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Microwave-Assisted Extraction of Propolis from *Tetragonula biroi* (Philippine Kiwot Bee) Hives

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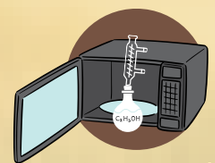
INTRODUCTION

Propolis from Kiwot bees (Tetragonula biroi) is rich in antimicrobial compounds. This study uses ethanol-based microwave-assisted extraction to improve efficiency, optimizing yield by testing solvent concentration, extraction time, and solvent-to-sample ratio, and analyzing phenolic and flavonoid content.

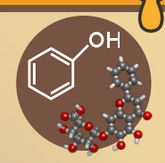
OBJECTIVES



MAE with ethanol

Effects of varying parameters

Best-case combination



Phenolics and flavonoids

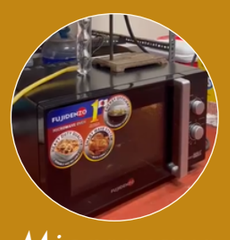
1. Solvent-to-Sample Ratio
2. Solvent Concentration
3. Extraction Time

MATERIALS AND METHODS

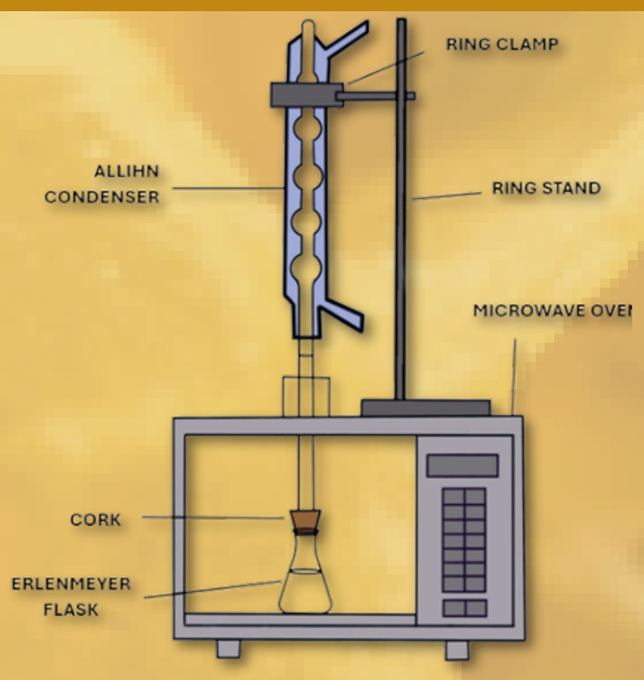
MATERIALS

T. biroi hives

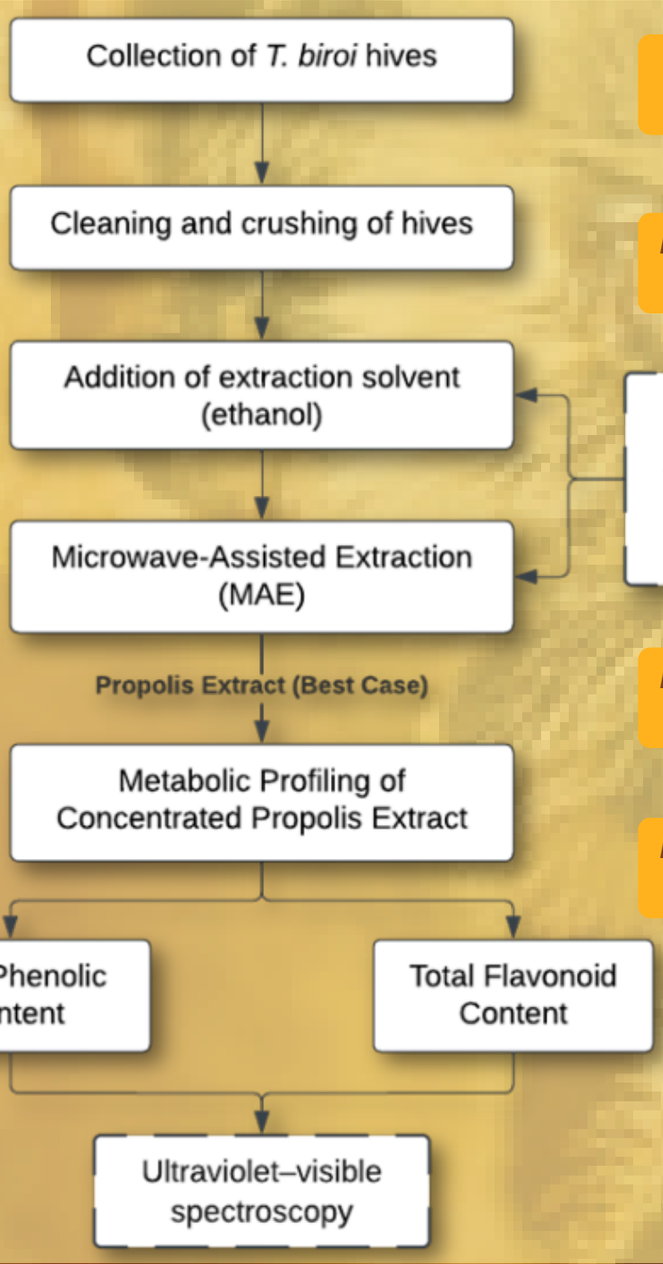
95% ethanol

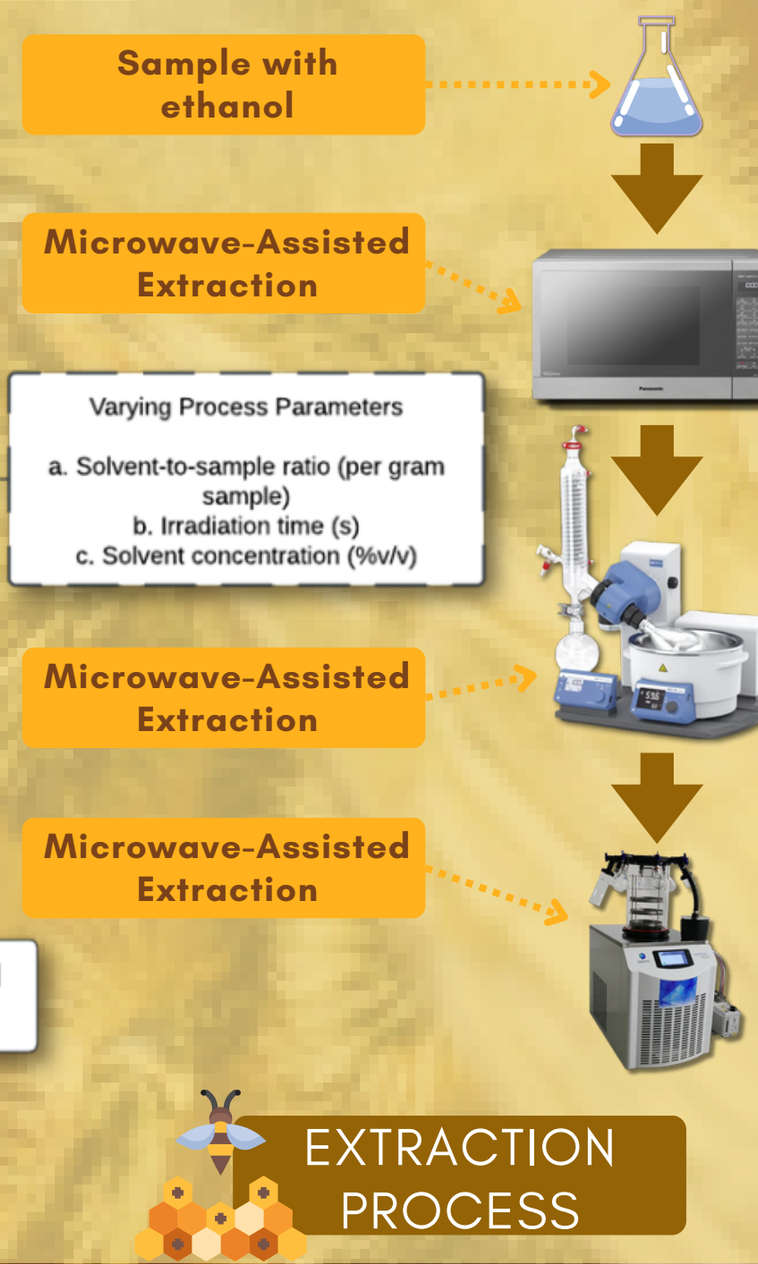


Microwave oven



MICROWAVE SETUP





EXTRACTION PROCESS

Crushed *T. biroi* bee hives

Centrifuged propolis after MAE

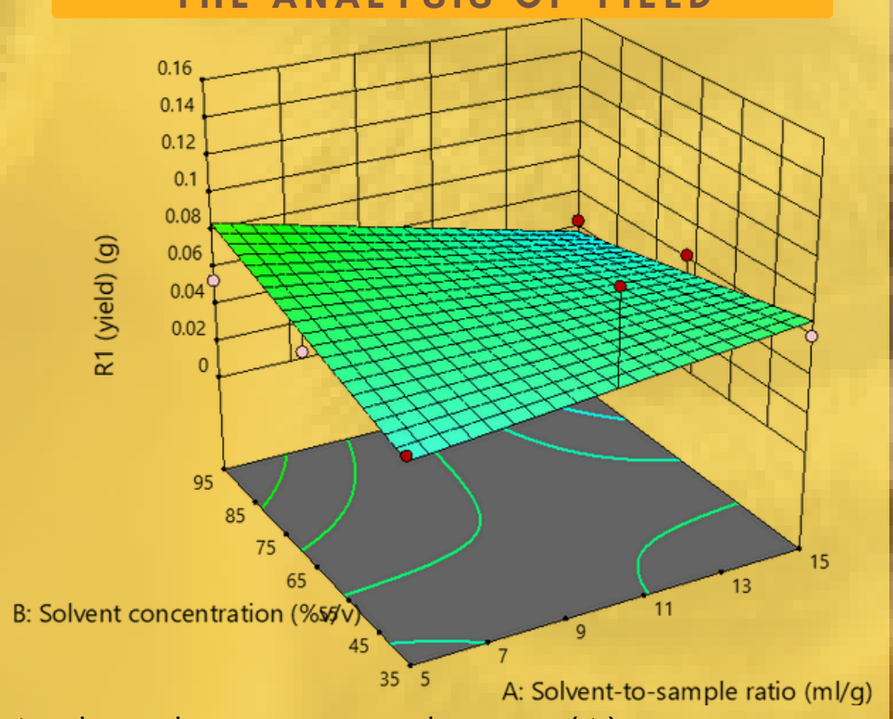
Solvent-free propolis

Freeze-dried propolis

RESULTS AND DISCUSSION

Run 10 gave the best yield (14.386 g/100 g) using a 5 mL/g solvent-to-sample ratio, 95% ethanol, and 300 s MAE; extraction time negatively affected phenolic content (longer irradiation can reduce phenolics), while flavonoid variation was driven by solvent-to-sample ratio and ethanol concentration—lower-polarity subclasses like flavones and isoflavones are less soluble in pure ethanol, so more water-containing solvents may extract them better.

3D MODEL GRAPH FOR THE ANALYSIS OF YIELD



As the solvent-to-sample ratio (A) increases from left to right on the plot, **the yield of propolis initially increases slightly but then levels off.** As for the solvent concentration (B), from back to the front on the contour plot, **the propolis yield increase initially, then reaching a plateau.**

CONCLUSION

This study found that ethanol-based microwave-assisted extraction effectively extracts T. biroi propolis. Optimal yield was achieved with a 5 mL/g solvent ratio, 95% ethanol, and 300 seconds. Solvent ratio and ethanol concentration significantly affected yield, while time did not. Runs 7, 10, and 13 showed the highest yields and strongest phenolic and flavonoid content.