# Innovate Green Method for Enhancing Production of Agarwood Oil


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## Introduction

Agarwood and its essential oil are commodities with great commercial value owing to its aromatic and excellent medicinal worth. Studies on pre-treatment methods before the extraction process is crucial to enhance production efficiency to meet global demand. This study aimed to examine various pre-treatment methods to improve the efficiency of oil extraction from different parts of one month inoculated Chinese *Aquilaria* bole viz the cortex, include phloem-xylem ring (IP-XR) zone and, pith. The pre-treatment suspension or solvent employed are enzymes from *Aspergillus niger*, sulphuric acid, and a combined treatment of enzyme and sulphuric acid. The extracts produced were compared with the control group which was without pre-treatment.

## Methodology

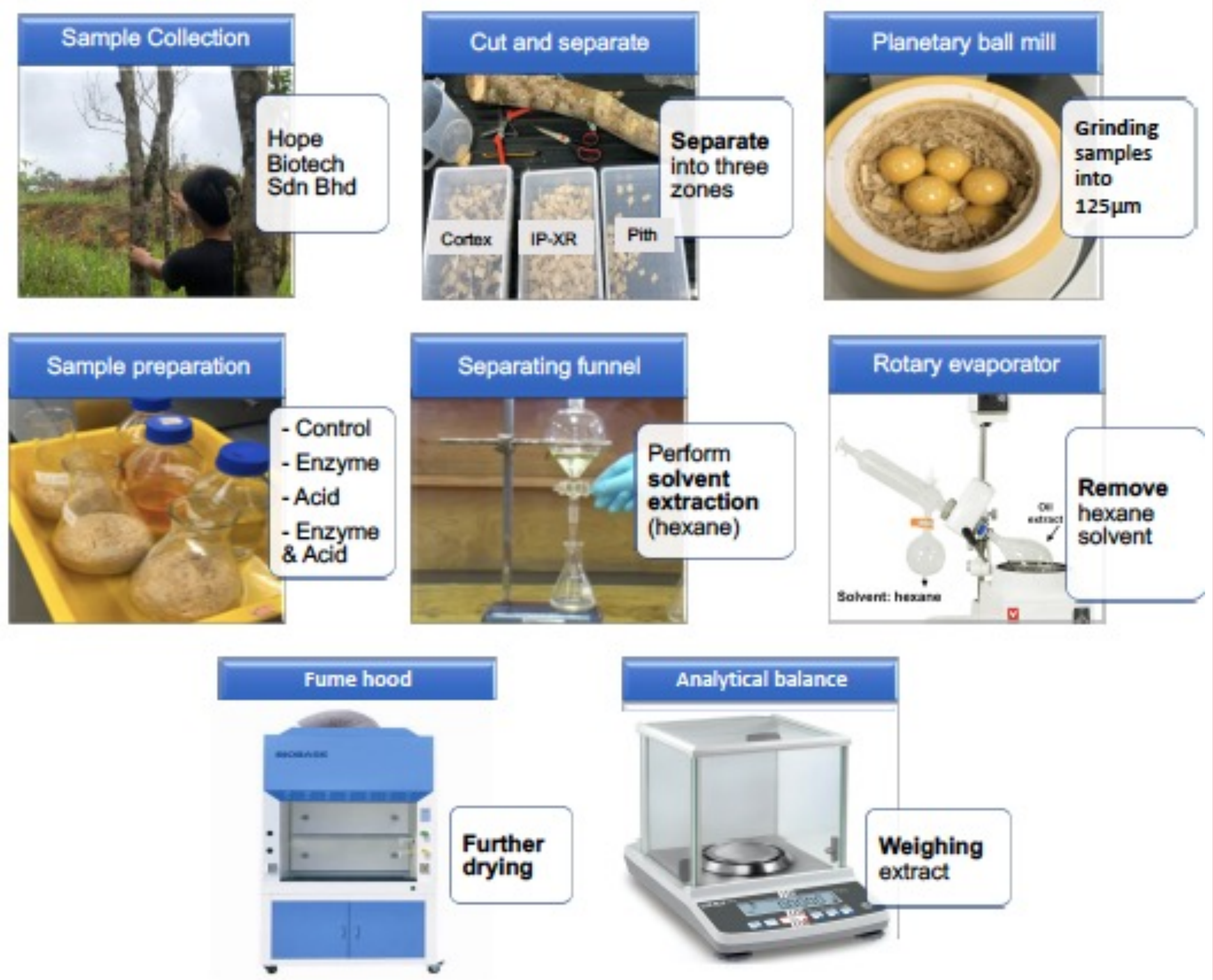


*Figure 1: Methodology*

Measurement of Total phenolic and flavonoid content (TPC & TFC)

1. Folin-Ciocalteau method: To identify **total phenolic content** of the oil extract.
2. Aluminium trichloride colorimetric method: To identify the **total flavonoid content** of the oil extract.

## Results

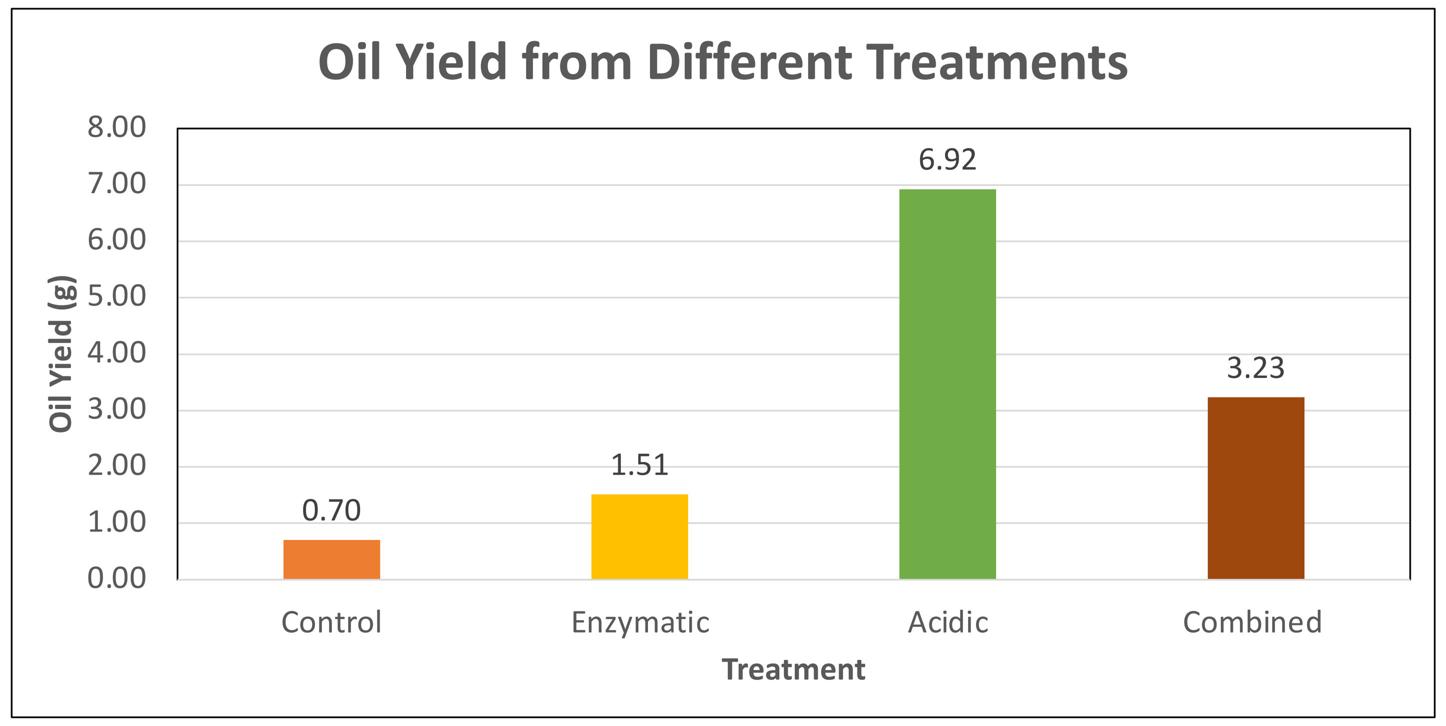


*Figure 2: Effect of Pre-treatment on Aquilaria Oil Yield Recovery*

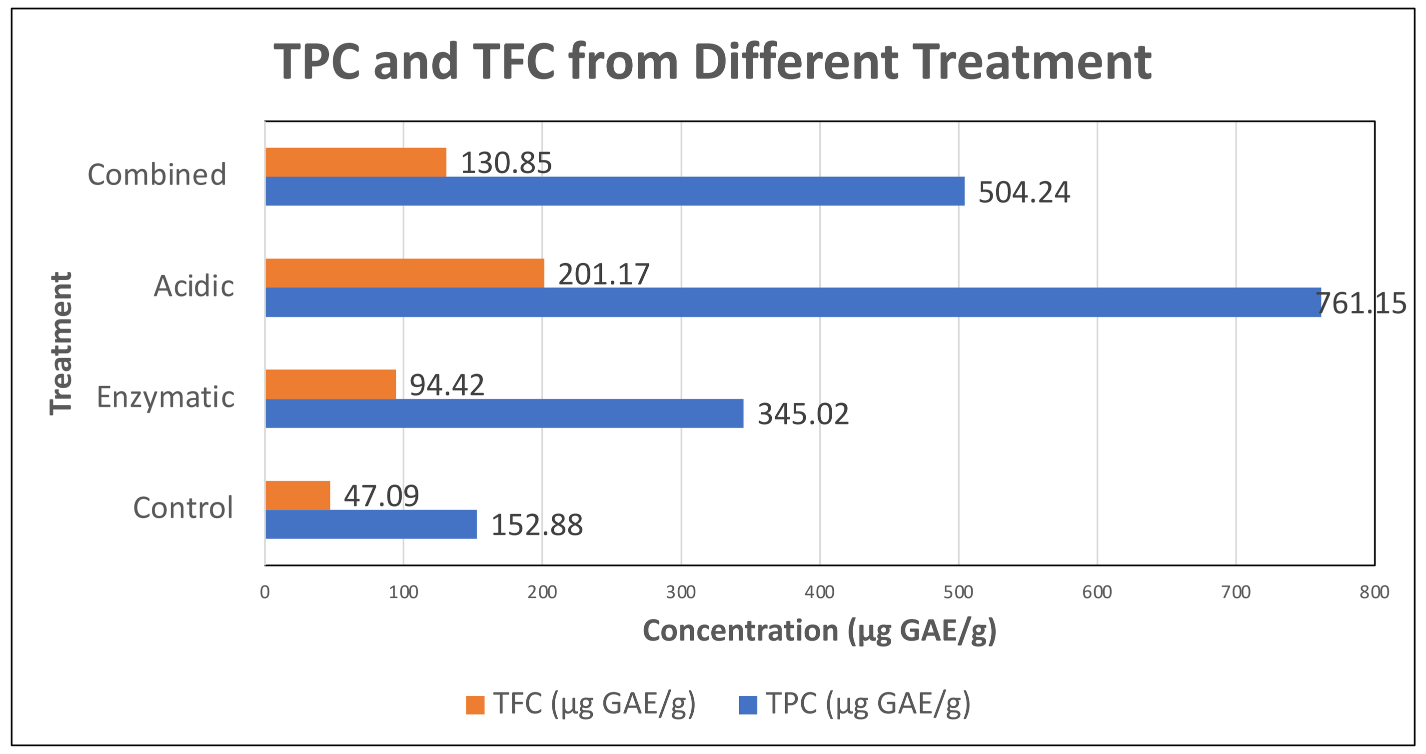


*Figure 3: Comparison of Total Phenolic and Flavonoid Content from Different Treatments*

- Acidic pre-treatment > Combination pre-treatment > Enzymatic pre-treatment > Control

- Acidic pre-treatment has resulted in **optimum cellular cell wall breakage** enabling the highest oil extraction, TPC and TFC.
- Combination pre-treatment might had caused **excessive corroding** of agarwood chips cell wall which eventually released the essential compounds of agarwood chips into the soaking medium (Jok et al. 2016).
- Enzymatic pre-treatment has the lowest oil yield probably due to **insufficient cellular wall breakage** as the amount of oil yield is **dependent** on the cellular contents (Abdul Rahim, Kadri & Harun 2019).

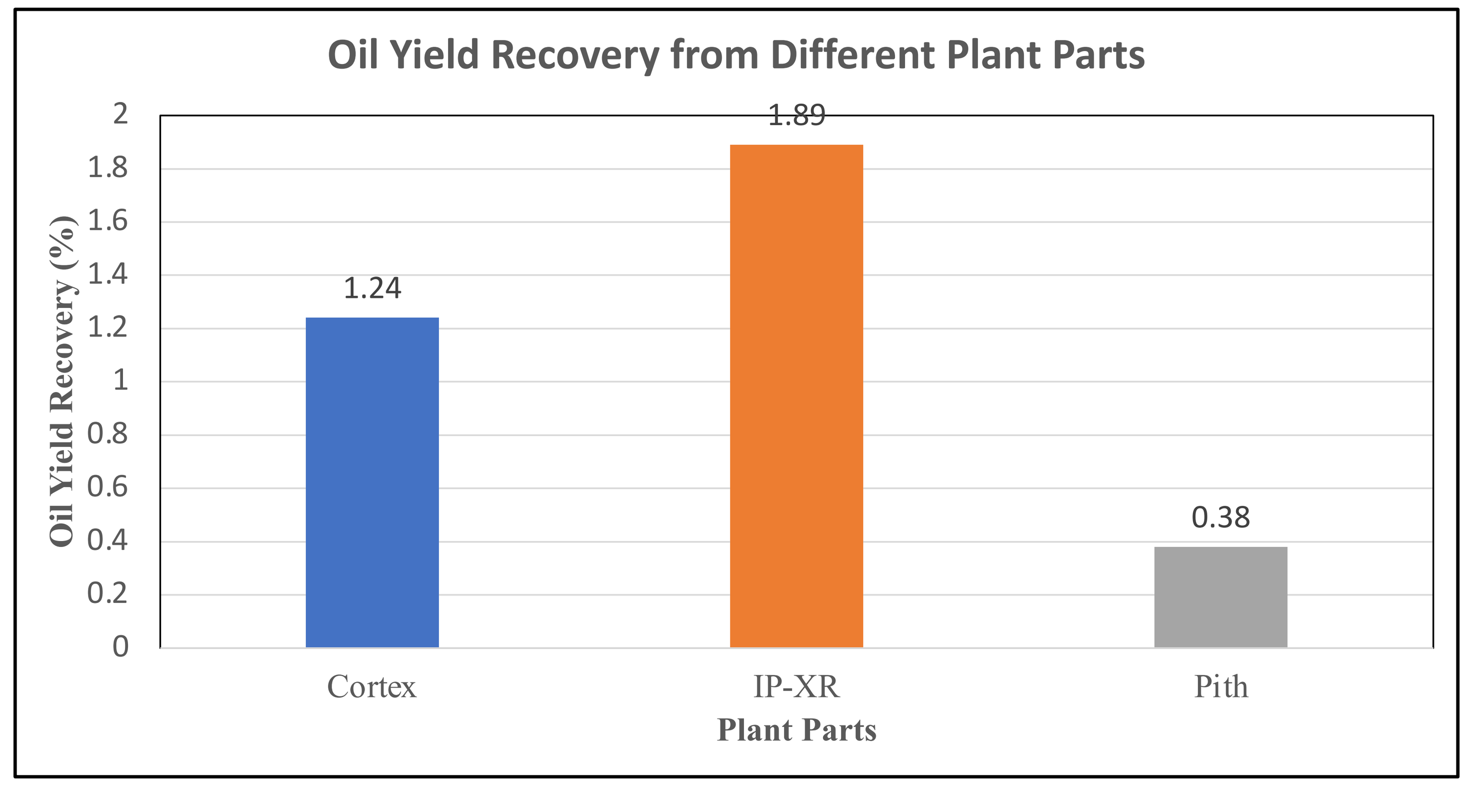


*Figure 4: Comparison on oil yield among different plant parts*

- IP-XR zone has shown the highest oil yield in all the pre-treatments indicating that this zone has the **highest concentration of agarwood resins.**

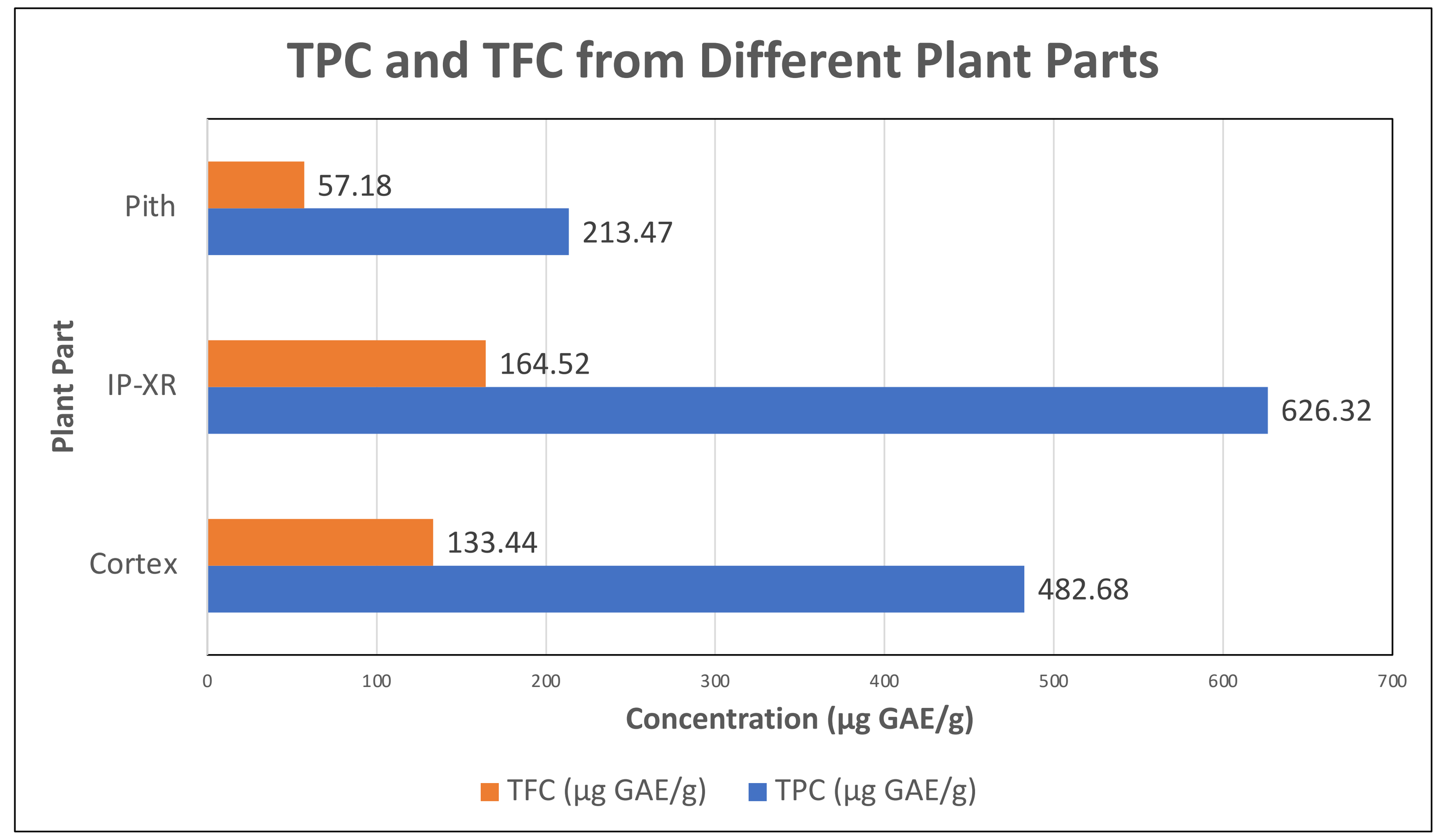


*Figure 5: Comparison on TPC & TFC among different plant parts.*

- IP-XR highest phenolic and flavonoid content, followed by cortex and the pith.
- *Aquilaria* (agarwood) quality correlates to its **resin yield** and **metabolite constituents** (Pasaribu et al 2015; Liu et al. 2017; Tan et al. 2019).

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## Conclusion

- From the above study, all pre-treatments employed had positively affected the yield and quality of volatile oil from different parts of the bole of *Aquilaria spp.*.
- The degree of effectiveness is determined by the type of pre-treatment employed, the method of extraction applied, and the solvent used in the extraction process.
- Different plant parts of the *Aquilaria* bole play a major role in contributing to the yield and quality of volatile oil as the part with the most metabolites content, that is the IP-XR zone, has shown the highest oil yield recovery and quality from the extracted oil. In conclusion, the choice of solvent and enzymes employed during pre-treatments (acidic, enzymatic or combination of acidic and enzymatic), and the extraction method together with the choice of solvent used during the extraction process are crucial as they are the key factors to successful oil extraction.

## Further work

- In my opinion, a combination of acid and enzymes should produce the highest oil yield result. Therefore, further studies are needed to improve the methodology process by adjusting the concentration of acid and enzymes in the combination pre-treatment to obtain optimum cell wall breakage to enable maximum yield extraction and oil quality.

## Acknowledgement

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## References

- Abdul Rahim, AF, Kadri, A & Harun, NM 2019, 'The effect of enzymatic pre-treatment in agarwood oil extraction', *International Journal on Advanced Science Engineering and Information Technology*, vol. 9, no. 4, pp. 1317.
- Ferrentino, G, Giampiccolo, S, Morozova, K, Haman, N, Spilimbergo, S, & Scampicchio, M 2020, 'Supercritical fluid extraction of oils from apple seeds: Process optimization, chemical characterization and comparison with a conventional solvent extraction', *Innovative Food Science & Emerging Technologies*, vol. 64, pp. 102428.
- Jok, VA, Arif, M, Zainudin, F, Radzi, NC & Ku, KH 2016, 'Compounds identification in agar wood soaking water by using GC-MS', *International Journal of Chemical Engineering and applications*, vol. 7, no. 5, pp. 340-343.
- Liu, YY, Wei, JH, Gao, ZH, Zhang, Z & Lyu, JC 2017. 'A review of quality assessment and grading for agarwood', *Chin. Herb. Med.*, vol. 9, no. 1, pp. 22–30.
- Pasaribu, GT, Waluyo, TK & Pari, G 2015. 'Analysis of chemical compounds distinguisher for agarwood qualities', *Indonesian J. For. Res. vol.* 2, no. 1, pp. 1-7.
- Rawana, Hardiwinoto, S, Budiadi & Rahayu, S 2020, 'The effect of phenolics in agarwood formation of Gyrinops versteegii tree induced by Fusarium sp.', In *AIP Conference Proceedings*, vol. 2260, no. 1.
- Tan, CS, Isa, NM, Ismail, I & Zainal, Z 2019, 'Agarwood induction: Current developments and future perspectives', *Frontiers in Plant Science*, vol. 10, p. 122.