Cubosomes [1] are submicrometric crystals of cubic lyotropic phases dispersed in water. Their production requires perfect knowledge of the phase behavior, for example, of phytantriol/ethanol/water ternary mixture.

The phase diagrams of phytantriol/ethanol/water system

Phase transition $L_2 \rightleftharpoons Pn3m$ obtained by decreasing the concentration of ethanol from 12% to 8% at constant temperature of 43°C

a. Three phases are present: the droplet surrounded by the $L_1$ phase is mainly made of the $Pn3m$ phase.

b. $Pn3m$ monocRYSTAL surrounded by the $L_1$ phase. The $Pn3m/L_1$ interface is partially faceted; predominant rough parts of the $Pn3m/L_1$ interface coexist with three types of facets: (111), (100) and (110). From b to d facets are growing at the expense of the rough surface. This phenomenon is due to the “growth-by-redistribution” effect.

c. Nanostructured emulsions

In the cryo-TEM method the solution is spread on a carbon grid in such a way that a very thin aqueous film is formed then immersed into a cooling medium (ethane). The grid with the film is transferred to the microscope and examined at liquid nitrogen temperature in transmission mode.

Experimental setup

The sample is situated in a flat capillary between two Peltier elements (b) washed by the solution of ethanol in water (c). The observation of the sample is made by a simple system consisting of a microscope objective, a video camera and an illumination system mounted on the vertical bench.

Images of the cubosomes obtained by cryo-TEM

In the cryo-TEM method the solution is spread on a carbon grid in such a way that a very thin aqueous film is formed then immersed into a cooling medium (ethane). The grid with the film is transferred to the microscope and examined at liquid nitrogen temperature in transmission mode.

[From the presentation of Jéril Degrouard, Orsay, France]

Conclusions

1. During experimental studies of phase diagrams we have identified all phase transitions which take place in the investigated ternary system. In particular, we observed monocRYstals of phase $Pn3m$ as well as droplets of isotropic phases $L_3$, $L_2$ and lamellar phase $L_0$

2. Thanks to all accumulated knowledge of phase diagrams, we were able to choose appropriate conditions for observation cubosomes by Cryo-TEM

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References