Probing photoinduced lipid hydroperoxidation in Langmuir monolayers

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Photodynamic therapy (PDT) efficiency depends on many factors including the incorporation of the photosensitizer (PS) in cell membranes and possible lipid hydroperoxidation. Herein, we show that hydroperoxidation may be photoinduced when eosin Y is incorporated into Langmuir monolayers that serve as cell membrane models. This occurs for Langmuir monolayers of 1,2-dioleoyl-sn-glycero-3-phosphocholine (DOPC) and 1-palmitoyl-2-oleoyl-sn-glycero-3-phosphocholine (POPC), which have unsaturation in their hydrophobic chains. In contrast, light irradiation had no effect on monolayers of saturated 1,2-dipalmitoyl-sn-glycero-3-phosphocholine (DPPC). Evidence of hydroperoxidation was obtained from the area increase in eosin-containing DOPC and POPC monolayers upon irradiation, which was accompanied by a decrease in monolayer thickness according to grazing incidence X-ray off-specular scattering (GIXOS) data. Furthermore, the changes in polarization-modulated infrared reflection absorption spectroscopy (PM-IRRAS) induced by irradiation were consistent with hydroperoxide migration toward the lipid hydrophilic heads. In summary, this combination of experimental methods allowed us to determine the effects of eosin Y interaction with cell membrane models under irradiation, which may be associated with the underlying mechanisms of eosin Y as photosensitizer in PDT.