

## **Abstract**

In this study, natural polymeric biofilms were prepared and loaded with cumin essential oil (CEO) nanoemulsions as antibacterial agents for use in food packaging. The films were prepared by solution casting technique using wheat starch, carboxy methyl cellulose (CMC), sodium alginate and Biocomposite films (wheat starch and CMC). These films were optimized by varying the concentration of base polysaccharide and glycerol content. Following that, preparation of nanoemulsions was done. Oil-in-water nanoemulsions were formulated using whey protein isolate (WPI) as natural emulsifier by ultrasonication technique. The nanoemulsions were optimized using various reaction parameters. 4% WPI with CEO to sunflower oil ratio of 1:1, and an ultrasonication time of 30 minutes, gave stable nanoemulsions with particle size of 72.1 nm and polydispersity index of 0.069, which were less than 200 nm and 0.1 respectively. The optimized edible films based on 20 % CMC, 5 % wheat starch and 30 % glycerol were loaded with different concentrations of cumin essential oil (CEO) nanoemulsions as antibacterial agents for use in food packaging. Nanoemulsions were optimized at 15 %. These optimized films had thickness of 0.125 mm, water solubility of 15.87 %, swelling ratio of 183 %, moisture content of 12.1 % and UV transmittance of 28 %. These films have significant antibacterial activity against *Staphylococcus aureus* and *Escherichia coli* with zone diameters of 23 mm and 28 mm respectively. Therefore, polymeric biofilms based on a blend of wheat starch and CMC, when incorporated with CEO nanoemulsions have the potential to be used as bioactive edible food packaging materials in place of synthetic plastic packaging.