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Development of asymmetric liposomes to mimic plant plasma membrane using cyclodextrins as lipid carriers – Influence of phospholipid fatty acid chains.

Content

Although liposomes can be criticized in terms of relevance to mimic real biological membranes, they give access to information at molecular or atomistic levels that are difficult to study in cellulo. In biophysical studies on liposomes, the asymmetric nature of the lipid distribution is often overlooked despite its role in several biological mechanisms. However, in the last decades, the preparation of asymmetric liposomes has been developed especially through protocols based on cyclodextrin-mediated lipid exchange, hemifusion or inverted emulsion phase transfer approaches. These strategies were applied on human plasma membrane (PM) models whereas the field of plant PM asymmetric liposomes remains unexplored. One difference between these two membranes concerns their phospholipid fatty acid composition. Linoleoyl chain (ex: PLPC) is widely found in plants instead of oleyl chain (ex: POPC) in human cells.

The main objective of this work was to elaborate preliminary asymmetric liposomes mimicking plant PM and containing charged and uncharged phospholipids. We developed asymmetric models containing phosphatidylcholine (PLPC or POPC) and phosphatidylserine (PLPS or POPS) or phosphatidylglycerol (PLPG or POPG) using methyl-β-cyclodextrins as lipid carrier. The asymmetry has been controlled using F2N12S, a fluorescent probe sensitive to the outer leaflet surface charge and lipid order. We found that the exchange efficiency is directly impacted by the nature of the hydrophobic chains. Indeed, an efficient exchange was observed between phospholipids with oleyl chain whereas no exchange occurred with phospholipids containing linoleoyl chain. Based on these results, we discuss on the relevance of the cyclodextrin-mediated lipid exchange strategy to produce asymmetric liposomes mimicking plant PM.

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