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- Plant essential oil based micro- and nanoemulsion were formulated by spontaneous emulsification and ultrasonic emulsification.

- Optimization of emulsion formulation was done with respect to process parameters like oil type, surfactant type, surfactant concentration, oil-surfactant mixing ratio and emulsification time.

- Increased in surfactant concentration resulted in reduced droplet size and turbidity but resulted in increased viscosity of emulsion system.

- Cinnamon oil microemulsion CMF4 showed very low droplet size of 5.7 nm and kinetic stability for 240 days. Hence, it was selected for application studies.

- Cinnamon oil microemulsion CMF4 demonstrated effective *in vitro* antibacterial activity *in vitro* against *E. coli* and *S. aureus*, and *in situ* in orange juice.

- Antibacterial activity of the CMF4 microemulsion was due to the reduced droplet size and the active ingredients present in the oil.

- Quantifying leakage of 260 nm absorbing substances, and staining with acridine orange and ethidium bromide confirmed alteration in membrane permeability of bacteria upon treatment with micro- and nanoemulsion formulations. FTIR studies showed the modification of surface functional group of bacteria and SEM images confirmed the morphological distortion of bacteria upon treatment with CMF4 microemulsion formulation.

- Evaluation of *in situ* antibacterial activity CMF4 in orange juice showed time, concentration and temperature dependent bactericidal activity of cinnamon oil microemulsion CMF4 and sodium benzoate. The results also confirmed that cinnamon oil microemulsion is better bactericidal agent than sodium benzoate.
Cinnamon oil microemulsion CMF4 was tested to be non-irritant and didn’t show any signs of erythema or oedema when tested on skin of wistar rats. CMF4 microemulsion triggered wound healing process in wistar rats i.e. complete healing of wound was seen in 14 days in case of cinnamon oil microemulsion CMF4 treated wistar rats, whereas it took 16 days in each case of cinnamon oil only, and standard ointment (neomycin) treated group; and 20 days in case of control/untreated wistar rats.

Cinnamon oil microemulsion CMF4 also demonstrated effective bactericidal activity against wound isolate *Macrococcus caseolyticus*. These above results suggest that CMF4 microemulsion prevents sepsis of wound and triggers wound healing in wistar rats.

Cinnamon oil microemulsion CMF4 demonstrated significant larvicidal activity against *Culex quinquefasciatus* larva. Histopathological staining confirmed alteration in larval morphology upon treatment with microemulsion formulation.