ABSTRACT

The emergence of multidrug-resistant (MDR) bacteria has become a major public health concern and a serious challenge, resulting in fewer and more expensive treatment options for infectious diseases. Synergistic combinations of several drugs with natural antimicrobials have been identified as additional effective strategies contributing to less drug toxicity and resistance. The present study evaluated to compare the antimicrobial properties of crude extracts of *Panax quinquefolium* and *Nigella sativa* extracted using conventional method and green extraction technologies, such as microwave-assisted extraction (MAE), ultrasonic fluid extraction (UAE), and supercritical fluid extraction (SFE) with efficiency yield at the range of 20-36.5%. The compounds in the plant extracts were detected and analysed using Thin-layer chromatography (TLC) and HPLC-UV to confirm the presence of antimicrobial compounds such as ginsenosides in Panax quinquefolium and Thymoquinone and Di thymoquinone in Nigella sativa.

A well diffusion assay of methanol extracts of plant demonstrated moderate inhibition of bacterial growth of the Gram-negative organisms- *Escherichia coli* and *Pseudomonas aeruginosa* (9-15mm) and the Gram-positive bacteria *Bacillus pumilis* and *Staphylococcus aureus* (11-14mm), with *E. coli* showing no activity for Nigella extract. Comparatively, the MAE had lesser activity. The bacteriostatic and bactericidal activity of plant extracts in combination with antibiotics against the organisms was further analysed by calculating the minimum inhibitory concentrations (MIC) and minimum bactericidal concentrations (MBC) using microtiter broth dilution method. The combination of *Nigella sativa* (40mg/ml, 20mg/ml) with Gentamycin (2µg/ml) reduces the MIC of Gentamycin alone by 25-50% exhibiting synergy against Gram-positive bacteria- *Staphylococcus aureus*.

Hence, the saponins from the plant extract exhibiting antimicrobial activity alone and synergy with antibiotic at specific dilution has opened better options for new treatment with lower toxicity. Future research would be to analyse the active compounds enhancing the activity in synergism with antibiotics and its cellular functions. And test the cytotoxicity on mammalian tissue cultured cells for potential development for applications in treatment of bacterial infections.