LOCALISATION OF OXIDATION ACTIVITY IN FOOD EMULSIONS WITH FLUORESCENT PROBES

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KEY WORDS: lipid peroxidation, oil-in-water emulsion, foods, ratiometric fluorescence, confocal laser scanning microscopy

LIPID OXIDATION IN FOOD EMULSIONS

Lipid peroxidation is the main cause for the limited shelf-life of food emulsions and preventing it is a major challenge in improving product quality. Full understanding of the oxidation process is therefore of crucial importance. However, this knowledge is lacking, especially in complex food emulsions where intricate mechanisms at the oil-water interface play an important role and the process is possibly heterogeneous. In biomedical research, oxidation sensitive fluorescent dyes have been used to study oxidation processes in cells [1] and more recently in emulsions as well [2]. Here, we use such dyes to localize and track oxidation in mayonnaise with confocal laser scanning microscopy (CSLM).

LOCALISATION OF OXIDATION ACTIVITY WITH RATIOMETRIC FLUORESCENCE IMAGING

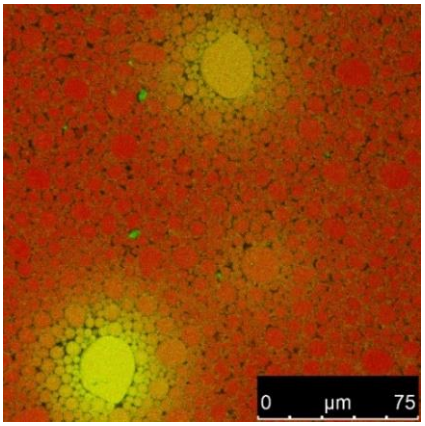

Figure 1: CSLM image of hot spots of oxidation activity in mayonnaise containing BODIPY$^{665/676}$. Native dye is shown in red and oxidized dye in green.

Fluorescent peroxidation probes BODIPY$^{581/591}$ and BODIPY$^{665/676}$ both exhibit a blue shift in emission upon oxidation. This shift is large enough to spectrally separate the native and oxidized dye and thus allows for ratiometric fluorescence imaging. The dyes were dissolved in vegetable oil with which mayonnaise was prepared that was subsequently stored at 30 °C and 50 °C. It was found that at 30 °C the oxidation process proceeds in a heterogeneous manner, with hot spots of high oxidation activity appearing throughout the samples. This points to a diffusion limited oxidation process, while at 50 °C these weren't observed indicating a reaction rate limited process. Furthermore, smaller droplets were found to oxidize at a higher rate than larger ones and oxidation was observed to induce droplet coalescence. These results show that lipid oxidation in food emulsions is a heterogeneous process and that fluorescent oxidation probes are a very helpful tool in elucidating the oxidation mechanism.

REFERENCES

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