Novel Controlled Density Softspheres

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Introduction

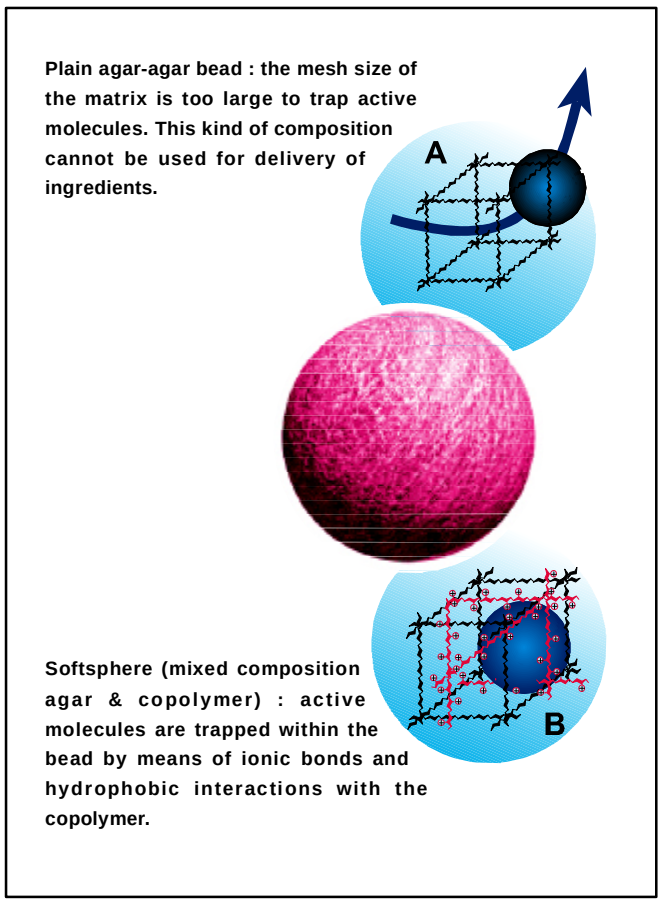
Softspheres are large spherical beads used in gels and emulsions for decoration and delivery of active ingredients to the skin. They are made of agar-agar and a cationic and amphiphilic copolymer : this unique structure allows them to be stable in a wide range of pH and in formulations containing high concentrations of surfactants, while being soft enough to be crushed on the skin without leaving any residue.
However, like the other large decorative beads on the market, Softspheres have a higher density than that of the formulations in which they are dispersed. This limits the range of formulas they can be incorporated in to high viscosity products.
Kobo Products have developed a new composition to precisely control Softspheres density, using a low density hollow microsphere as the density reducer. This allows them to remain dispersed even in low viscosity formulations. Softspheres based on this composition still maintain their desirable tactile properties and their stability.

Structure of Softspheres

Softspheres are large (0.7 to 2.8 millimeters) spheres, made of agar-agar, a natural polysaccharide and a cationic and amphiphilic copolymer embedded within the agar matrix. The system have the capacity to trap active molecules by means of ionic bonding or hydrophobic interactions. They can also be colored and used for decoration of transparent cosmetic preparationsDensity of Softspheres.

Density of Softspheres

Most Softspheres compositions (basically water, polymers and pigments) have a density greater than 1.0 g/cm^3. When incorporated to low viscosity formulations, their density is higher and that of the formula and they tend to sink to the bottom of the jars. The rate at which Softsphere will settle down to the bottom will depend on their actual composition and density relative to that of the formula and on the viscosity of the formula.



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Controlled Density Softspheres

In order to control the density of Softspheres, without affecting their structure and their capacity to trap active ingredients, we have added a density reducer, made of lightweight hollow microspheres. These microspheres have a very low density (0.024 g/cm^3) and they are large enough (average diameter 40 microns) to be trapped by the meshed structure of the Softsphere. The density reducer was added at various percentages to test its ability to control the reduction in density of Softspheres.

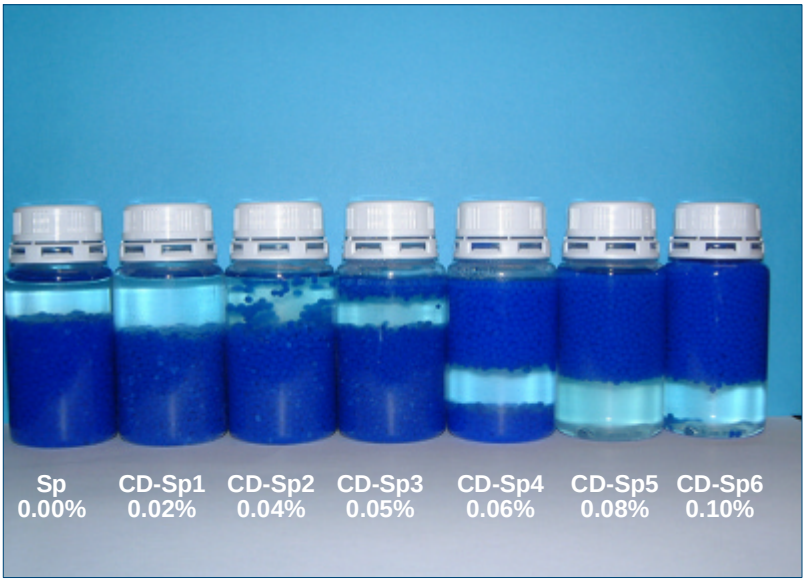
Softspheres of the following compositions were prepared using a standard manufacturing procedure and tested for their density :

	Percent of Density Reducer
Regular Softspheres :	0.00%
CD-Sp1 :	0.02%
CD-Sp2 :	0.04%
CD-Sp3 :	0.05%
CD-Sp4 :	0.06%
CD-Sp5 :	0.08%
CD-Sp6 :	0.10%

Flotation Test

Seven different Softspheres compositions were added to water and allowed to settle 1 day at room temperature.

Softspheres Composition	Percent Density Reducer	Obervation	Observed Density
Sp	0.00%	Have settled down to bottom of jar	> 1
CD-Sp1	0.02%	Have settled down to bottom of jar	> 1
CD-Sp2	0.04%	Have settled down to bottom of jar	> 1
CD-Sp3	0.05%	Some float on top Some have settled down	± 1
CD-Sp4	0.06%	Some float on top Some have settled down	± 1
CD-Sp5	0.08%	Float on top of jar	< 1
CD-Sp6	0.10%	Float on top of jar	< 1

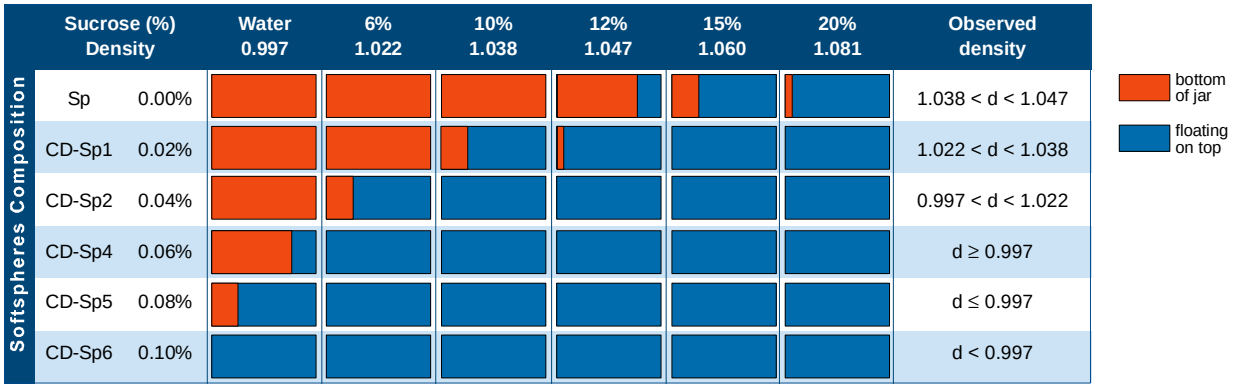


Compositions containing none or low percentages of Density Reducer have settled down to the bottom of the jars, which denotes an observed density greater than 1.0 g/cm^3. On the contrary, compositions containing high percentages of Density Reducer are observed to float on the top of the jars, and have thus an observed density lower than 1.0 g/cm^3. This result shows that the Density Reducer is able to modify the density of Softspheres.

For compositions containing 0.05 and 0.06% of the Density Reducer, Softspheres are distributed between the top and the bottom of the jars : their observed density is in this case close to that of water (1.0 g/cm^3).

Density Measurements

Six sucrose aqueous solutions were prepared with density ranging from 0.997 (water) to 1.0810 g/cm3 (20% sucrose). Softspheres containing various amounts of Density Reducer were added to these solutions and allowed to settle for 15 minutes at room temperature. Density of the different Softspheres compositions were determined by observing the distribution of Softspheres within the liquid. In the following table, we have represented the relative proportions of Softspheres observed to have settle down to the bottom of the jars (red bars) and those observed floating on the surface (blue bars).



We have been able to determine an observed density for each Softspheres composition, except to the ones that have a lower density than 1.0g/cm3. As already observed in the Flottation Test, increasing amounts of Density Reducer lower the density of Softspheres. CD-Sp4, Softsphere composition which contains 0.06% of Density Reducer, has the observed density closest to that of water.

Conclusion

Because of their unique structure, Softspheres have many advantages as delivery systems and for decoration of cosmetics formulations. However, their high density limits their use in low viscosity products.

The preliminary work described in this presentation shows that a lightweight hollow microsphere can be added to Softspheres as a density reducer. It is then possible to control the density of Softspheres composition to match that of the formula they are incorporated in. Work is now in progress to adapt this concept to other areas of applications : food, pharmaceuticals, oral care or house care products.