

**POSTHARVEST PHYSIOLOGICAL AND BIOCHEMICAL  
CHARACTERISTICS OF *Syzygium samarangense* FRUITS**

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## ABSTRACT

Little data is available in the scientific literature on postharvest changes taking place in three varieties of *Syzygium samarangense* fruits, an increasingly popular fruit in the Asian region. In this study, the postharvest physico-chemical and mechanical properties of three varieties of *Syzygium samarangense* (red, pink and deep red) namely, fruit color, weight loss, pulp firmness, total soluble solids, pH, titratable acidity, total sugar, total starch and total protein were determined during the postharvest storage period under ambient conditions of *Syzygium samarangense* fruits. It was observed that weight loss, total soluble solids (TSS), pH, total sugar and total protein of the *jambu air* fruits increased significantly ( $p < 0.05$ ) with time whilst pulp firmness, total starch and the color index of the fruits decreased. Analysis of the antioxidant activity, determined in the methanol extracts of the *jambu* fruit extracts over a period of 9 days after harvesting, using the DPPH (2,2-diphenyl-1-picrylhydrazyl) and the ABTS (2,2 azino-bis-(3-ethylbenzthiazoline-6-suphonic acid) methods, showed that the antioxidant activity increased gradually during post harvest ripening. The total phenol content determined by the Folin-Ciocalteau method revealed a high concentration of phenol content in the *jambu* fruits, with values around  $372.62 \pm 69.64$ ,  $188.59 \pm 24.22$  and  $254.27 \pm 78.20$  mg gallic acid equivalent (GAE) / 100g fresh fruit in red, pink and deep red *S. samarangense*, respectively. Similarly, the flavonoid content measured spectrophotometrically, using the aluminum chloride colorimetric assay, also showed an increasing trend over the same period. The results were expressed as mg of ascorbic acid equivalent (AAE), GAE and catechin equivalent (CE) per 100g of sample. The activity of L-phenylalanine ammonia-lyase (PAL), was also studied in the *jambu* fruits. PAL activity increased significantly ( $p < 0.05$ ) throughout the ripening process. These results represent new data on postharvest changes occurring in *Syzygium samarangense*

fruits and show that this increasingly popular fruit has great potential for future development in the agriculture sector.

## ABSTRAK

Pada masa kini, tidak banyak maklumat yang boleh didapati dalam kajian sains mengenai perubahan lepas tuai yang berlaku pada buah *Syzygium samarangense* yang kini menjadi semakin popular di rantau Asia. Dalam kajian ini, ciri-ciri fizikal-kimia dan mekanikal dalam tiga jenis buah *Syzygium samarangense* (merah, merah jambu dan merah pekat) iaitu warna buah, kehilangan berat buah, tahap kekerasan buah, jumlah bahan larut (TSS), pH, tahap keasidan yang boleh dititrat, jumlah gula, jumlah kanji dan jumlah protein telah ditentukan semasa tempoh penyimpanan lepas tuai pada suhu bilik. Hasil kajian ini mendapati bahawa kehilangan berat buah, jumlah bahan larut (TSS), pH, jumlah gula dan jumlah protein meningkat dengan signifikan ( $p < 0.05$ ) dengan pertambahan masa manakala tahap kekerasan buah, jumlah kanji dan Indeks warna buah menurun dengan pertambahan masa. Analisis aktiviti antioksidan telah dijalankan ke atas ekstrak metanol buah jambu sepanjang 9 hari selepas dituai, dengan menggunakan kaedah DPPH (2,2-diphenyl-1-picrylhydrazyl) dan ABTS (2,2 azino-bis-(3-ethylbenzthiazoline-6-suphonic acid). Analisis tersebut menunjukkan bahawa aktiviti antioksidan meningkat dengan beransur-ansur sepanjang tempoh pemasakan lepas tuai. Jumlah kandungan Fenol yang ditentukan dengan menggunakan kaedah Folin-Ciocalteu menunjukkan kepekatan kandungan fenol yang tinggi di dalam buah jambu, dengan nilainya sekitar  $372.62 \pm 69.64$ ,  $188.59 \pm 24.22$  dan  $254.27 \pm 78.20$  mg bersamaan asid galik (GAE) / 100 g buah jambu segar merah, merah jambu dan merah pekat, mengikut turutan masing-masing. Begitu juga dengan kandungan flavonoid yang diukur dengan kaedah spektrofotometer (kaedah kolorimetrik Aluminium klorida), juga menunjukkan peningkatan dalam tempoh yang sama. Keputusannya dinyatakan sebagai bersamaan mg asid askorbik (AAE), GAE dan catechin (CE) pada setiap 100 g sampel. Aktiviti L-phenylalanine ammonia-lyase (PAL) dalam buah jambu juga dikaji. Aktiviti PAL meningkat dengan signifikan ( $p < 0.05$ ) sepanjang tempoh pemasakan. Penemuan-

penemuan dalam kajian ini merupakan data-data baru dari aspek perubahan lepas tuai yang berlaku dalam buah *Syzygium samarangense* dan ini menunjukkan bahawa buah yang semakin popular ini mempunyai potensi yang besar untuk diperkembangkan dalam sektor pertanian.

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## LIST OF ABBREVIATIONS AND SYMBOLS IN THE TEXT

|                                      |                                                                   |
|--------------------------------------|-------------------------------------------------------------------|
| a*                                   | greenness to redness                                              |
| A512nm                               | absorbance at 512 nanometer                                       |
| A700nm                               | absorbance at 700 nanometer                                       |
| A765nm                               | absorbance at 765 nanometer                                       |
| AA                                   | antioxidant activity                                              |
| AAC                                  | ascorbic acid content                                             |
| AAE                                  | ascorbic acid equivalent                                          |
| ABTS                                 | 2,2'-azinobis-3-ethylbenzthiazoline-sulphonic acid                |
| ABTS <sup>•+</sup>                   | 2,2'-azinobis-3-ethylbenzthiazoline-sulphonic acid radical cation |
| AC                                   | antioxidant capacity                                              |
| AEAC                                 | ascorbic acid equivalent antioxidant capacity                     |
| AH                                   | antioxidant in the non-radical (reduced) state                    |
| Al (NO <sub>3</sub> ) <sub>3</sub>   | aluminum nitrate                                                  |
| AOAM                                 | methanol extract                                                  |
| APX                                  | ascorbate peroxidase                                              |
| ATP                                  | adenosine triphosphate                                            |
| b*                                   | blueness to yellowness                                            |
| BHA                                  | butylated hydroxyanisole                                          |
| CAT                                  | catalase                                                          |
| CE                                   | catechin equivalent                                               |
| cm                                   | centimeter                                                        |
| ddH <sub>2</sub> O                   | deionized, distilled water                                        |
| DHAR                                 | dehydroascorbate reductase                                        |
| DNA                                  | deoxyribo-nucleic acid                                            |
| DPPH                                 | 2,2-diphenyl-1-picrylhydrazyl                                     |
| DPPH <sup>•</sup>                    | 2,2-diphenyl-1-picrylhydrazyl radical                             |
| DTT                                  | 1,2-dithio-DL-threitol                                            |
| EDTA                                 | ethylenediaminetetraacetic acid                                   |
| F&C                                  | Folin-Ciocealteu                                                  |
| FRAP                                 | ferric reducing antioxidant power                                 |
| f.wt                                 | formula weight                                                    |
| g                                    | force of gravity (9.8 m/s <sup>2</sup> )                          |
| g                                    | gram                                                              |
| GAE                                  | gallic acid equivalent                                            |
| GR                                   | glutathione reductase                                             |
| h                                    | hour                                                              |
| ha                                   | hectare                                                           |
| H <sub>2</sub> SO <sub>4</sub>       | sulfuric acid                                                     |
| IC <sub>50</sub> (EC <sub>50</sub> ) | concentration for 50% inhibition                                  |
| kg                                   | kilogram                                                          |
| kg•f                                 | kilogram force                                                    |
| kJ                                   | kilojoule                                                         |
| L*                                   | lightness                                                         |
| L                                    | liter                                                             |
| LFP                                  | lipofuscin pigments                                               |
| LOX                                  | lysyl oxidase                                                     |
| M                                    | molar                                                             |
| MC                                   | medicarpin                                                        |
| MDA                                  | malondialdehyde                                                   |
| MDHAR                                | monodehydroascorbate reductase                                    |

|                                  |                                     |
|----------------------------------|-------------------------------------|
| MG                               | mature green                        |
| mg                               | milligram                           |
| ml                               | milliliter                          |
| min                              | minute                              |
| mm                               | millimeter                          |
| mM                               | millimolar                          |
| N                                | Newton                              |
| N                                | normality                           |
| Na <sub>2</sub> CO <sub>3</sub>  | sodium carbonate                    |
| NaCl                             | sodium chloride                     |
| NaOH                             | sodium hydroxide                    |
| Na <sub>2</sub> HPO <sub>4</sub> | disodium hydrogen phosphate         |
| NaH <sub>2</sub> PO <sub>4</sub> | sodium dihydrogen phosphate         |
| nm                               | nanometer                           |
| NaNO <sub>2</sub>                | sodium nitrite                      |
| No.                              | number                              |
| O <sub>2</sub> <sup>-•</sup>     | superoxide anion                    |
| OR                               | overripe                            |
| ORAC                             | oxygen radical antioxidant capacity |
| PAL                              | L-phenylalanine ammonia-lyase       |
| PE                               | pectinesterase                      |
| PG                               | polygalacturonase                   |
| POX                              | peroxidase                          |
| PPO                              | polyphenoloxidases                  |
| r                                | correlation coefficient             |
| ROS                              | reactive oxygen species             |
| \$                               | dollar                              |
| s                                | second                              |
| SC                               | starch content                      |
| SD                               | standard deviation                  |
| TA                               | titratable acidity                  |
| TFC                              | total flavonoid content             |
| TP                               | total protein                       |
| TPC                              | total phenolic compound             |
| TSC                              | total sugar content                 |
| TSS                              | total soluble solids                |
| USD                              | United State dollars                |
| UV                               | ultraviolet                         |
| v                                | volume                              |
| °C                               | degrees Celsius                     |
| µg                               | microgram                           |
| µL                               | microlitre                          |
| µM                               | micromolar                          |
| %                                | percent                             |