

# Prooxidant Mechanisms of Oleic Acids in Stripped Soybean Oil-in-Water Emulsions

T. Waraho<sup>1</sup>, M.T. Rodriguez-Estrada<sup>2</sup>, D.J. McClements<sup>1</sup>, and E.A. Decker<sup>1</sup>

<sup>1</sup>Department of Food Science, University of Massachusetts - Amherst (USA)

<sup>2</sup>Department of Food Science, University of Bologna – Bologna (Italy)

Free fatty acids are known as prooxidants in bulk oils but little is known about how they effect oil-in-water emulsions. The prooxidant role of free fatty acids was studied in 1.0% stripped soybean oil-in-water emulsions. Increasing concentrations of oleic acid (0 to 5.0% of oil) in the emulsions increased lipid hydroperoxides and headspace hexanal formation and increased the negative charge of the emulsion droplet. Methyl oleate added to the emulsions at 1.0% of oil did not increase oxidation rates compared to the emulsions containing the same amount of oleic acid. The ability of oleic acid to promote lipid oxidation in oil-in-water emulsions at different pH (2-8) showed a decrease in oxidation with decreasing pH. A dramatic reduction in oxidation was observed when the pH was low enough so oleic acid was in its non-protonated form, and thus, did not increase the negative charge of the emulsion droplet. When ethylenediaminetetraacetic acid (200  $\mu\text{m}$ ) was added to emulsions in the presence of oleic acid (1.0%), lipid oxidation was strongly inhibited indicating that transition metals were responsible for accelerating oxidation. Oleic acid hydroperoxides did not increase oxidation rates suggesting that hydroperoxides on free fatty acids are not strong prooxidants in oil-in-water emulsion. These results suggest that the prooxidant activity of free fatty acids in oil-in-water emulsions is due to their ability to attract prooxidant metals to the emulsion droplet surface. The results from this study may contribute to understanding the threshold level of free fatty acids in oil-in-water emulsions beyond which oxidation is accelerated.