Normal and shear forces between surfaces bearing stabilized liposomes

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Phosphatidylcholine (PC) liposomes have been shown to lead to a striking reduction in the sliding friction under physiologically-high pressures (1). However instabilities of liposomes during storage are a serious limiting factor for their applicability due to fusion and aggregation. We have synthesized a novel molecule with a structure based on the lipid distearoylphophatidylethanolamine (DSPE) but with a highly-hydrated, chain-like poly(methacryloylphosphorylcholine) (PMPC), whose monomer contains the phosphorylcholine group (headgroup of lipid), have proved to be extremely efficient boundary lubricants up to quite high pressures. These DSPE-pMPC molecules can be incorporated into PC-SUVs (phosphatidylcholine-small unilamellar vesicles), forming PC-SUV-PMPC liposomes, which stabilize them against aggregation/fusion (Figure 1); at the same time such stabilized liposomes serve as very efficient high-pressure lubricants between sliding surfaces via the hydration lubrication mechanism. This resolves the issue of long shelf life for such lubricating PC liposomes (which, when unstabilized, aggregate within a week, and when stabilized by poly(ethylene glycol) (PEG) provide less good lubrication in salt at high pressures). That is attributed to the stronger hydration of pMPC (ionic solvation) than PEG's (hydrogen bonding).

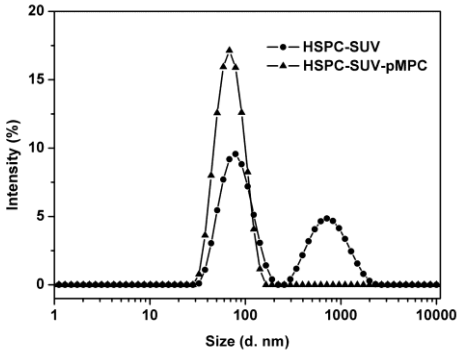

Figure 1 Size distribution of HSPC liposomes (one week after preparation) and DSPE-pMPC polymer stabilized HSPC (three months after preparation) in water.

(1) Goldberg, R.; Schroeder, A.; Silbert, G.; Turjeman, K.; Barenholz, Y.; Klein, J. *Advanced Materials* **2011**, *23*, 3517.