping quality of the treated pastes were evaluated.

It was observed that the fresh onion contained moisture, 82.20 %; food energy 45.86 %; protein 1.3%; fat 0.13 %; ash 0.50 %; carbohydrate 11.25%; fibre 0.70%; vitamin C 12.0 %; acidity1.44 % and pH 4.19. The effects of temperature and storage time on the composition of onion paste produced from fresh onion treated with three types of preservatives; were packed in GB and food grade PP and stored in room (RT; 25-30<sup>0</sup>C) and refrigerated (RFT;10<sup>0</sup>C) temperature. There was little bit difference in moisture content, ash, acidity, pH and TSS with respect to increase storage period. A little bit bacteria was found in the sample of T<sub>1</sub> and T<sub>2</sub> onion paste after 270 days storage which can be destroy in cooking time but *Salmonella spp.* and *E coli* were almost absent. The color, flavor, texture and overall acceptability of the onion pastes, treated with 10% NaCl+1% CA+1000ppm KMS was more acceptable at room up to180 days and refrigerated temperature up to 270 days for both packaging. The onion paste of GB shown little bit better results compared to PP.

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## **STORAGE BEHAVIOUR OF HYBRID CLONES OF POTATO UNDER AYT IN NATURAL CONDITION**

T. Hasan, M.H. Rashid, M.M. Islam And S. Akter

The experiment was conducted at Tuber Crops Research Center, BARI from March to July 2023. Five clonal hybrids of AYT were evaluated with five check varieties for storage behaviour under natural conditions. At 60 DAS, the minimum weight loss (10.20%) was found in BARI Alu-7 followed by BARI Alu- 28 (10.27%), 17.19 (21.67%) and 17.12a (21.97%). At 90 DAS, the minimum weight loss (19.67 %) was also recorded in BARI Alu-13 followed by BARI Alu- 28 (28.09%). Among the hybrid clones minimum weight loss was recorded in 17.12a from 15 DAS to 105 DAS ranging from 2.91% to 82.43%. At 60 DAS maximum BSR loss was recorded in BARI Alu-90 (41.29%) closely followed by 17.18 (40%) and minimum was in BARI Alu-7 (4.83%). The data shows that the minimum bacterial soft rot (BSR) of 33.76% was found in BARI Alu-7 and maximum in BARI Alu-90 (72.56%) at 90 DAS. Compared to controls all the tested hybrid clones showed moderate loss due to BSR ranging from 51.86% - 68.86% at 105 DAS where 17.12a (54.05%) and 17.167 (51.86%) performed better. In conclusion, hybrid clones 17.12a, 17.19 and 17.167 under AYT performed better storage performance in natural conditions.

## **STORAGE BEHAVIOUR OF HYBRID CLONES OF POTATO UNDER RYT IN NATURAL CONDITION**

T. Hasan, M.H. Rashid, M.M. Islam And S. Akter

The study was conducted at Tuber Crops Research Center, BARI during 2023-24 with six hybrid clones under RYT to evaluate the storage quality of hybrid clones under natural conditions. All the six tested hybrid clones under RYT ranged from 22% to 94.17% for cumulative weight loss for 90 and 120 DAS. At 90 DAS, the minimum weight loss (19.66%) obtained in BARI Alu- 7 was statistically similar with 16.28 (22%), BARI Alu-28 (28.09%), 16.62 (30.6%), 16.9 (31%) and 16.16 (32.63%) while maximum weight loss was recorded in 33.33 (86.25%). Minimum weight loss at 150 DAS was found in 16.62 (45.24%) followed by 16.28 (57.2%) and 16.16 (64.73%). Among the tested genotypes maximum percentage of bacterial soft rot (BSR) (69.16%) was observed in 33.33 and minimum in 16.28 (14.40%) which was statistically similar to 16.62 (14.57%) and 16.9 (26.60%) at 90 DAS. 16.62 (20.28%) was recorded with the lowest rottage loss followed by 16.28 (36.80%) whereas the maximum was found in BARI Alu-90 (83.64%) at 150 DAS. It can be concluded that hybrid clones 16.62, 16.28 and 16.9 under RYT showed better storage performance in natural conditions.

## **STORAGE BEHAVIOUR OF EXOTIC POTATO VARIETIES UNDER SYT IN NATURAL CONDITION**

T. Hasan, M.H. Rashid, M.M. Islam And S. Akter

An experiment was conducted at Tuber Crops Research Center, BARI from March to June 2023. Tubers of four exotic potato varieties with five check varieties of SYT were evaluated for storage behaviour under natural conditions. Maximum cumulative weight loss at 60 DAS was recorded in BARI Alu-13 (29.53%) while the minimum was recorded in Cheona (6.47%) closely followed by BARI Alu-7 (10.20%) and BARI Alu-28 (10.27%). All the tested potato varieties under SYT ranged from 19.67% to 78.28% for cumulative weight loss at 90 DAS. At 90 DAS, the minimum weight loss (19.67%) obtained in BARI Alu-7 was statistically similar to Cheona (25.07%), Zorba (46.52%) and BARI Alu-28 (28.09%) while maximum weight loss was recorded in again in Alanis (78.28%). All the tested exotic varieties performed better compared to controls ranging from 4.85% -24.53% at 60 DAS. A maximum percentage of bacterial soft rot (BSR) (41.29%) was observed in BARI Alu-90 and a minimum in SCH 1010 at 60 DAS. Cheona

(42.61%) was recorded with the minimum rottage loss which was statistically similar to BARI Alu-7 (33.77%) and the maximum was recorded again in BARI Alu-90 (72.56%) at 90 DAS. To conclude among the four exotic potato varieties Cheona and Zorba perform better in terms of cumulative weight loss and cumulative rottage loss due to BSR at 90 DAS.

## **STORAGE BEHAVIOUR OF HYBRID CLONES OF POTATO UNDER SYT IN NATURAL CONDITION**

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An experiment was conducted at Tuber Crops Research Center, BARI from March to July 2023. Tubers of seven hybrid clones of SYT were evaluated for storage behavior under natural conditions. Cumulative weight loss for seven hybrid clones at 60 DAS ranged from 10.20- 38.97% where maximum was recorded in 18.13(38.97%) and minimum in BARI Alu-7 (10.20%) and BARI Alu-28 (10.26%) which was statistically significant with 18.8 (17.20%), 18.19 (15.20%), 18.46 (22.22%), 18.102 (16.83%) and 18.117 (22.04%). At 75 DAS 18.102 and 18.117 were recorded with 23.57% and 29.95% cumulative weight loss which was statistically similar to BARI Alu-28 (12.52%) and BARI Alu-7 (18.33%). There was a sharp increase in weight loss % for the hybrid clones after 75 DAS. Among the tested hybrid clones cumulative weight loss % at 105 DAS ranged from 71.66%- 95.82%) while the lowest was in BARI Alu-7 (34.73%). Among the hybrid clones minimum percentage of bacterial soft rot (BSR) was observed in 18.19 (15.60%) followed by 18.8 (17.91%), 18.102 (20.42%) and 18.117(17.37%) which was statistically significant with BARI Alu-7 (4.83%) 60 DAS. Loss due to Bacterial Soft Rot (BSR) was high (48.43%-69.04%) in all the hybrid clones at 90 DAS (Table 2) where the maximum was recorded at 18.8. At 105 DAS maximum rottage loss was recorded in BARI Alu-90 (83.64%) which was statistically similar with all the tested materials except BARI Alu-7 (61.13%). It can be concluded that hybrid clones 18.8, 18.46, 18.102 and 18.117 showed better performance in terms of cumulative weight loss % and rottage loss %.

## **STUDIES ON THE PROCESSING QUALITY (CHIPS AND FRENCH FRY) OF POTATO CULTIVARS AND HYBRID CLONES**

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Hybrid clones and nutrient-enriched (Fe and Zn) materials from CIP source under SYT and AYT were studied for their processing quality in the form of chips and French Fries. Among the hybrid materials under SYT and AYT 19.87 produced light whitish colour (scored 10) crispy chips, 19.113 produced light golden colour (scored 8) crispy chips and 19.96 produced golden colour (scored 6) crispy chips like the chips from BARI Alu-28 and BARI Alu-97 (scored 8-9). 18.8 produced light whitish colour chips (scored 10) with excellent appearance (scored 20) which supersedes the performance of the check varieties. 18.19 and 18.37 produced light golden to light whitish colour crispy chips (scored 8-9.33) with very good to excellent appearance (scored 18.67). Among the nutrient-enriched (Fe and Zn) materials from CIP sources CIP-401 and CIP-446 produced light whitish colour crispy chips with an excellent external appearance. CIP-402 and CIP-444 produced golden to light golden colour chips with very good external appearance like BARI Alu-28 and BARI Alu-97. 19.96 produced light golden colour French fries (scored 8) with bright white crystalline internal colour (scored 20), crispy texture (scored 20) and mealy inside texture (score 30). 18.8 produced excellent French fries with a light whitish colour (scored 10), white, crystalline internal colour (scored 20), crispy outside texture (scored 20) and mealy inside texture (scored 30). 18.19 and 18.102 produced very good French fries with golden to light golden colour, opaque inside colour, moderately crispy outside texture and mealy inside texture. Among the 21 CIP materials CIP-401 and

CIP-402 produced very good French fries with a light golden colour, opaque internal colour, moderately crispy to crispy outside texture and moderately mealy to mealy inside texture like BARI Alu-28 and BARI Alu-97. Processing quality of hybrid clones 19.87 and 19.113 produced light golden to light whitish colour chips and 19.96 produced both excellent chips and French fries under SYT. Among the hybrid materials under AYT 18.8, 18.19 and 18.37 showed better performance in producing chips whereas 18.8, 18.19 and 18.102 were good at producing French fries too. Among the nutrient-enriched materials from CIP source CIP-401, CIP-402, CIP-444, and CIP-446 performed better for chips. CIP 401 and CIP 402 are good at producing French fries.