DETERMINATION OF THE DIFFUSION AND PARTITION COEFFICIENTS OF ANTHOCYANINS ENCAPSULATED IN WATER/OIL/WATER DOUBLE EMULSIONS

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Introduction. Double emulsions from the type Water in Oil in Water are liquid membranes in which a simple emulsion (W1/O) is dispersed on a second aqueous external phase (W2). These multi compartment liquid dispersions have significant potential in many applications (cosmetics, pharmaceutics and food) that require the protection, transport or controlled release of active agents from an internal reservoir to the continuous phase [1]. They are able to stabilize and protect in their inner phase active materials unstable to external factors, like the anthocyanins, that are the largest and most important group of water-soluble pigments in nature, and also possess an important antioxidant activity [2].

In this research we prepared double emulsions with food grade materials, stabilized with whey protein isolate (WPI), containing anthocyanins in the inner aqueous phase, and the diffusion and partition coefficients, as well as the release kinetics of the compounds were determined.

Methods. The W/O/W emulsions were prepared by using a two-step emulsification procedure. In the first step, the primary W/O emulsions were obtained by adding drop wise aqueous anthocyanins extract to canola oil containing 20% of the emulsifiers PGPR an Panodan®. In the second step, the W/O emulsions were dropped into an aqueous phase containing 12.5% of WPI. The release kinetics of the anthocyanins was obtained, measuring the variation of the Croma value *C* with time, using a Colorimeter CR400 with the CIEL*a*b* system. The partition coefficient was obtained by analysis in biphasic systems, and with the data obtained, the mass transfer was adjusted to the Fick Law [3] and using the mathematical software Matlab®, the global diffusion coefficient was obtained. The stability of the emusions was measured by the changes in droplet size, using a Malvern Mastersizer Instrument.

Results. The behavior of the particle size distribution (Figure1) showed minimal change in the first 16 days, meaning that the emulsions remain stable.

The analysis in biphasic systems revealed that the anthocyanins possess a strong affinity to the interphase formed by the emulsifiers, and the partition coefficient at the interphase determined was 0.48. The adjust of the model to the experimental data of the release kinetic of the anthocyanins is shown in Figure 2; it could be adjusted for the first 9 days of release, and the diffusion coefficient obtained was D = 141.042982 cm^2 / day. After 30 days of analysis, almost 37% of the initial concentration of

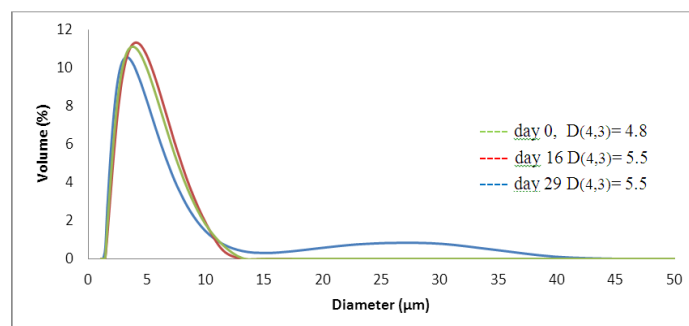anthocyanins incorporated in the inner aqueous phase of the emulsions was released.

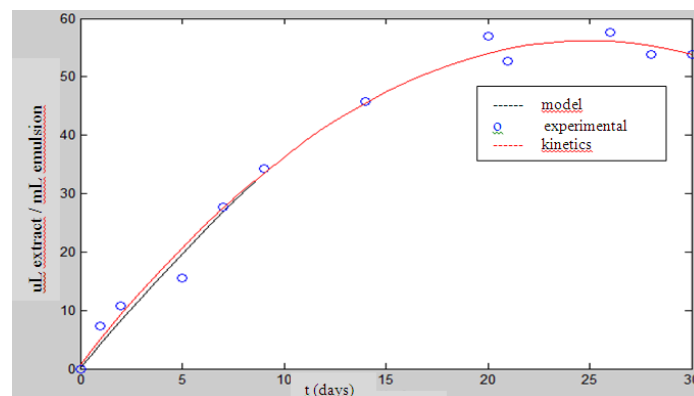**Fig.1** Particle size distribution of the double emulsions at day 0, 16 and 29.

Fig.2 Release kinetics of the anthocyanins in the double emulsions.

Conclusions. By measuring the variation of color with time of the double emulsions containing anthocyanins in the inner aqueous phase, we could establish the release kinetics of these compounds and also determined their diffusion coefficient; these data can serve as tools for further application in a food product, since they showed to be stable with time and thus, being useful to protect unstable compounds.

References.
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