Encapsulation of Oregano (*Origanum vulgare L.*) essential oil into β-cyclodextrin and lipidic dispersions: Characterization and Evaluation of their antimicrobial activity against *Listeria monocytogenes* in broth and model food

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AIM: To study the encapsulation of Oregano essential oil (OEO) in β-cyclodextrin (β-CD) and lipidic dispersions as means to enhance dispersion and controlled release of EO and evaluate their effect on the survival of *Listeria monocytogenes* in Tryptic Soy Broth (TSB) and cheese broth

Methods

- Co-precipitation method for **Encapsulation of OEO into β-CD**
- Thin-film hydration method for the **incorporation of OEO into lipidic dispersion** (L-a phosphatidyloholine & cholesterol)
- Dynamic Light Scattering (DLS): **Size distribution** (PDI), **zeta-potential** (ζ)
- UV-Vis spectroscopy for **encapsulation efficiency (EE%) & release rate (%)**.
- **The effect of ICs and free OEO** at MIC, ½ MIC and 2xMIC **against *L. monocytogenes*** (3-strain cocktail: 10^6 CFU/ml) **in TSB (pH 7.0, 4.3)** and **cheese broth** prepared from 'katiki' cheese (pH 4.3) **at 7°C**.

Results & Discussion

❑ **Strain** & OEO **batch variation** on the MIC between the 3 *L.m* strains (**Fig 1**): OEO Batch 1forβ-CDs & OEO Batch 2 for lipidic dispersion **(Photo 1)**

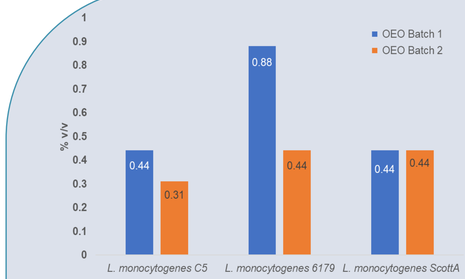

Figure 1. MIC (% v/v) of 2 OEO batches against 3 *L. m* strains

Photo 1: Formed ICs

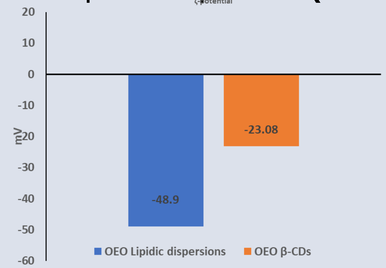

Figure 3: ζ potential (mV) of ICs

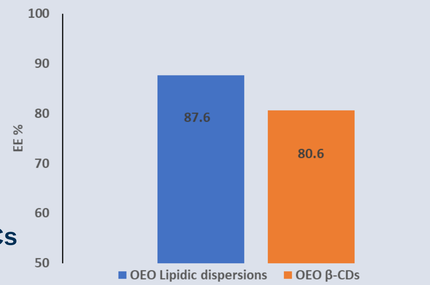

Figure 4: % Encapsulation Efficiency of ICs

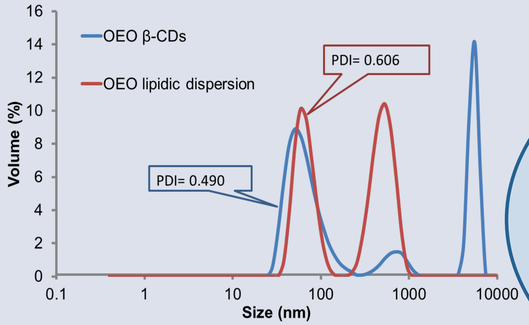

Figure 2. Particle size distribution of ICs

Characterization of complexes:

- ✓ **good size dispersion** (PDI) (**Fig 2**)
- ✓ **acceptable stability** (ζ-potential) (**Fig 3**)
- ✓ **nanoscale size** (<1000 nm) (**Fig 2**)
- ✓ **high EE % (Fig 4)**
- ✓ **Continuous release** of EOE (**Fig 5**)

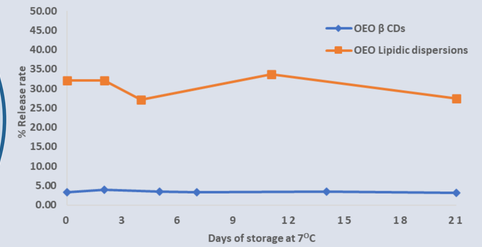

Figure 5: OEO Release rate (%) from ICs during storage

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Results & Discussion

- **Dose-dependent inhibitory effect** of encapsulated OEO against *L. monocytogenes (***Fig 6 & Fig 7C***)*
- **OEO Lipidic dispersions showed higher effect in TSB** than in cheese-broth (**Fig 6**) and **Increased inhibitory effect at lower pH (Fig 6A & B)**
- **OEO Lipidic dispersions were more effective compare to OEO-β-CDs** at both TSB pH values **(Fig 6 & 7)**
- The antimicrobial effect of encapsulated OEO was not as rapid as the effect of free OEO (**Fig 6 & 7**)

Results:

✓ confirming the slow release of EO due to encapsulation

✓ indicative for the application of encapsulated OEO to control of *L. monocytogenes* in foods

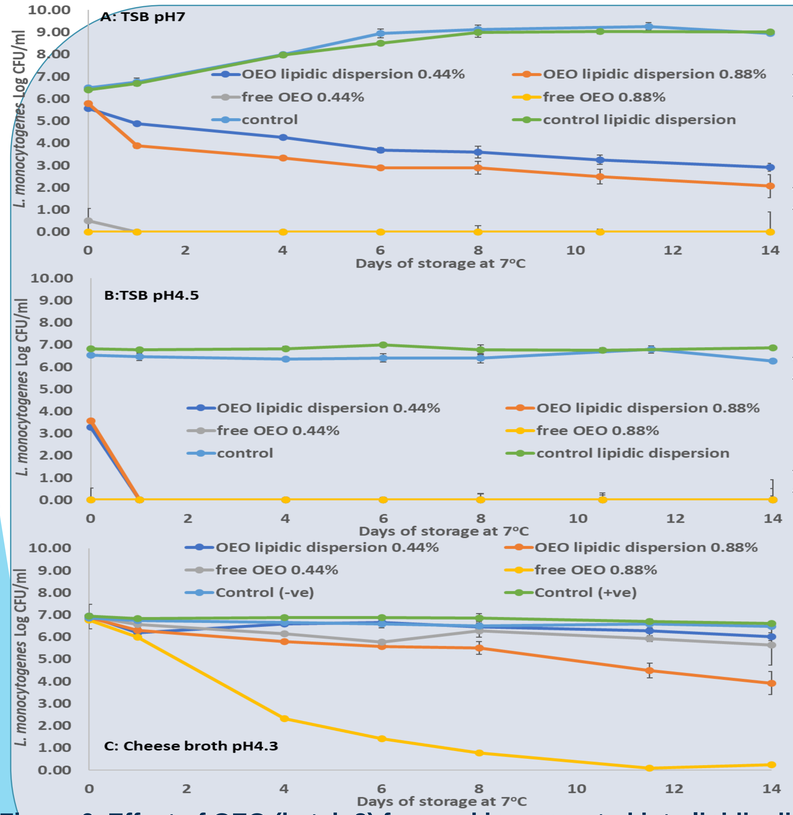

Figure 6. Effect of OEO (batch 2) free and incorporated into lipidic dispersion against *L. monocytogenes* in broth (A, B) and cheese broth (C) at 7°C

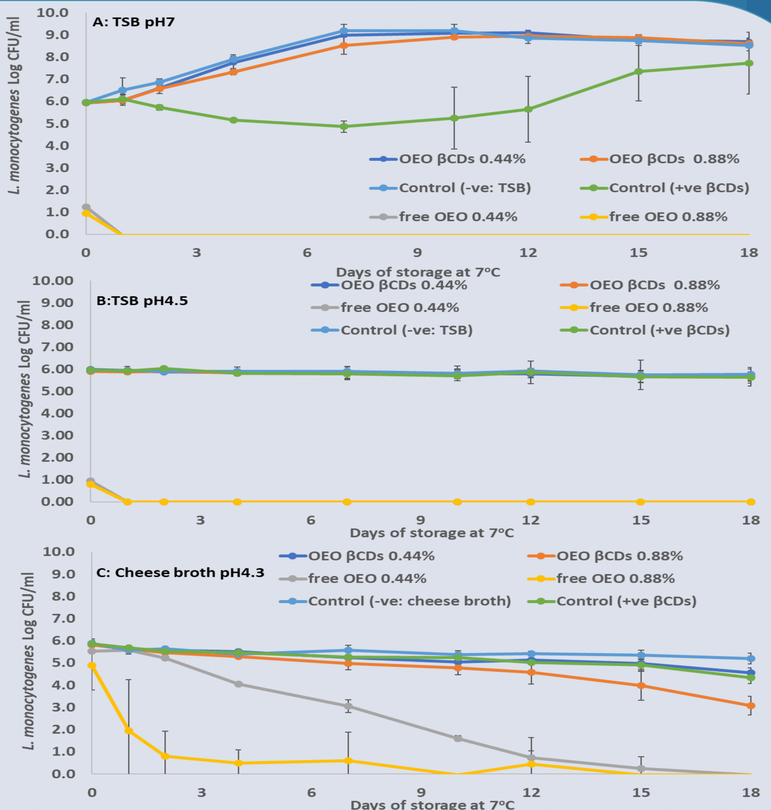

Figure 7. Effect of OEO (batch 1) free and encapsulated in βCDs against *L. monocytogenes* in broth (A, B) and cheese broth (C) at 7°C

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