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Lycopene and β-carotene thermal degradation kinetics and colour-antioxidant changes in gac (*Momordica cochinchinensis*) fruit aril paste

Abstract

This study investigated the impact of heating temperatures (70 °C to 90 °C for up to 14 h) on lycopene and β-carotene degradation kinetics in gac aril paste. Carotenoids extracted via low-volume hexane-assisted ultrasonic extraction revealed a first-order degradation pattern with high correlation coefficients (0.96–0.97). Lycopene degraded faster at 90 °C (k = 12.05 × 10^2 h^{-1}) than at 70 °C (5.41 × 10^2 h^{-1}), while β-carotene displayed relatively slower degradation. Corresponding half-life ($t_{1/2}$) values for lycopene ranged from 5.75 to 12.81 h, while β-carotene displayed values of 9.48–20.2 h. β-carotene showed superior thermal stability compared to lycopene across all temperatures. Additionally, colour changes indicated decreased brightness with increasing temperature. The DPPH radical scavenging activity and FRAP values decreased during gac fruit heating. Overall, this study emphasises temperature-induced declines in lycopene and β-carotene levels in gac aril paste and offers insights into their degradation kinetics under thermal processing.

Keywords:

Antioxidant activity, carotenoids, colour changes, degradation, half-life, heating, kinetic parameters