

## ABSTRACT

*Syzygium aromaticum*, commonly known as cloves, is considered as one of the richest dietary sources of antioxidant and polyphenolic compounds. The bioactivity and antimicrobial activity of this spice is enhanced by using novel extraction techniques such as ultrasound-assisted extraction (UAE). Sample-to-solvent ratio is one of the important factors that impact the functional properties of plant extracts. Hence, this study aimed to optimize the sample-to-solvent ratio for ultrasound-assisted ethanolic clove extracts. The resulting antioxidant properties were measured through 2,2-diphenyl-1-picrylhydrazyl (DPPH), total phenolic content (TPC), and total flavonoid content (TFC) assays. The antimicrobial properties were measured using well diffusion technique, minimum inhibitory concentration (MIC), and minimum bactericidal concentration (MBC) on *Escherichia coli* and *Staphylococcus aureus*. The 2.5% (w/v) plant concentration conferred the highest antioxidant activity ( $44.69 \pm 3.44 \mu\text{g/mL}$ , p-value = 0.027), TPC ( $90.04 \pm 7.47 \text{ mg/g}$ , p-value = <0.001), and TFC ( $73.79 \pm 4.57 \text{ mg/g}$ , p-value < 0.001). The 5% (w/v) plant extracts provided the highest yield ( $59.68 \pm 0.36 \%$ , p-value = 0.039). The results obtained from well diffusion indicated that the 2.5% (w/v) clove extracts were most effective against *S. aureus* ( $9.89 \pm 0.37 \text{ mm}$ , p-value = 0.010) and *E. coli* ( $9.26 \pm 0.28 \text{ mm}$ , p-value = <0.001) and there was a greater inhibition zone for *S. aureus* than for *E. coli*. For MIC and MBC, the plant concentration did not impact the results of any of the antimicrobial analyses, although *E. coli* was more susceptible to the extracts (MIC = 250  $\mu\text{g/mL}$ , MBC = 1000  $\mu\text{g/mL}$ ) at all the tested concentrations in comparison to *S. aureus* (MIC = 500  $\mu\text{g/mL}$ , MBC = N/A). Overall, it was found that a plant concentration of 2.5% (w/v) was optimum as any higher concentration resulted in oversaturation and hence a reduction in bioactivity.

**Keywords:** Antimicrobial properties, Antioxidant properties, Sample-to-solvent ratio, *Syzygium aromaticum*, Ultrasound-assisted extraction.