<u>Research highlights:</u>

We exploited the self-assembly of oppositely charged nanoparticles to achieve stable water-in-water (w/w) emulsion droplets with enhanced storage and mechanical stability. This w/w emulsion route can be used as a template to make water-dispersible microcapsules free of oil traces. In many situations, such as the encapsulation of oil-sensitive active ingredients and the development of sustainable next-generation low-calorie food products, the oil phase is known to cause deleterious effects. Hence the replacement of the oil phase with another suitable aqueous phase is desirable. This phenomenon provides additional variability to study the physical characteristics of the emulsion-based products. For instance, the influence of the number and the size ratio of OCNPs on the structure and quality of the desired products. Figure 1 describes the schematic description of process of making bijels and emulsion droplets.

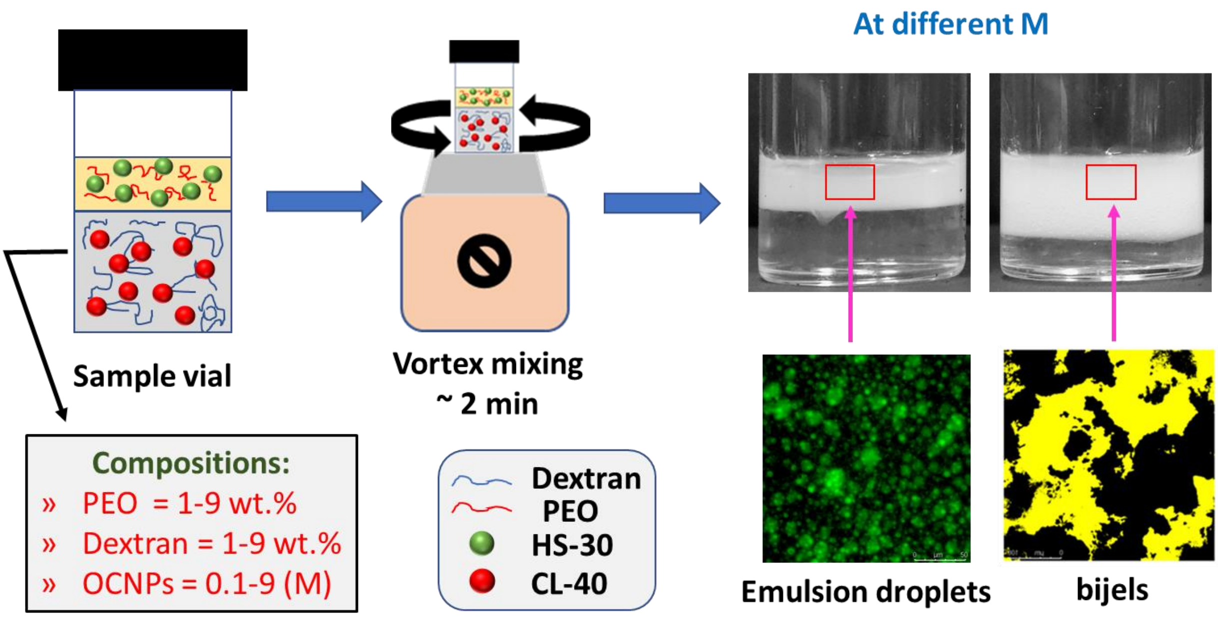

Fig. 1. Schematic description showing the process of making bijels or emulsion droplets.

To probe the mechanical stability, we subjected the emulsion droplets under higher centrifugal action by placing a small drop of emulsion samples corresponding to different M (Ratio of wt. fraction of positively charged nanoparticles to negatively charged one) on a glass substrate and allowing the samples to experience a mechanical disturbance in the form of rotational spinning under centrifugal action. The spin coater is used to dry these samples at the desired set point. The programmed speed and run time operated by us are 1000 RPM and 2 min, respectively.

Figure 2A and B reveal the structural state of emulsion droplets imaged using HRSEM. We observed that the droplets and bijels remained stable even after exposing them to higher shear conditions. Although these droplets were not collapsible under shear, they were found elongated a little bit due to the centrifugal action.

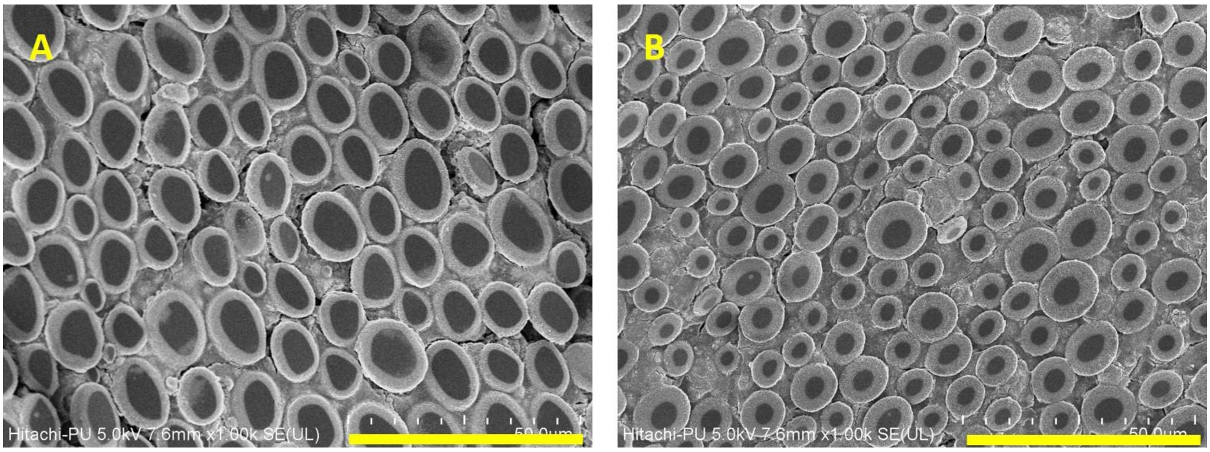

Figure 2. The representative HRSEM images showing the structurally stable emulsion droplets in solid state after mechanical perturbation. A) Emulsion droplets prepared at M=4, B) Emulsion droplets prepared at M=9. Scale bar corresponds to 50 µm.

It is intriguing to note the fact that while the droplets stabilized by OCNPs have shown good resilience under a high centrifugal action, the bijels produced in this way continued to remain stable for a long time, offering a facile route to prepare the bijels with a hierarchical bi-continuous network structure.