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Nano-Phytosomal Formulation of *Cyclopia Subternata* (Honeybush) Extract Improves Storage Stability of Polyphenols as Functional Food Ingredient

Chantelle Human[1], Dalene de Beer[1,2], Elizabeth Joubert[1,2]

[1]Plant Bioactives Group, Post-Harvest & Agro-Processing Technologies, Agricultural Research Council, Stellenbosch, South Africa. [2]Department of Food Science, Stellenbosch University, Stellenbosch, South Africa

Abstract

Introduction: A green honeybush tea (*Cyclopia subternata*) extract showed potential to alleviate allergies *in vivo* at a dose equivalent to a cup of tea. Exploitation of its full potential as a functional food ingredient is limited by susceptibility to oxidation and poor epithelial membrane permeability of the phenolic compounds responsible for the bioactivity. Nano-phytosomes, formed through a phenolic-phospholipid interaction and micellular self-assembly, are an attractive option to overcome the caveats associated with honeybush phenolic compounds.

Methodology: The preparation of nano-phytosome vesicles using food-grade ingredients and "generally recognised as safe" solvents were investigated using an aqueous ethanol *C. subternata* extract (CSE) and fat-free soybean lecithin containing 40% phosphatidylcholine (PC). The impact of various process parameters (PC:CSE ratio, sonication time and reaction temperature) on the properties linked to phytosome formation efficiency including vesicle size, yield, encapsulation efficiency (EE) and loading capacity (LC) of the extract in the phytosomes was investigated.

The storage stability of the freeze-dried phytosomes was assessed by exposure to different relative humidity (RH)-temperature combinations (7, 53 and 75% RH; 25 and 40 °C). The content of the individual phenolic compounds was quantified by high performance liquid chromatography. Reaction rate constants, determined by kinetic modelling, was used to compare treatments.

Results and Discussion: Phytosome formation and chemical interaction between PC and CSE were confirmed with nuclear magnetic resonance and Fourier transform infrared spectroscopy. Vesicle size and LC could be tailored by adjusting the sonication time and PC:CSE ratio, respectively. This allowed for the production of honeybush phytosomes in the nanoscale (127 nm) with a high LC (11.9 %). These properties are desired for increased in vitro circulation and to lower the required dose in a final product, respectively.

The phenolic compounds followed second-order degradation kinetics during storage, confirming that phytosomal formulation decreased phenolic degradation when stored at low RH.

Conclusions: The study provides valuable information on the impact of specific process parameters on production of food-grade phytosomes for improved stability of hydrophilic phenolic-based functional food ingredients.

PRESENTER BIOGRAPHY: CHANTELLE HUMAN

Dr Chantelle Human's inherent interest in the application of chemistry in product development has guided her career thus far. She completed her MSc in chemistry and polymer science gaining expertise in physicochemical analyses techniques and applications for smart polymers. Chantelle's sentiment for food and healthy-living led her to complete a PhD in Food Science. Her research had a strong focus on chemistry and polymer science within the field of food science and involved the efficient delivery of a rooibos nutraceutical by micro- and nanoencapsulation. After completion of her PhD, she was employed as an R & D Chemist at Vital Health Foods, which allowed her to gain valuable industry experience in terms of relevant analytical testing and nutraceutical product development. Currently, she is employed at the Agricultural Research Council as a researcher where she is focused on improving the agro-processing industry of South Africa.