Interactions of Bile Acids with Model Lipid Membranes

Engudar, G., Andresen, T.*, Ozcelik, B., Istanbul Technical University
Istanbul, Turkey
*Technical University of Denmark, Kgs. Lyngby, Denmark

Bile salts are biological surfactants that play an important role in fat digestion and absorption through intestinal wall by forming mixed micelles with lipids, fats and cholesterol. Liposomes are lipid vesicles which are spherical self-assembled aggregates, consisted of amphiphilic molecules such as phospholipids. Because liposomes have structural and compositional similarities with biological membranes, they can be used as model lipid membranes. Liposomes are also used as carrier for bioactive molecules as a result of mimicking the biological membranes, but gastrointestinal conditions affect the stability of liposomes. Therefore, delivery systems which can mimic the gastrointestinal conditions such in the presence of bile salts can be developed to be used as convenient vehicles for pharmaceuticals and nutraceuticals. In this study, the understanding of interactions between bile acids and lipid membranes was aimed in order to develop the efficient colloidal delivery systems, consisting of bile acid- phospholipid mixed micelles. The interactions of bile salts with model lipid membranes include partitioning of bile salts into membranes and solubilization of membranes by bile salts. In the present study, the thermodynamic profile of interactions including, enthalpy, Gibbs free energy, entropy change, and partition coefficients were determined by isothermal titration calorimetry (ITC). Partitioning of bile salts between water and lipid membranes was investigated by determination of partition coefficient, considering the electrostatic interactions of negatively charged bile salt monomers and vesicles in the model. Solubilization effect of bile salts on lipid membranes was investigated by establishing the vesicle-to-micelle phase diagrams and some critical parameters were determined from phase boundaries to quantify membrane solubilization. Chenodeoxycholic acid (CDCA) and deoxycholic acid (DCA) were used as biosurfactants and 1-palmitoyl-2-oleoyl-sn-glcero-3-phosphocholine (POPC) and 1,2-dipalmitoyl-sn-glycero-3-phosphocholine (DPPC) were used to prepare the model lipid membranes in this study.