The antimicrobial efficacy of native Australian essential oils against foodborne pathogens and spoilage microorganisms

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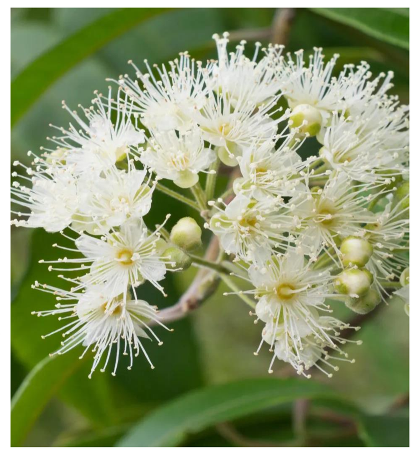
Introduction



Food spoilage and pathogenic microorganisms are a major challenge in the food industry threatening public health, food security and sustainability (2). Consequently, there has been an increased interest in exploration of alternative antimicrobial agents such as essential oils. Many essential oils have been found to exhibit significant antimicrobial activity and there is growing interest in understanding the antimicrobial activity of native Australian plants (2,3). This study investigated the *in vitro* antimicrobial activity of essential oils derived from native Australian plants Tasmanian mountain pepper (*Tasmannia lanceolata*) and lemon myrtle (*Backhousia citriodora*), as well as non-native thyme (*Thymus vulgaris*) against common foodborne microorganisms. Along with analysis of the antimicrobial activity of the oils in the liquid phase, their activity in vapour phase was also investigated as the oils are intended for application in antimicrobial active packaging.

Methodology

Initial screening of the antimicrobial activity of the essential oils was conducted using the disc diffusion assay. The broth microdilution assay was used to determine of the minimum inhibitory concentration (MIC) and the minimum bactericidal concentration (MBC) of the essential oils. An inverted petri plate assay was used to determine the antimicrobial activity of the volatile components of the oils (1).

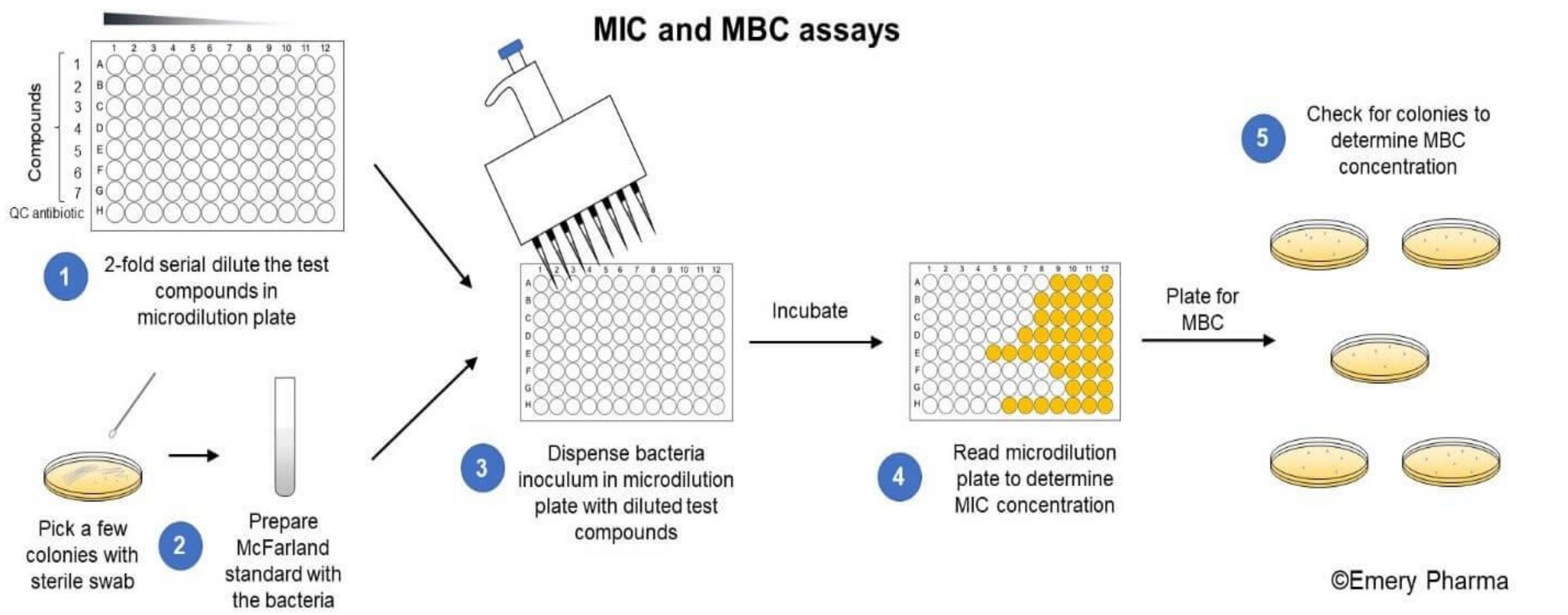


Figure 1: Broth microdilution assay

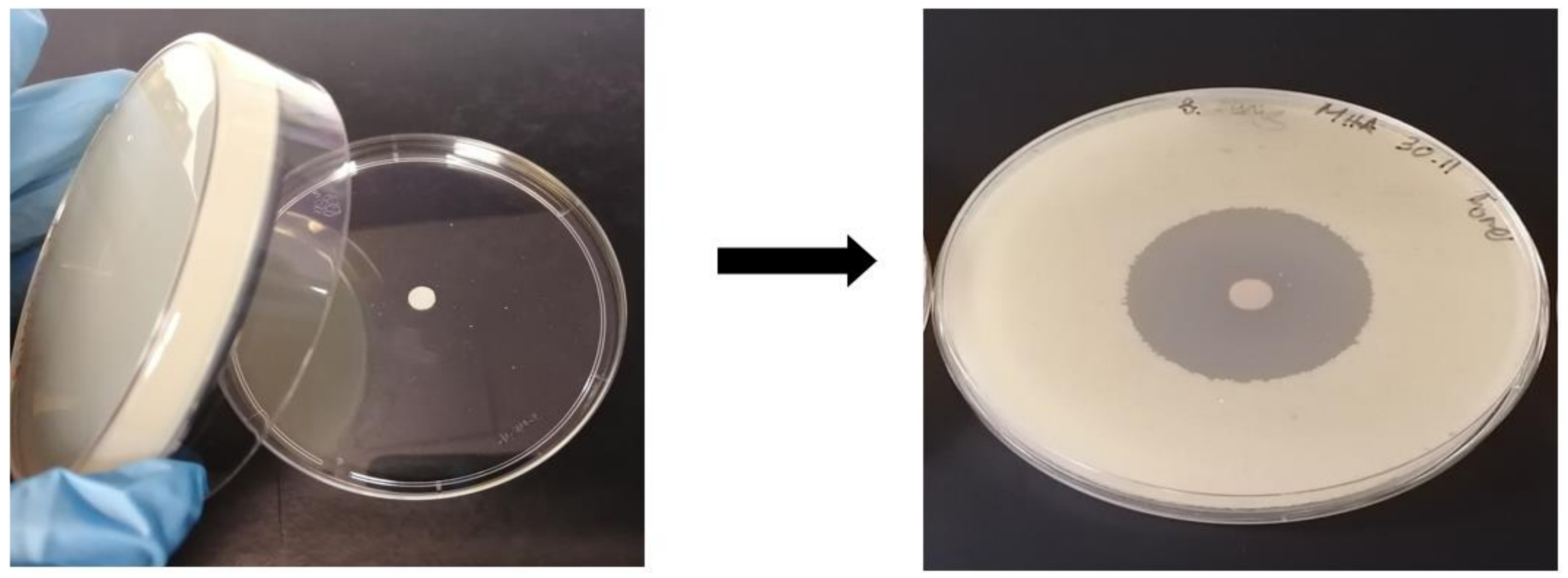


Figure 2: Inverted petri plate assay

Results

The oils generally showed good antimicrobial activity in liquid phase as indicated by low MIC and MBC values. Gram positive bacteria appeared to more susceptible to the oils in comparison to Gram negative bacteria, and this could be ascribed to their morphological differences (3). The antimicrobial activity of lemon myrtle in liquid phase was comparable to non-native thyme and generally higher than Tasmanian pepper berry. In vapour phase, lemon myrtle and thyme also showed high activity. Tasmanian pepper berry generally did not show activity in vapor phase highlighting its limitation in applications that rely on gaseous diffusion such as antimicrobial active packaging. The differences in the antimicrobial activities of the oils could be ascribed in the differences in their compositional profiles (2).

Table 1: MIC and MBC values for essential oils against food microbes

	Lemon myrtle		Thyme		Tasmanian pepper berry	
	MIC (%V/V)	MBC (%V/V)	MIC (%V/V)	MBC (%V/V)	MIC (%V/V)	MBC (%V/V)
Gram negative						
E.coli	0.39	0.39	0.78	0.78	6.25	6.25
H. alvei	0.20	0.78	0.20	0.39	12.50	12.50
Gram positive						
L. innocua	0.10	0.10	0.01	0.02	0.39	6.25
B. thermosphacta	0.39	0.39	0.05	0.39	0.10	0.10

Table 2: Zones of inhibition of essential oils in vapour phase

	Diameter of zone of inhibition (mm)		
	Lemon myrtle	Thyme	Tasmanian pepper
Gram negative			
E.coli	22.0 ± 0.0	25.0 ± 0.0	ND
H. alvei	34.0 ± 0.6	22.0 ± 0.0	ND
Gram positive			
L. innocua	51.0 ± 1.2	31.0 ± 0.6	ND
B. thermosphacta	27.0 ± 1.2	33.0 ± 0.6	ND

N = 3, Mean ± SD reported ND-Not Detected

Conclusion

Essential oils represent a good alternative for chemical based antimicrobial agents. In particular native lemon myrtle is a potent antimicrobial in both liquid and vapour phase. Essential oils could potentially be used as antimicrobials in food and food packaging related applications.

References

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