Fatty acid vesicles as drug carriers

Type of project:	Bachelor (10 or 15 ECTS) or Master (30 or 45 ECTS)
Supervisor:	Judith Kuntsche (kuntsche@sdu.dk)
Language:	Danish or English

Project description

Phospholipid vesicles (liposomes) are well-established as delivery systems for both lipophilic and hydrophilic drugs and some liposome formulations are in clinical use (Barenholz, 2012). However, vesicles can also be formed by fatty acids and their salts in a specific pH interval (**figure 1,** Walde et al., 2010). The vesicles can be further stabilized by the ad of cationic surfactants, monoglycerides or fatty alcohols (Apel et al, 2002, Maurer et al., 2009, Caschera et al., 2011).

Fatty acid vesicles appear interesting formulations for drug delivery especially for dermal drug administration as both fatty acids and fatty alcohols are known penetration enhancers (Lane, 2013). In a recent project, vesicles composed of a mixture of fatty acid and fatty alcohol have been compared with Voltaren gel with respect to permeation of diclofenac through human skin in vitro (Chaaban, 2022). These first results appear vary promising, but more work is needed to fully explore the penetration enhancing potential of fatty acid vesicles and their promise for (trans)dermal drug delivery and, potentially, for oral drug delivery.

Projects will focus on investigations on, e.g., formulation aspects and the preparation methods, physical stability upon storage and in physiological relevant fluids as well as drug incorporation and release.

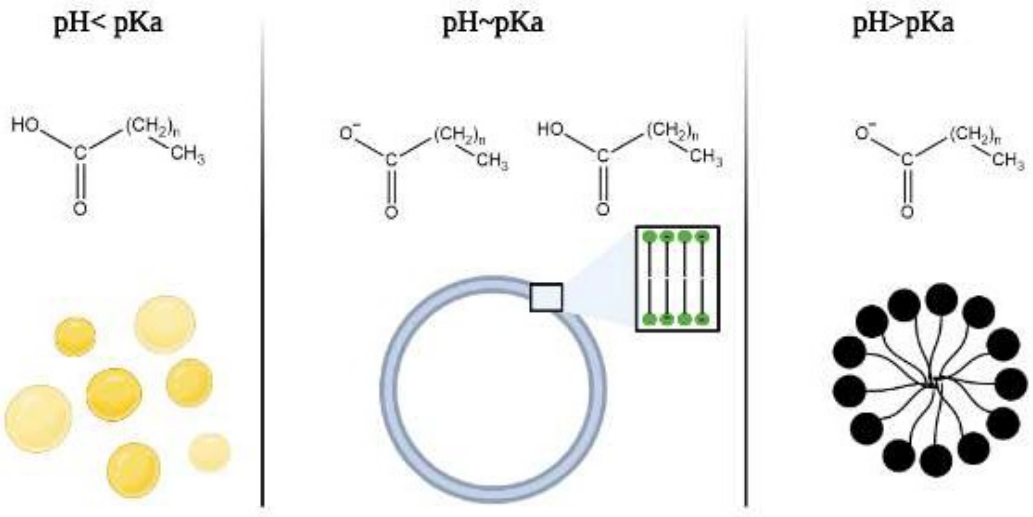

Figure 1: Aggregate structure of fatty acids in water in dependence on pH (from Chaaban, 2022).

References

Apel, C.L., Deamer, D.W., Mautner, M.N., 2002, Self-assembled vesicles of monocarboxylic acids and alcohols: Conditions for stability and for the encapsulation of biopolymers. BBA 1559: 1-9.

Barenholz, Y., 2012. Doxil® - The first FDA-approved nano-drug: Lessons learned. J. Control. Rel. 160: 117-134.

Caschera, F., Bernadino de la Serna, J., Löffler, P.M., Rasmussen, T.E., Hanczyc, M.M., Bagatolli, A., Monnard, P.A., 2011. Stable vesicles composed of monocarboxylic or dicaborylic fatty acids and trimethylammonium amphiphilies. Langmuir 27: 14078-14090.

Chaaban, M.A., 2022. Evaulation of fatty acid vesicles for transdermal drug delivery. Bachelor thesis, SDU.

Lane, M.E., 2013. Skin penetration enhancers. Int. J. Pharm. 447: 12-21.

Maurer, S.E., Deamer, D.W., Boncella, J.M., Monnard, P.A., 2009. Chemical Evolution of amphiphiles: Glycerol monoacyl derivates stabilize plausible prebiotic membranes. Astrobiol. 9: 979-987.

Walde, P., Namani, T., Morigaki, K., Hauser, H., 2010. Formation and properties of fatty acid vesicles (Liposomes). In: Liposome Technology, Volume I: Liposome preparation and related techniques, Ed. G. Gregoriadis; CRC Press, pp. 1-19.