

Physicochemical Properties of Beta-cyclodextrin Assisted Extracts of Green Rooibos (*Aspalathus linearis*)

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Abstract

Betacyclodextrin (β -CD)-assisted extracts of green rooibos were reported to exhibit higher antioxidant activity than their aqueous counterparts. Successful application of these extracts in food will require characterising their physicochemical properties. Green rooibos was extracted with water, and 15 mM β -CD at 40°C for 60 min resulting in freeze-dried extracts termed GRE and β -GRE. The moisture content (MC), water activity (a_w) and colour ($L^*a^*b^*$) were analysed. Thermogravimetric analysis (TGA) and Fourier transform infrared (FTIR) were applied to confirm the formation of green rooibos- β -CD inclusion complexes.

No significant differences ($p > 0.05$) were observed between the MC of GRE and β -GRE at 3.29 and 2.45%, respectively. However, the a_w of β -GRE was significantly ($p < 0.05$) lower at 0.11 than that of GRE at 0.18. Betacyclodextrin (β -CD)-assisted extracts resulted in increased lightness (L^*), and reduced redness ($+a^*$) ($p < 0.05$), with no significant differences ($p > 0.05$) on the yellowness ($=b^*$) of green rooibos.

Thermograms of β -CD and β -GRE revealed that thermal degradation was initiated by the evaporation of water absorbed on the surface and cavity of β -CD between 100 – 120°C. Degradation of β -CD occurred in the range 340 – 375°C. While that of GRE was observed from 180°C. The thermogram of β -GRE, on the other hand, was a superposition of both GRE and β -CD, thus confirming the formation of inclusion complexes. As a result of complexation, the primary degradation stage of β -GRE occurred at a higher temperature of 260°C compared to 180°C of GRE. Furthermore, complexation was further confirmed via FTIR spectra.

Absorption spectra of β -CD and β -GRE overlapped at specific regions and showed certain spectral differences compared to GRE. Similarities between GRE and β -GRE were observed at peaks 578, 1025, 1154 cm^{-1} . When the β -GRE inclusion complex formed, most characteristic peaks of GRE and β -CD disappeared or shifted in the newly formed complex. The 1255 cm^{-1} band depicting C – O stretching of carboxylic acid disappeared due to the formation of hydrogen bonds with β -CD. The GRE 1030 – 1070, 1606, and 2939 cm^{-1} bands shifted to 1025, 1615 and 2939 cm^{-1} in the β -GRE complex.