

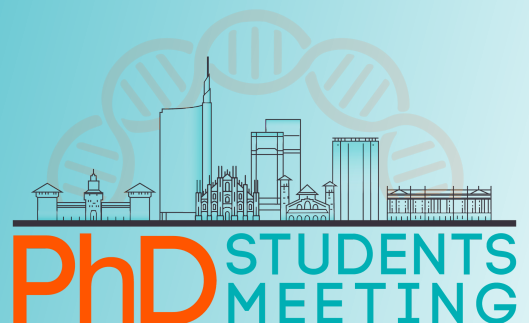
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***Abstract
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T49: Zein-based nanoparticles as a potential delivery system of anthocyanins from purple corn cob

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Background: Anthocyanins are purple-red natural pigments belonging to the flavonoid family known to exert several health beneficial effects, particularly against chronic inflammatory-related diseases, such as cardiovascular diseases. Nevertheless, the bioavailability of anthocyanins was reported to be 12.4%, considering anthocyanin-derived metabolites, or less than 1% considering only native anthocyanins, meaning that only a little part of anthocyanins can reach the blood stream and then the target site after oral ingestion. This suggests that the bioactivity of anthocyanins could be limited due to their instability and/or metabolization along the gastro-intestinal tract.

In a previous study, mice fed an anthocyanin-rich diet based on purple corn challenged with Doxorubicin, a chemotherapeutic agent known for its cardiotoxicity, showed an improved short-/mid-term survival rate compared to their anthocyanin-free diet counterpart fed with a diet based on yellow corn. However, the long-term survival rate was the same for both groups (1). We hypothesized that the cardioprotective activity of anthocyanins could be limited by their low bioavailability. Thus, we aimed at developing a strategy to nano-encapsulate anthocyanins in order to potentially improve their bioavailability and consequently their bioactivity.

Methods: With a circular economy approach, we obtained an anthocyanin-rich extract from purple corn cob, the inner inedible part of the ear, and we encapsulated it in a polymeric system based on zein, the main storage protein of maize seeds, previously selected as less cytotoxic compared to starch-based nanoparticles (2).

Anthocyanins were firstly extracted with hydroalcoholic solutions acidified with six different acids (i.e. formic, hydrochloric, acetic, lactic, tartaric and citric acids). Based on the efficiency and the selectivity of the extraction, only three acidified extracts were selected to test their cytocompatibility on CaCo-2 human intestinal cells via MTT assay. The two more tolerated extracts were selected for zein-based nanoparticles formulations.

The resulting delivery systems were characterized in terms of size and morphology through Dynamic Light Scattering and Scanning Electron Microscopy. Finally, the cytocompatibility of both delivery systems was verified on CaCo-2 cells, considered as the first barrier after oral ingestion, and HL-1 murine cardiomyocytes, representing the final target.

Results: Among the six purple corn cob extracts tested, only the three acidified with formic, hydrochloric and acetic acids showed a good extraction efficiency and selectivity. Nevertheless, only extracts acidified with formic or hydrochloric acids were the most cytocompatible for CaCo-2 cells and were encapsulated in zein-nanoparticles acidified using the same extract. The nanoparticles showed a spherical shape with a nanometric dimension. Curiously, zein-nanoparticles formulated with formic acid exhibited a significantly stronger cytotoxicity on HL-1 cardiomyocytes compared to their hydrochloric counterpart whereas nanoparticles with hydrochloric acid were not cytotoxic on both cell lines at all the concentrations tested.

Conclusions: Zein-based nanoparticles acidified with hydrochloric acid could represent a safe starting point to develop a stable oral delivery system for anthocyanins.

- (1) Petroni et al., *Nutr Metab Cardiovasc Dis.*, 2017. doi:10.1016/j.numecd.2017.02.002
- (2) Massironi et al., *J Drug Del Sci Technol*, 2025. doi: 10.1016/j.jddst.2025.106624