V. SUMMARY

Canning industries are major section of the food industries in Egypt. So the quality of canned food plays an important of the consumption, mean while the canned juices preserved by thermal processing to inactive the highest resistance enzyme and that treatment affect on the chemical composition of these juices. So the aim of these studies which include canning of mango, guava and orange nectars, are as follows:

1- To study the effect of canning processing steps on chemical composition of nectar.
2- To study the effect of thermal process on enzyme activity of pectinmethylesterase (P.M.E.), peroxidase (P.O.) and polyphenoloxidase (P.P.O.).
3- To study the heat penetration of canned nectar to calculate the parameters of heating and cooling curves.
4- To evaluate the thermal process of canned nectars based on the highest resistant enzyme.
5- To calculate the required holding time to inactive the highest resistant enzyme at different initial and retort temperatures.

The results could be summarized as follows: Edible portion of mango, guava and orange were analyzed for moisture, protein, ash, ether extract, crude fiber and total carbohydrates; the obtained data were 82.43, 0.88, 0.31, 0.23, 0.90 and 15.25% for mango; 84.73, 0.96, 0.432, 0.306, 0.68 and 12.89% for guava and 86.44, 0.32, 0.302, 0.13, 0.37 and 11.938% for orange; respectively.

Part 1: Canned mango nectar:

1.1. Effect of canning process on chemical composition:

1.1.1. The total solids and soluble solids were 16.3% and 14.5°Brix increased to 18.7% and 16.79°Brix after preheating mango nectar meanwhile no noticeable effect on total and soluble solids after thermal processing at 91.3°C/35 min. (A); 94.9°C/25 min. (B) and 99.9°C/15 min. (C), was observed.

1.1.2. The acidity ranged from 0.39 to 0.40% (as citric acid), while pH values ranged from 3.5 to 3.65 after thermal process of mango nectar.

1.1.3. Ascorbic acid content (Vit. C) was 3.41 mg/100 g; of raw mango nectar which decrease after preheating to 1.24 mg/100 g. After thermal processing at A, B, C became 1.09, 1.08 and 1.06 mg/100 g, respectively.

1.1.4. Total sugars were 12.16 and 12.71 for raw and preheated mango nectar, respectively and ranged from 12.53 to 12.60% after thermal processing A, B and C. Non reducing sugars were 11.03 and 11.43% for raw and preheated mango nectar, respectively and ranged from 10.86 to 11.04% after thermal processing A, B and C. While reducing sugars were 1.13 and 1.28% for raw and preheated mango nectar, respectively and ranged from 1.62 to 1.67 after thermal processing at A, B and C.

1.1.5. Carotene content of prepared mango nectar was 0.396 mg/L which decreased after preheating to 0.374 and ranged from 0.311 to 0.348 mg/L after thermal processing at A, B and C.

1.2. Effect of canning processing on enzyme activity:

1.2.1. Activity of pectinmethylesterase (P.M.E.) was 82.7 (P.M.E. unit $x10^6$/g) which decreased to 40 (PME $Ux10^6$/g) after preheating mango nectar. On the other hand it reduced after thermal processing at A, B and C to 6.3, 6.6 and 10.0 (P.M.E. $Ux10^6$/g), respectively.

1.2.2. Peroxidase and polyphenoloxidase activity in raw and after preheating mango nectar were 15.3, 2.6 and 0.2 O.D.$x10^3$/min., respectively. Thermal processing at A, B and C resulted in no activity for either peroxidase or polyphenoloxidase enzyme.

1.3. Thermal processing for canned mango nectar were evaluated on the base of the highest resistance enzyme (P.M.E.):

The percentage of enzyme retention (based an reviewed Z = 11.9°C, D = 0.33 min. and reference temperature 100°C).

1.3.1. Thermal processing at A, B and C reduced the percent enzyme retention from 100 to $7.36x10^{-5}$, $1.73x10^{-7}$ and $3.89x10^{-7}$%, respectively, and F values for these thermal process were 2.024, 2.89 and 2.775 min., respectively. While the decimal reduction of enzyme equivalent to "F" value used for process calculation (F/D) were 6.13; 8.76 and 8.409 for three process, respectively.

1.3.2. Enzyme retention as % of (P.M.E.) at constant initial temperature 42.2°C were $7.36x10^{-5}$, $5.45x10^{-4}$ and $1.15x10^{-6}$% for thermal processing A, B and C, respectively. The optimum holding time for thermal processing A, B and C with constant initial temperature of 42.2°C to reduce the enzyme retention of (P.M.E.) to $5.45x10^{-4}$% (F = 1.737 min.) were 32.74; 25 and 12.72 min. for these treatments, respectively. On the other hand,

calculation of optimum thermal processing time at retort temperature 90°C were 37.86, 26.70 and 22.70 min. when initial temperatures was 50, 60 and 70°C; respectively. Also the optimum holding time for thermal processing at 100°C retort temperature were 17.36, 16.03 and 13.57 min. at the same initial temperatures 50, 60 and 70°C, respectively.

1.4. Sensory evaluation for canned mango nectar:

The scores for sensory attributes showed that no significant difference in texture, colour and overall acceptability of thermal process mango nectar A, B and C. On the other hand, there are significant difference in taste and odour for the same processed mango nectar.

Part 2: Canned guava nectar:

2.1. Effect of canning process on chemical composition:

2.1.1. The total solids and soluble solids were 15.97, 17.28% and 14.82 and 15.52°Brix for raw and after preheated guava nectar, respectively. After thermal process at 90.4°C/35 min. (A); 95.1°C/25 min. (B) and 99.8°C/15 min. (C) the total solids were 17.45, 17.57 and 17.47% and soluble solids were 15.63, 15.62 and 15.63°Brix for guava nectar, respectively.

2.1.2. The acidity of canned guava nectar ranged from 0.192 to 0.203% (as citric acid), while pH values ranged from 3.39 to 3.34 after thermal process guava nectar.

2.1.3. Ascorbic acid content (Vit. C) of raw guava nectar was 26.5 mg Vit. C/100 g decrease to 22.83 mg Vit. C/100 g after

preheating. After thermal processing at A, B, C became 20.0, 21.30 and 22.78 mg Vit. C/100 g, respectively.

2.1.4. Total sugars of raw and preheated guava nectar were 12.37 and 13.42%, and non reducing sugars were 10.57 and 11.42%, respectively, but reducing sugars were 1.80 and 2.00%, respectively. After thermal processing guava nectar at A, B and C the total sugars were 13.66, 13.47 and 13.25%; non reducing sugars were 10.72, 10.54 and 10.43 %, respectively. While reducing sugars were 2.94, 2.93 and 2.82%, respectively.

2.1.5. Carotene content were 0.174 and 0.091 mg/L for prepared (raw) and after preheated guava nectar, respectively. After thermal processing at A, B and C were 0.055, 0.057 and 0.061 mg carotene/L, respectively.

2.2. Effect of canning processing on enzyme activity:

2.2.1. The pectinmethylesterase (P.M.E.) activity was 135.8 (P.M.E. unit $x10^6$/g) which decreased to 75 (PME $Ux10^6$/g) after preheated guava nectar. After thermal processing at A, B and C reduced to 26.6, 35.0 and 40.0 (P.M.E. $Ux10^6$/g) for guava nectar, respectively.

2.2.2. Peroxidase and polyphenoloxidase activity in raw and after preheated guava nectar were 22.5 and 1.4 O.D.$x10^3$/min. decrease to 0.50 and 0.40 O.D. $x10^{-3}$/min., respectively. After preheated thermal processing at A, B and C resulted in no activity for either peroxidase or polyphenoloxidase enzyme.

2.3. Thermal processing for canned guava nectar were evaluated on the base of the highest resistance enzyme (P.M.E.):

The percent of enzyme retention (based an reviewed Z = 16.2°C, D = 0.34 min. and reference temperature 100°C).

2.3.1. Thermal processing at A, B and C reduced the percent enzyme retention from 100% to $1.76x10^{-5}$, $3.5x10^{-4}$ and 0.222%, respectively, and F values for these thermal process were 2.29, 1.855 and 0.902 min., respectively. While (F/D) were 6.756; 5.44 and 2.65 for thermal process A, B and C, respectively.

2.3.2. Enzyme retention as % of (P.M.E.) when initial temperature constant at 45°C were $1.71x10^{-3}$, $3.5x10^{-4}$ and 3.98% for thermal processing A, B and C, respectively. The optimum holding time for thermal processing A, B and C with constant initial temperature of 45°C to reduce the enzyme retention to $3.5x10^{-4}$% (F = 1.855 min.) were 35.85; 25.0 and 21.28 min. for three thermal process, respectively. On the other hand, calculation of optimum thermal processing time at retort temperature 90°C were 39.53, 34.63 and 26.94 min. when initial temperatures was 50, 60 and 70°C; respectively. While the optimum holding time for thermal processing at 100°C retort temperature were 28.32, 19.73 and 15.81 min. at the same initial temperatures, respectively.

2.4. Sensory evaluation for canned guava nectar:

The obtained data showed that no significant difference between thermal process A, B and C in texture, taste and odour. While there are significant difference in colour and overall acceptability between these thermal process.

Part 3: Canned orange nectar:

3.1. Effect of canning process on chemical composition:

3.1.1. The total solids and soluble solids of raw orange nectar were 13.85% and 12.83°Brix increase to 14.03% and 13.63°Brix after preheated. After thermal processing orange nectar at 90.2°C/30 min. (A); 95°C/20 min. (B) and 100.1°C/15 min. results is no noticeable effect on total and soluble solids.

3.1.2. Total acidity and pH values were 0.306, 3.560 and 0.292% (as citric) and 3.55 for raw and after preheated orange nectar, respectively. After thermal process at A, B and C the acidity ranged from 0.294 to 0.295% and pH values were still at 3.57 for orange nectar.

3.1.3. The level of Vit. C in raw orange nectar was 13.22 mg Vit. C/100 g after preheated became 10.68 mg Vit. C/100 g, while after thermal process A, B and C were decrease to 8.14, 8.43 and 8.86 mg Vit. C/100 g, respectively.

3.1.4. The total sugars, reducing sugars and non reducing sugars were 11.81, 1.37 and 10.44% for raw orange nectar, respectively. After preheating were 12.03, 1.63 and 10.40%, respectively. While after thermal processing orange nectar at A, B and C were 12.16; 12.12 and 12.30% for total sugars; 2.17, 1.98 and 1.83% for reducing sugars and 9.99, 10.14 and 10.30 for non reducing sugars, respectively.

3.1.5. The carotenoids content were 0.35 and 0.23 mg/L for raw and after preheated orange nectar. After thermal process A, B and C were ranged from 0.196 to 0.210 mg/L.

3.2. Effect of canning processing on enzyme activity:

3.2.1. Pectinmethylesterase (P.M.E.) activity were 198.0 and 66.7 (P.M.E. unit $x10^6$/g) for raw and after preheated orange nectar, respectively. Thermal process A, B and C reduced the activity 0.30, 4.5 and 16.5 (P.M.E. unit $x10^6$/g).

3.2.2. Peroxidase (P.O.) and polyphenoloxidase (P.P.O.) activity were 195.0 and 18.0 O.D. $x10^3$/min. preheated process led to decrease these activity to 4.0 and 0.60 O.D. $x10^3$/min., respectively. Thermal process A, B and C resulted in no activity for either peroxidase or polyphenoloxidase enzymes.

3.3. Evaluation of the thermal process for canned orange nectar are based on recommended "F" value 43 min at 82°C with Z = 7.78°C that means $F_{100}^{7.78} = 0.21$ min.

3.3.1. Thermal processing at 90.2°C/min. (A), 95.2°C/20 min. (B) and 100.1°C/15 min. (C) were resulted in F values of 1.07, 1.92 and 6.66 min, respectively. The optimum holding time were 14.86, 6.29 and 1.05 min at constant initial temperature 45.4°C (on the base of recommended $F_{100}^{7.78} = 0.21$ min.) for thermal process A, B and C, respectively.

3.3.2. The optimum holding times at initial temperatures 50, 60 and 70°C when retort temperature was 90°C, were 17.41, 16.40 and 13.31 min., respectively. While the retort temperature was 100°C the optimum holding time was 4.63, 4.15 and 2.35 min. at the same temperatures, respectively.

3.4. **Sensory evaluation for canned orange nectar**

Sensory evaluation of canned orange nectar processed at A, B, C was studied. The data showed that no significant difference in order of

the treated orange nectar while are significantly different in the texture, colour, taste and overall acceptability of orange nectar processed at A, B and C. The highest scores in texture and colour were at process B and C. Also, the highest scores in taste and overall acceptability were in process (C).