

Antioxidant and anti-tyrosinase properties of wood vinegar from Matang Mangroves, Malaysia

Background

In Matang Mangroves, Perak, Malaysia, wood vinegar or pyroligneous acid is a by-product of charcoal making from the billets of *Rhizophora* (Loo, 2008; Chan *et al.*, 2012). Smoke from the vents of charcoal kilns (Fig. 1) is condensed in steel tubes and collected in plastic drums as raw distillate.

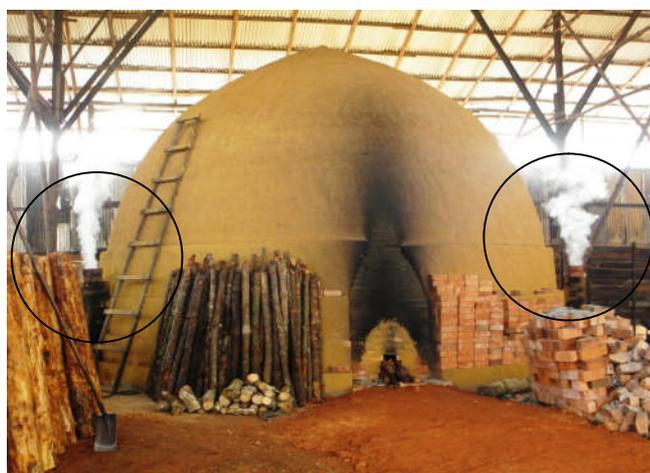


Fig. 1. A dome-shaped charcoal kiln in Matang with smoke emitting from the vents

Traditionally, wood vinegar has been used as deodorizer, fertilizer, sterilizer and antimicrobial agent (Loo, 2008). It has a wide range of applications such as industrial, agricultural, medicinal and home uses. In Thailand, wood vinegar is used to treat skin infections and dandruff (Rakmai, 2009).

Concentrated mangrove wood vinegar from Matang has been studied for its phenolic content and antioxidant activity (Loo *et al.*, 2007). Syringol, catechol and 3-methoxycatechol were antioxidative compounds isolated (Loo *et al.*, 2008). In a recent publication, we reported that the wood vinegar from Matang displayed potent antibacterial activity (Chan *et al.*, 2012). Both the non-distilled and distilled mangrove wood vinegar inhibited all six bacterial species tested. Generally, Gram-positive bacteria of

Bacillus cereus, *Micrococcus luteus*, *Staphylococcus aureus* were more susceptible than Gram-negative bacteria of *Escherichia coli*, *Pseudomonas aeruginosa* and *Salmonella typhi*.

In this study, the wood vinegar from Matang (in its original liquid form) was analysed for antioxidant and anti-tyrosinase properties. Antioxidant properties were compared with those of black tea of *Camellia sinensis* (Chan *et al.*, 2010) based on 3 g of tea per cup of 125 ml (Gulati *et al.*, 2003).

Materials and methods

Two bottles of wood vinegar produced by a factory in Matang (Fig. 2) were tested for antioxidant and anti-tyrosinase activities. The non-distilled wood vinegar is dark brown in colour, resembling coffee. After distillation, it becomes golden brown, resembling tea.



Fig. 2. Non-distilled (left) and distilled (right) mangrove wood vinegar

Antioxidant properties (AOP) based on total phenolic content (TPC), ascorbic acid equivalent antioxidant capacity (AEAC), ferric reducing power (FRP) were analysed using Folin-Ciocalteu, 2,2-diphenyl-1-picrylhydrazyl (DPPH) and potassium ferricyanide assays (Chan *et al.*, 2010). Anti-tyrosinase (AT) activity was analysed using the modified dopachrome method with L-DOPA as substrate (Masuda *et al.*, 2005; Chan *et al.*, 2008).

Results and discussion

AOP of non-distilled wood vinegar based on TPC, AEAC and FRP were significantly stronger than distilled wood vinegar (Table 1). TPC and FRP of non-distilled wood vinegar were significantly higher than or comparable to those of black tea but AEAC was lower.

Table 1. Antioxidant properties of non-distilled and distilled wood vinegar from Matang

Wood vinegar	TPC mg GAE/ml	AEAC mg AA/ml	FRP mg GAE/ml
Non-distilled	3.5 ± 0.1 ^a	1.5 ± 0.0 ^b	1.4 ± 0.0 ^a
Distilled	1.6 ± 0.1 ^d	0.5 ± 0.0 ^c	0.5 ± 0.0 ^c
Black tea			
Lipton	2.0 ± 0.2 ^b	2.8 ± 0.3 ^a	1.3 ± 0.1 ^{ab}
Boh	1.8 ± 0.0 ^c	2.5 ± 0.1 ^a	1.3 ± 0.0 ^b

Concentration of black tea was 24 mg/ml. Columns with different superscripts (a-d) are significant at $p < 0.05$ using Tukey HSD test. Abbreviations: TPC = total phenolic content, AEAC = ascorbic acid equivalent antioxidant capacity, FRP = ferric reducing power, GAE = gallic acid equivalent, AA = ascorbic acid and HSD = honestly significant different.

IC₅₀ of AT activity of non-distilled wood vinegar was 19 ± 0.2 µl/ml (Fig. 3) while that of distilled wood vinegar was not detected. AT activity of non-distilled wood vinegar was equivalent to 1.06 mg/ml of quercetin (IC₅₀ = 0.025 mg/ml). Quercetin is a flavonoid with potent tyrosinase inhibitory ability (Xie *et al.*, 2003; Jeong & Shim, 2004).

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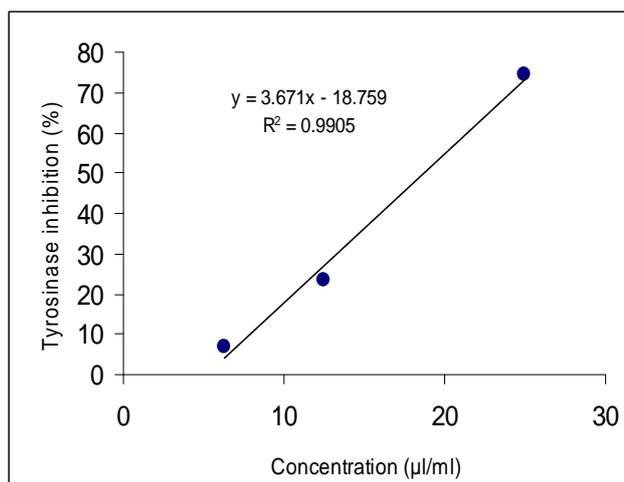


Fig. 3. Graph of concentration (µl/ml) against tyrosinase inhibition (%) of non-distilled wood vinegar

Conclusion

Antioxidant properties based on TPC and FRP of the non-distilled wood vinegar from Matang are higher than or comparable to those of black tea. AT activity is equivalent to 1.06 mg/ml of quercetin. Wood vinegar is a viable source of antioxidants and AT compounds which can play a role in food preservation and skin care.

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