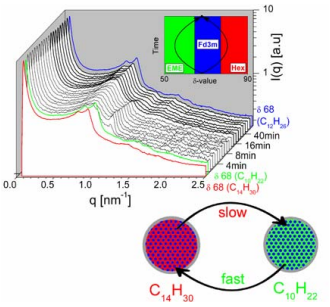
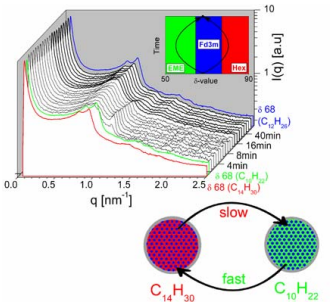
Boston University
Biophysics Seminar

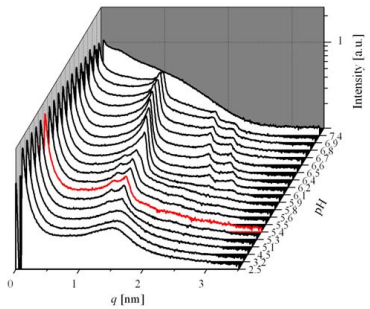
Transfer Kinetics:



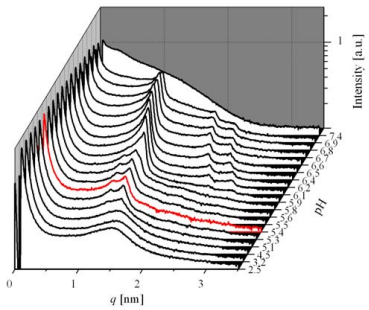
Transfer Kinetics:



pH Variation:



pH Variation:



Nanostructured Lipid Droplets

In this seminar we present our results on hierarchically organized fluid particles, i.e., sub-micron sized lipid droplets kinetically stabilized as an aqueous emulsion having a self-assembled nanostructured interior [1-3]. The nanostructures in the kinetically stabilized particles are thermodynamic equilibrium structures based on monolinolein or phytantriol. The stabilizer can be of polymeric type, like Pluronics F127, or of colloidal type like Laponite nanoparticles [4]. The addition of tetradecane or other oils induces a transition of the internal particle nanostructure from continuous Pn3m (cubosomes) to H2 (hexosomes), discontinuous cubic Fd3m (micellar cubosomes) and W/O microemulsions (emulsified microemulsion, EMEs) at a given temperature. Most interestingly, these systems allow us to study transfer of lipidic phases or of other molecules inserted to the interior of the droplets [5].

The solubilisation of oleic acid (OA) in monoolein (MO) based cubosomes decreases the interfacial curvature of the liquid crystalline phase to more negative values. pH variation between 2 and 8 in a OA-MO system shows that the internal particle structure strongly depends on the pH of the aqueous phase. At high enough OA concentration, transformations from structure less emulsions to emulsified microemulsion (EME), emulsified Fd3m, hexosomes, bicontinuous cubosomes and vesicles can be observed as a function of pH. Interestingly, the liquid crystalline structure to vesicle transition always occurs at intestinal pH values. All transitions with pH are reversible.

An apparent pKa for OA in MO is evaluated from the change of structure with pH. This value is within in the physiological pH range of the intestine (between pH 5.5 and 7.5). For pure OA a higher pKa value between 8 and 8.5 was given in literature.

The structures of these systems have been studied by SAXS. For the transfer kinetic experiments we developed a special high flux laboratory system with a flow cell, equipped with a CCD camera which allows time resolved measurements down to one experiment per minute. These structural studies are complemented by Cryo-TEM and dynamic light scattering experiments.

References

[1] L. de Campo, et al., 2004 Langmuir 20, 5254.
[2] A. Yaghmur, et al., 2005 Langmuir 21, 569.
[3] A. Yaghmur, et al., 2006 Langmuir 22, 517.
[4] A. Salonen, et al., 2008 Langmuir 24, 5306.
[5] Ch. Moitzi, et al., 2007 Adv. Materials 19, 1352.

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June 23, 2009 (Tuesday) at 4:00pm
590 Commonwealth Ave., Room 352, Boston University