

Effect of the mode of incorporation of antioxidants on the oxidative stability of oil-in-water emulsions

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PHENOLIPIDS: ADJUSTING AND OPTIMIZING AOX EFFICIENCY OF PHENOLIC COMPOUNDS



alkyl alcohols or fatty acids)



Rosmarinates (160 μ M) in low moisture foods (crackers)

RC20> RC12 >> RC0



Figure 2. (A) Lipid hydroperoxides and (B) headspace hexanal in crackers with rosmarinic and its esters (chain lengths = 0, 12, or 20 carbons) incorporated into the lipid prior to dough formation. Crackers were stored in the dark at 55 °C. Standard error bars are smaller than data points in some instances.

Incorporation of phenolipids <u>in the lipid</u> <u>phase</u> prior to dough formation Barden et al., JAFC, 2015 **RC20** >> **RC12** > **RC0**

EFFECT OF MODE OF INCORPORATION

Mode of incorporation modified C12 efficiency



Figure 3. (A) Lipid hydroperoxide and (B) headspace hexanal formation in crackers made by incorporating rosmarinic ester antioxidants (chain lengths = 0, 12, or 20 carbons) into the aqueous phase prior to dough formation. Crackers were stored in the dark at 55 °C. Standard error bars are smaller than data points in some instances.

Incorporation of phenolipids by **mixing in the aqueous phase** prior to dough formation



HYPOTHESIS AND OBJECTIVES

Emulsion System I - one type of oil







Emulsion system I : single lipid droplets emulsion system







✓ <u>Rank of AOxs:</u> best C16 and C12, with slight effect of the mode of incorporation





- $\checkmark \quad \underline{\text{Rank of AOxs}}: \text{ Same as bellow CMC}$
- ✓ In presence of micelles, Rank of Aoxs was not affected by mode of incorporation
- ✓ Higher formation of TBARS for long chain compounds (C12 and C16)



- ✓ <u>Individual effect of mode of incorporation</u>: C16 and C8 were less affected by the mode of incorporation
 - / In general, effect of mode of incorporation slightly or no affected the others AOxs



Emulsion system II: mixed lipid droplets emulsion system

Experimental design



Emulsion system I I: mixed lipid droplets emulsion system









 Mode of incorporation
In single lipid droplet emulsions (System I), mode of incorporation affected mainly C8 and C16.

The effect of incorporating AOXs in different lipid droplet populations (System II) showed to be molecule-dependent, with significant effect only for very bulky compounds (RC16).

Presence of micelles
In single lipid droplets emulsions (System I), the presence of micelles affected mainly long chain compounds (TBARS value).

➢ In emulsions with different lipid droplet populations (System II), the effect of the presence of micelles also seems to be related with the molecule bulkiness

THANKYOU FORYOUR ATTENTION!

















Concluding remarks and future studies



The mode of incorporation affected the efficiency of the antioxidants in a single lipid emulsion system.

In mixed lipid systems, the effect of the mode of incorporation depended on the compounds oon the chain chain length. No effect was observed for Gallate ester C16, while for Gallic $\circ \circ$ acid (C0), it was more effective when added to MCT droplets.

- Rutin and Rutin ester C16 showed an opposite behavior to that of Gallic acid and Gallates.
 - of emulsifier reshaped the antioxidant activity of phenolipids in a single lipid An tem.
- 3 d lipid emulsion system, an excess of emulsifier only affected Rutin ester C16 For behavior.
- Future studies ▶ Investigate the behavior of Emulsion System II using a hydrophlici radical initiator Investigate the mechanisms underlying our observations

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lved in the observed systems



ROLE OF THE EMULSIFIER: Interactions





