

Topic 4: Food structures, digestion and imaging technologies | Poster

(22758) - NANOENCAPSULATION OF ANTHOCYANINS BASED ON PECTIN AND LYSOZYME: A NEW TECHNOLOGICAL APPROACH TO INCREASE THE PHYSICOCHEMICAL STABILITY, BIOACCESSIBILITY AND ABSORPTION

Osvaldt Rosales, Thiécla Katiane (Brazil)¹; Alves Da Silva, Fábio Fernando (Brazil)²; González Rivera, Andy (Brazil)²; Soares Bernardes, Emerson (Brazil)²; Fabi, João Paulo (Brazil)¹

1 - University of São Paulo; 2 - Instituto de Pesquisas Energéticas e Nucleares - IPEN

Abstract

Anthocyanins are bioactive compounds with essential properties, such as antioxidant, anti-inflammatory, and anticancer. However, they have high molecular instability, limited bioaccessibility, and bioavailability. The study aimed to develop a new methodology to nano-encapsulate anthocyanins extracted from blackberries (*Rubus* spp.) using nanogels. They were based on citrus pectin associated with lysozyme through molecular self-assembling. Nanoparticles were subjected to evaluation of colloidal stability and behavior on *in vitro* and *in vivo* models. Cyanidin-3-O-glycoside was primarily identified as the main anthocyanin (95%), and the nanoencapsulation proportions of 1:2:0.4 (m:m:m) of pectin, lysozyme, and anthocyanin, respectively, were statistically established. The nanoparticles showed a size of 190 nm, Zeta Potential -30 mV, and invariably spherical and homogeneous morphology (polydispersity index of 0.1). Nano-encapsulated anthocyanins were stable at different pH values (2 to 12) and temperatures (4, 25 and 40°C). The INFOGEST 2.0 digestion indicated preserving the anthocyanins' integrity and gradual release. A significant content remained intact in the nanostructure at the end of the intestinal phase. Cytotoxicity was not observed in 2D and 3D models, and nanoparticles were absorbed in both cell systems in a time-dependent way. A new methodology was developed to radiolabel anthocyanins directly with Technetium (^{99m}Tc) and nano-encapsulate them. An *in silico* model was developed to indicate the molecular interaction between the anthocyanin and the radioisotope. Biodistribution in different tissues, Kinect of absorption, and molecular visualization by μ SPECT/CT showed that nano-encapsulated ^{99m}Tc-anthocyanins are absorbed differently than free molecules in mice. The molecule in blood, bone, bladder, lung, brain, heart, pancreas, liver, and spleen was significantly higher for nano-encapsulated after 24 hours of oral administration. The *in vitro* and *in vivo* methodologies demonstrated that nano-encapsulation can protect anthocyanins against digestion factors, with a controlled release in the intestine, improving absorption and targeting different organs. These results contribute to knowledge about the bioavailability of nano-encapsulated bioactive compounds and their potential clinical applications for the food and pharmaceutical industries.

References

Rosales et al.,

doi: 10.1016/j.foodhyd.2023.108516

doi: 10.1016/j.foodhyd.2020.106563.

Acknowledgments

The National Council for Scientific and Technological Development (CNPq) for T.K.O.R. scholarship (#151150/2023-0) and J.P.F. productivity scholarship (#307842/2022-3). The authors acknowledge the São Paulo Research Foundation (FAPESP) for T.K.O.R. scholarship (#2023/09620-3). The study was financially supported by grants #2013/07914-8, #2022/12834-2 and #2023/01396-7 from the São Paulo Research Foundation (FAPESP).

Keywords : Nanoencapsulation, Molecular imaging, Cyanidin-3-O-glycoside, Bioaccessibility, Food colloids