THESIS INFORMATION

INTRODUCTION

- Title: **RESEARCH ON FORMULATION OF BLACK PEPPER ESSENTIAL OIL NANOEMULSION AND APPLICATION IN FOOD PRESERVATION**
- Major: **FOOD TECHNOLOGY**
- Major code: **62540101**

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ABSTRACT

Nanoemulsion has been a common system for dispersion lipophilic compounds in many fields including food, pharmacy and cosmetic. Black pepper essential oil has been a mixture of lipophillic substances which have been prove to have antimicrobial activity in many recent studies. In our reseach, black pepper essential oil had been loaded in nanoemulsion with Tween 80 as surfactant. The two low – energy methods: Phase Inversion Temperature and Emulsion Phase Inversion had been compared to find out better method for our system. The results had showed that EPI nanoemulsions more stable than PIT samples after 4 weeks. Moreover, loading efficiency of EPI samples had been higher (70%), but average droplet size and polydispersity index of them had been lower than PIT nanoemulsions. In order to improve characteristics, EPI nanoemulsions had been frozen at -15^{o}C for 24 hours.

This frozen process had decreased not only droplet size of nanoemulsion from 32.4nm to below 20nm, but also polydisperisity index from 0.453 to below 0.1. It meant that the black pepper essential oil nanoemulsion had changed physicochemical properties after frozen-thawed step. The DSC and TGA analysis had also presented various thermal properties between nanoemulsions with and without freezing-and-thawing. Besides, the frozen-thawed nanoemulsions had been indicated more steadiness when they almost retained their transparent state without phase separation, small droplet (< 20nm) and low PdI after 6 months. While the unfrozen nanoemulsions had been unstable after 5 weeks. Moreover, antioxidant acitivity of the frozen-thawed nanoemulsions were also higher than the others (free essential oils and unfrozen nanoemulsions) with the lowest IC_{50} index in DPPH inhibition test.

Then, our optimum black pepper essential oil nanoemulsion had been evaluated antibacterial activity against some common food pathogens: *Escherichia coli, Pseudomonas aeruginosa, Salmonella enterica* and *Staphylococcus aureus* by dilution method. And the low MICs of 137 µg/mL for *E. coli* and 273 µg/mL for *S. enterica* had been obtained. So, these two bacteria had been utilized in the next experiment for more clearance inhibitory activity of nanoemulsion on meat. Pork samples, which were dipped into BPEO nanoemulsions at various concentrations, had been incubated with bacterial suspensions for 6 days at 5^oC and bacterial population on pork samples had been measured. The results indicated that nanoemulsions could decrease bacterial biomass compared to the control samples for both of *E. coli* and *S. enterica*. In the next step of this study, BPEO nanoemulsions had been used as preservative in 3 products (seasoning-adding pork, seasoning-adding chicken and minced beef). These products had been kept at 5^oC for 6 days. The total viable aerobic microbial counts had been analyzed at the 2^{nd}, 4^{th} and 6^{th} day. The results showed that BPEO nanoemulsions could reduce microbial counts below 5 Log CFU/g during storage period while the control samples had presented microbial population over 5 Log CFU/g very soon, often at the 2^{nd} day.

In conclusion, black pepper essential oil nanoemulsion had been successfully formulated by EPI method and improved characteristic by frozen-thawed process.

Our nanoemulsion could inhibit food bacteria not only in broth media but also in real meat products.

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