



Research paper

## Calcein release behavior from liposomal bilayer; influence of physicochemical/mechanical/structural properties of lipids

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### abstract

The design of the drug delivery depends upon different parameters. One of the most noticeable factors in design of the drug delivery is drug-release profile which determines the site of action, the concentration of the drug at the time of administration, the period of time that the drug must remain at a therapeutic concentration.

To get a better understanding of drug release, large unilamellar liposomes containing calcein were prepared using 1,2-dioleoyl-*sn*-glycero-3-phosphocholine, 1-palmitoyl-2-oleoyl-*sn*-glycero-3-phosphocholine and 1,2-palmitoyl-*sn*-glycero-3-phosphocholine, and a mixture of them; calcein was chosen as a model of hydrophilic drug. The calcein permeability across liposomal membrane (with different compositions) was evaluated on the basis of the first-order kinetic by spectrofluorometer. Also, the effects of liposome composition/fluidity as well as the incubation temperature/pH were investigated.

Furthermore, we simulated the digestion condition in the gastrointestinal tract in humans, to mimic human gastro-duodenal digestion to monitor calcein release during the course of the digestion process. *In vitro* digestion model "pH stat" was used to systematically examine the influence of pH/enzyme on phospholipid liposomes digestion under simulated gastro-duodenal digestion.

The results revealed that calcein permeates across liposomal membrane without membrane disruption. The release rate of calcein from the liposomes depends on the number and fluidity of bilayers and its mechanical/physical properties such as permeability, bending elasticity. Chemo-structural properties of drugs like as partition coefficient (Log *P*), H-bonding, polar surface area (PSA) are also determinative parameter in release behavior.

Finally, stimulated emission depletion (STED) microscopy was used to study calcein translocation through liposomal bilayers.

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