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INFLUENCE OF NANOPARTICLES ON DOPC LIPID BILAYERS

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In biotechnology, including biomedical applications, the nanomaterials stand out to integrate a new generation of cell probes or carriers for drug delivery, especially because of their small size and tunable surface properties. The material, size, and morphology of nanoparticles play an important role in interaction with biologic components, such as lipid membrane. Thus, in this work, we evaluated the interaction of silver nanoparticles (AgNp), silica-coated silver nanoparticles (AgNp@SiO2), and gold nanoparticles (AuNp) with the DOPC (1,2-dioleoyl-sn-glycero-3-phosphocholine), a phospholipid present in the cell membrane. The analysis was carried out using the large unilamellar vesicles (LUVs, size ~130 nm, in PBS buffer) and giant unilamellar vesicles (GUVs, size 10-20 µm, in HEPES buffer). The DOPC LUVs were exposed to AgNp, AgNp@SiO2, or AuNp colloid for 180 minutes and evaluated by dynamic light scattering (DLS) and zeta potential. The DOPC GUVs were also exposed to the same nanoparticles and evaluated by phase-contrast microscopy, obtaining the microscopy image for different exposition times (30 – 180 min). In the LUVs system, a decrease of 23% of LUVs amount with sizes ~130 mn and an increase of distribution group with sizes higher than 1000 nm was observed only for the AgNp up to 90 minutes. These changes indicate a strong interaction

of AgNp on DOPC bilayer with small curvature. A small variation was observed to AgNp@SiO2 up to 90 minutes, which can be scribed to AgNp residues present in the AgNp@SiO2 colloid, once the AgNp was applied as a precursor in the nanoparticle synthesis. No changes were observed for DOPC LUVs in the presence of AuNp. The effects observed on LUVs and GUVs were confirmed by transmission electron microscopy (TEM) images. In the GUVs system, after 180 min the AgNp and AgNp@SiO2 showed, respectively, an increase of 6% and 1% on the loss of phase-contrast in comparison with the GUVs control, reinforcing higher AgNp reactivity than AgNp@SiO2. On the other hand, the AuNp affect only the morphology of the GUVs (24.6% of GUVs with changes in morphology), however, did not affect the phase-contrast or changes in the mean sizes. Thus, the results suggest a high surface reactivity for AgNp onto DOPC lipid with small bilayer curvature (LUVs), which promotes a break in the DOPC bilayer. The SiO2 coat showed a decrease in surface reactivity, leading to a smaller effect on both LUVs and GUVs systems. In the case of AuNp, the nanoparticles interact with the DOPC bilayer but do not disturb the bilayer structuration. In short, we observed that nanoparticle plays an important role in interaction with biocomponent and the results can contribute to understanding the reactive and biocompatibility of nanomaterials in the biological system.