Macroporous Adsorbent Resin Chromatography Fractionation of Cyclopia Subternata Extract for Enhanced Bioactivity

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Abstract

Cyclopia subternata is a good source for the production of aqueous extracts for the food and nutraceutical industries due to the presence of various bioactive phenolic compounds. A need for extracts enriched in specific phenolic compounds exists in order to deliver standardised products for the nutraceutical market. The present study investigated the use of macroporous adsorbent resin chromatography (MARC) to enhance the bioactivity of C. subternata extract.

A hot water extract of unfermented C. subternata plant material was used for the development of a MARC fractionation protocol. Small-scale static sorption tests were performed to select an appropriate macroporous resin (XAD 1180N or HP20) and to determine the optimal sample loading concentration, contact time, temperature, and concentration of the desorption solution. Dynamic sorption experiments were performed in a glass column packed with XAD 1180N macroporous resin to determine the optimal loading volume and elution gradient, whereafter the fractionation was up scaled, and fractions enriched in specific compounds produced. The extract and fractions were analysed using HPLC-DAD and their activity tested, using antioxidant assays and the xanthine oxidase inhibition assay.

The benzophenone, 3-β-D-glucopyranosyl-4-O-β-D-glucopyranosyliriflophenone (IDG), exhibited the lowest affinity for the macroporous resin and was the limiting factor in the selection of optimal experimental conditions. The adsorption isotherm data collected at 23 °C and 40 °C fitted both the Langmuir and Freundlich models well and indicated higher adsorption capacity at the lower temperature. The extract was fractionated using stepwise gradient elution with water-ethanol mixtures to produce four fractions (66% recovery). The major phenolic compounds present in the fractions were IDG and 3-β-D-glucopyranosyliriflophenone (fraction 1), mangiferin and isomangiferin (fraction 2), 3',5'-di-β-D-glucopyranosylphloretin and scolymoside (fraction 3) and hesperidin (fraction 4). Fractions 1, 2, 3 and 4 showed the highest ORAC, DPPH radical scavenging, superoxide radical anion scavenging and xanthine oxidase inhibition, respectively, all higher than that of the extract.

MARC fractionation is a promising technique for large-scale separation of phenolic compounds from Cyclopia plant material. The fractionation protocol can be scaled up to industrial level to produce fractions

with enhanced bioactivity that, together with knowledge of their phenolic composition, could guide use by the nutraceutical industry.

Biography: Carla Dippenaar

Carla Dippenaar completed her BSc degree in food science (cum laude) at Stellenbosch University (SU) in 2019. Carla is currently a MSc Food Science student at SU, focussing on the fractionation of a Cyclopia subternata extract for enhanced valorisation.