Combinatorial effect analysis of Peppermint (Mentha x piperita L. Carl) essential oil and meropenem against plasmid-mediated resistant E. coli

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Abstract

This study was carried out to investigate the bactericidal mechanism of peppermint essential oil (PEO) when PEO (1 % v/v) used individually and PEO (1 % v/v) in combination with meropenem (0.5 µg/mL) against multidrug resistant Escherichia coli. Chemical composition of PEO were identified via GC-MS, followed by time-kill analysis which was performed to evaluate the antibacterial activities of PEO and meropenem. In order to assess the ability of PEO in disrupting the bacterial membrane, zeta potential measurement, outer membrane permeability test and scanning electron microscopy were performed. Next, anti-quorum sensing assay was performed to assess the ability of PEO in quorum sensing inhibition. A complete killing activity was observed within five minutes of treatment with PEO and meropenem at sub-lethal concentrations. In addition, the zeta potential measurement and outer membrane permeability test performed indicated increase in the membrane permeability and membrane disruption which can be observed in the scanning electron micrograph. Furthermore, significant decrease in the light production of E. coli pSB1075 treated with PEO indicates the presence of quorum sensing inhibitors within PEO. The findings suggested that PEO possesses the capability to disrupt the bacterial outer membrane, thus increasing membrane permeability, in addition to possible inhibition of bacterial quorum sensing ability in multidrug resistant E. coli, elucidation of the actual mechanism will, greatly assist the mitigation of reversal of antibiotic resistance.

Keywords: Escherichia coli; essential oil; membrane permeability; Mentha x piperita L. Carl; quorum sensing; combinatorial effect.

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