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Antimicrobial activity of nanoemulsion on drug-resistant bacterial pathogens

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6

7 **ABSTRACT**

8 The appearance of drug-resistant (DR) bacteria in the community is a crucial
9 development, and is associated with increased morbidity, mortality, healthcare costs, and
10 antibiotic use. Natural oil nanoemulsions (NEs) have potential for antimicrobial
11 applications. In the present study, we determined the antimicrobial activity of an NE
12 against DR bacterial pathogens *in vitro*. The NE comprised *Cleome viscosa* essential oil,
13 Tween 80 nonionic surfactant, and water. We found that an NE with a droplet size of 7
14 nm and an oil:surfactant (v/v) ratio of 1:3 was effective against methicillin-resistant
15 *Staphylococcus aureus* (MRSA), DR *Streptococcus pyogenes*, and DR extended-
16 spectrum beta-lactamase (ESBL)-producing *Escherichia coli*, *Klebsiella pneumoniae*,
17 and *Pseudomonas aeruginosa*. Fourier-transform infrared (FTIR) spectroscopy revealed
18 that NE treatment modified the functional groups of lipids, proteins, and nucleic acids in
19 DR bacterial cells. Scanning electron microscopy (SEM) showed damage to the cell
20 membranes and walls of NE-treated DR bacteria. These alterations were caused by
21 bioactive compounds with wide-spectrum enzyme-inhibiting activity in the NE, such as
22 β -sitosterol, demecolcine, campesterol, and heneicosyl formate. The results suggest that

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