Study of encapsulation of commercial essential oil of *Cistus ladanifer* in beta- and gamma-cyclodextrin – Evaluation of heat stability and antioxidant activity

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Cistus plant, also known as rockrose, is a widespread shrub species family in the Mediterranean region and it belongs to the *Cistaceae* family. Especially, its essential oils are known for their antimicrobial and antioxidant activity and consequently, it has the potential for applications in the cosmetic, food, and pharmaceutical industries.

Essential oils show sensitivity to some physicochemical factors, such as oxygen, light, high temperature, and extreme pH values. A very effective way of protecting them is their encapsulation. A common carrier of essential oils is cyclodextrins, because of their better solubility in water, their hydrophobic cavity and hydrophilic external surface, and their lack of toxicity (in the used concertation). Thus, this project aimed to study the encapsulation of the essential oil of *C. ladanifer* in beta- and gamma-cyclodextrin and some properties of the inclusion complex. Firstly, Gas chromatography–Mass spectrometry (GC-MS) showed that the essential oil consists mainly of monoterpenes (a-pinene is the main component), and sesquiterpenes (such as bornyl acetate and viridiflorene). The inclusion complex was prepared using the method of co-precipitation. The amount of encapsulated essential oil was determined after extraction of essential oil from the complex with hexane/ethanol/water, sonication for 30 minutes three times, analyzed with GC-MS, and the results showed that gamma-cyclodextrin included a higher amount of essential oil than beta-cyclodextrin (95,93% for inclusion complex with gamma-cyclodextrin and 71,96% for beta-cyclodextrin). The carriers had null antioxidant power assessed with the ferric reducing assay (FRAP) whereas the gamma-cyclodextrin complex had almost double the antioxidant power than the beta-cyclodextrin one. Furthermore, heat stability took place at 110˚C for 6 hours at intervals of 1 hour. Cyclodextrins protected the evaporation of their encapsulated essential oil comparatively with the evaporation of free essential oil. Last but not least, the FRAP values of the complexes further increased up to 5 h of incubation. The results suggest that the inclusion process was effective to a high degree and provided a new material with antioxidant properties and stability against high temperatures that could find interesting applications.