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 \cite{1}. This phenomenon occurs in ternary mixtures of a hydrophobic oil, a water-miscible solvent and water \cite{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.\cite{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.\cite{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.

We used the ”Ouzo effect” in the presence of nanoparticles to produce hybrid nanocapsules (~ 100 nm), called Hybridosomes ®.\cite{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\textsuperscript{-1} of hydrophobic molecule inside.\cite{6} Recently, we have tried to nanoencapsulate chemotherapeutic molecules such as Sorafenib and Paclitaxel.


\begin{figure}[h]
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\includegraphics[width=\textwidth]{figure1.png}
\caption{Schematic representation of the use of the “Ouzo effect” to produce robust nanocapsules}
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