Minicolloque n° 2 ☒ **Oral** ☐ **Poster**

Understanding the "Ouzo effect" to elaborate hybrid nanocapsules

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The "Ouzo effect" is a spontaneous emulsification generating metastable nanodroplets, without using surfactant or energy input [1]. This phenomenon occurs in ternary mixtures of a hydrophobic oil, a water-miscible solvent and water [2]. Thus, the supersaturated oil aggregates into small droplets (or particles if the hydrophobic solute is solid) which are suspended in the continuous phase. While the Ouzo domain is characterized by a turbid aspect, a limpid domain called Surfactant-Free MicroEmulsion (SFME) exists in a large part of the monophasic region and is described as a stable microemulsions.[3] Until now, the transition between the SFME and Ouzo domains has generally been characterized in a subjective way by visual observation of the solution (limpid/turbid). The size evolution of nano-objects in the SFME and Ouzo domains has been studied mostly by Dynamic Light Scattering (DLS) analysis.[4] Our work focuses on a more objective understanding of the transition between the SFME and Ouzo domains. We used the model system limonene/DMSO/water, with DMSO as solvent for biological applications. The originality of our work consists in using different characterization techniques such as i) Zeta potential measurements, ii) Nanoparticle Tracking Analysis (NTA), which gives realistic information on the size distribution of the dispersed phase (in the range 20 nm-1 µm) and its concentration in the sample, and iii) the Turbiscan instrument which uses light scattering to study the stability of our samples over time.

We used the "Ouzo effect" in the presence of nanoparticles to produce hybrid nanocapsules (~ 100 nm), called Hybridosomes ®.[5] These are composed of an inorganic nanoparticle shell (Iron Oxide, Au, etc) stabilized by a polymer (PAA, PEG-PAA, etc.), that make them exceptionally robust. These nanocapsules have an internal volume enabling to load up to 170 $g.L^{-1}$ of hydrophobic molecule inside.[6] Recently, we have tried to nanoencapsulate chemotherapeutic molecules such as Sorafenib and Paclitaxel.

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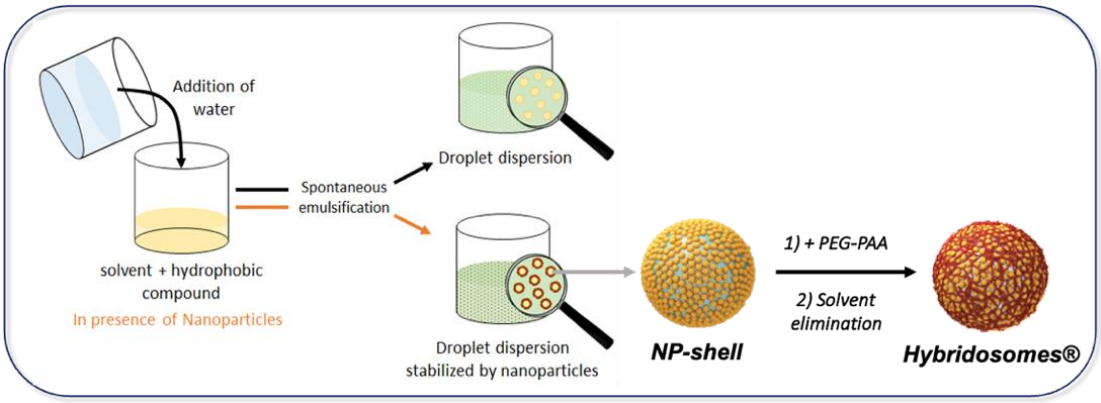

Figure 1: *Schematic representation of the use of the "Ouzo effect" to produce robust nanocapsules*