Nano-Emulsions From Essential Oils: A Sustainable Solution in Agriculture

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Food production heavily relies on pesticides, which can be harmful to both the environment and human health. Sustainable alternatives such as nanoemulsions made from essential oils have been investigated as potential solutions. In this study, nanoemulsions were produced using essential oils from Cymbopogon winterianus, Cymbopogon flexuosus, and Mentha piperita to combat weed and phytopathogen fungi. The stable nanoemulsions were created through a low-energy technique, with the oil phase and aqueous phase mixed in a range of 5-10% of the oil phase. The stability of the nanoemulsions was evaluated through various parameters such as pH, turbidity, refractive index, and particle size using dynamic light scattering (DLS) test. The particle size values for nanoemulsions obtained at essential oil concentrations of 2.5% for Cymbopogon winterianus, 1% for Cymbopogon flexuosus, and 1% for Mentha piperita were 146.8nm; 77.65; and 54.68nm. Finally, based on stability tests conducted in triplicate at different temperatures, it was also possible to conclude that simple refrigeration extended the stability of our nanoemulsions, making it a recommendation for potential commercialization. Based on MIC and MBC tests conducted by partner researchers, it was established that our formulations are effective against common bacteria, with the nanoemulsions of Citronella and Lemongrass, and multi-resistant bacteria with also the nanoemulsion of Lemongrass.Future studies will investigate the potential of these nanoemulsions as insecticides and fungicides for agriculture products, which can replace the use of harmful pesticides.