Antimicrobial Potential of Crop-Derived Extracts of *Echinacea purpurea* and *Chenopodium formosanum* against Oral Pathogens

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INTRODUCTION & AIM

The global rise of antimicrobial resistance highlights the need for effective natural alternatives in oral care. *Echinacea purpurea* and *Chenopodium formosanum* possess phenolic, alkamide, and saponin-rich profiles associated with antimicrobial potential. However, limited studies have examined their effects on clinically relevant oral pathogens.

This study evaluates the antimicrobial, MIC, anti-biofilm prevention and disruption performance of methanolic extracts from both plants against major oral pathogens to assess their suitability for natural oral hygiene applications.

METHOD
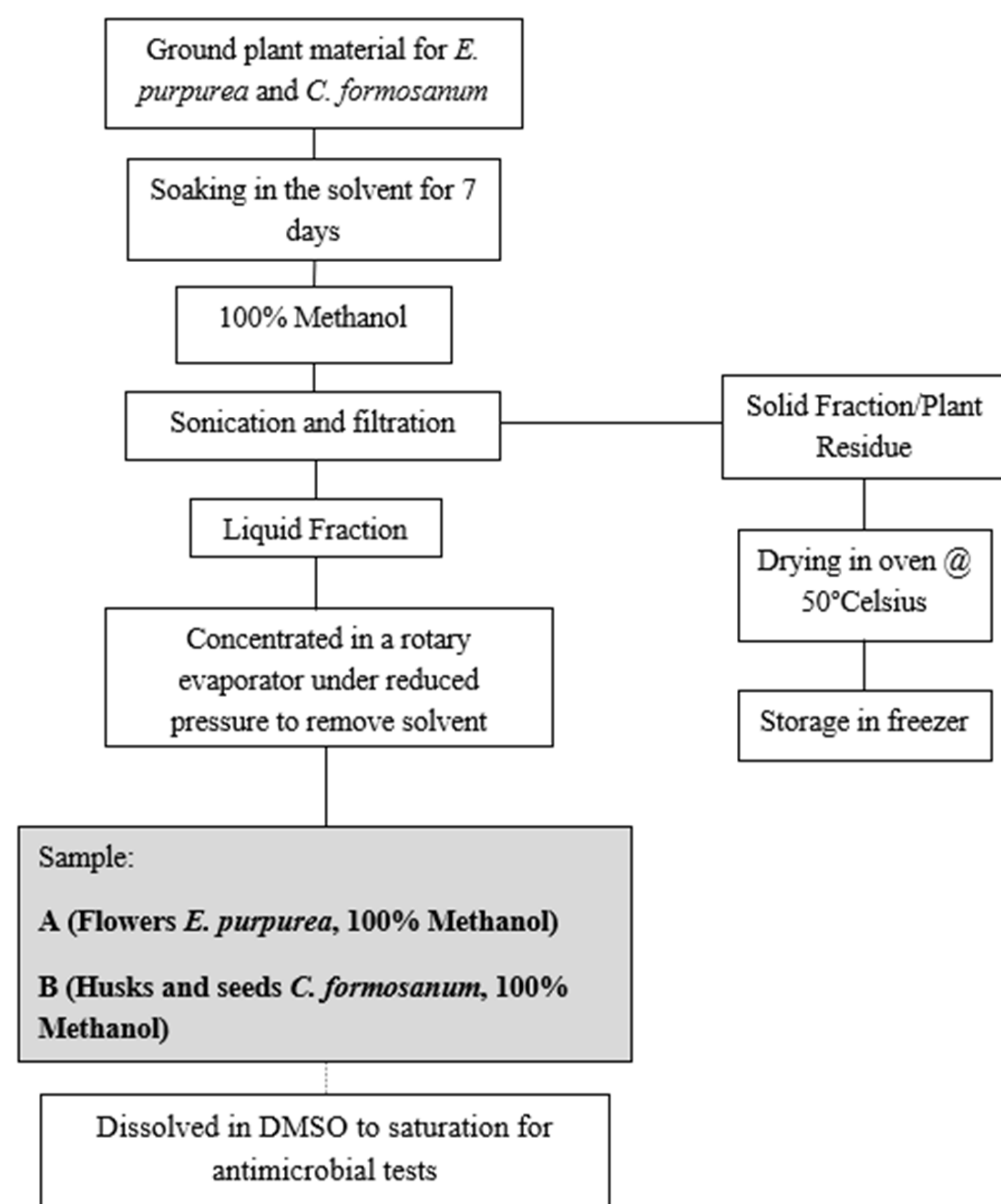
FUTURE WORK / REFERENCES

- Evaluate synergistic effects with established antimicrobials.
- Conduct cytotoxicity and sensory analyses for product development.
- Purify and characterize key bioactive fractions.

1. Liu et al. (2023). Antimicrobial activity of *Echinacea purpurea* extracts.
2. Abreu et al. (2012). Plants as sources of new antimicrobials and resistance-modifying agents.
3. Cai & Kim (2023). Biofilm ecology associated with dental caries: understanding of microbial interactions in oral communities leads to development of therapeutic strategies targeting cariogenic biofilms.
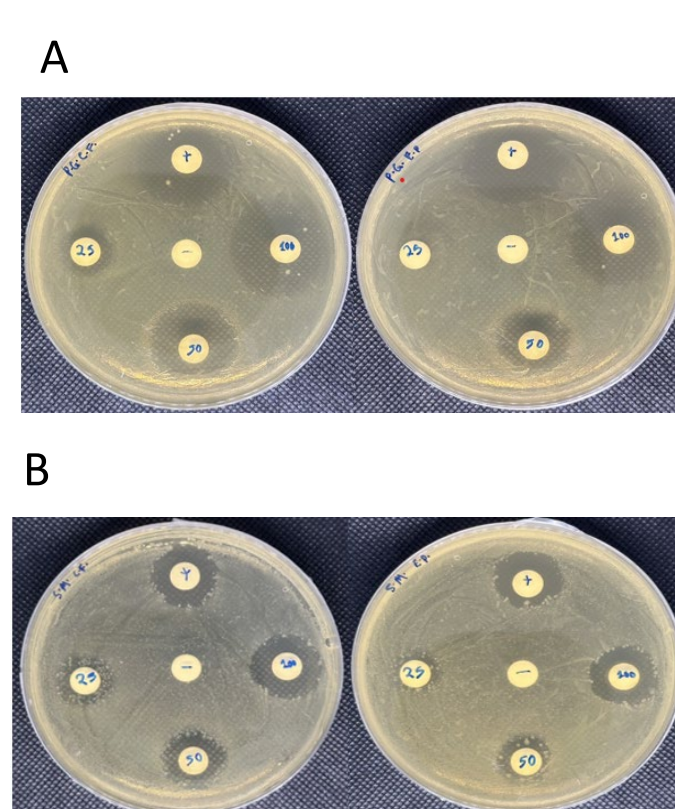
RESULTS & DISCUSSION

Figure 1. Antibacterial effects of plant extracts. (A) *P. gingivalis* and (B) *S. mutans* growth on BHI agar anaerobically at 37°C after subjection to methanolic *C. formosanum* (left-CME) and *E. purpurea* (right-EME) extracts
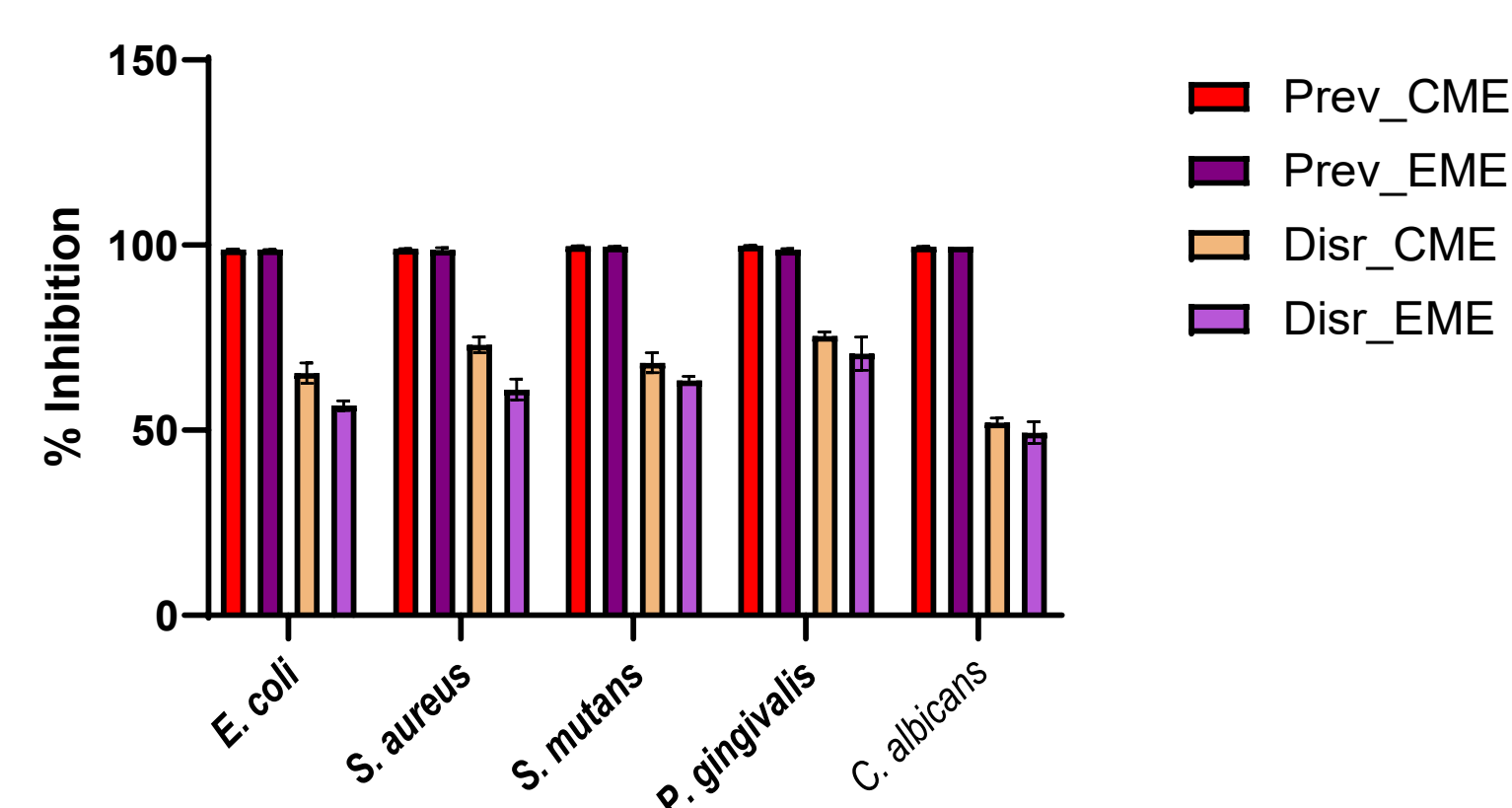

Figure 2. Comparative antibiofilm activity of CME and EME (600 µg/mL) in biofilm prevention and disruption assays. Data (mean ± SD, n = 3) show that both extracts almost completely prevented biofilm formation (>95% inhibition) in all species tested (*E. coli, S. aureus, S. mutans, P. gingivalis,* and *C. albicans*). Disruption of pre-formed biofilms was lower (~45–75% inhibition), with CME consistently outperforming EME across all microbes.
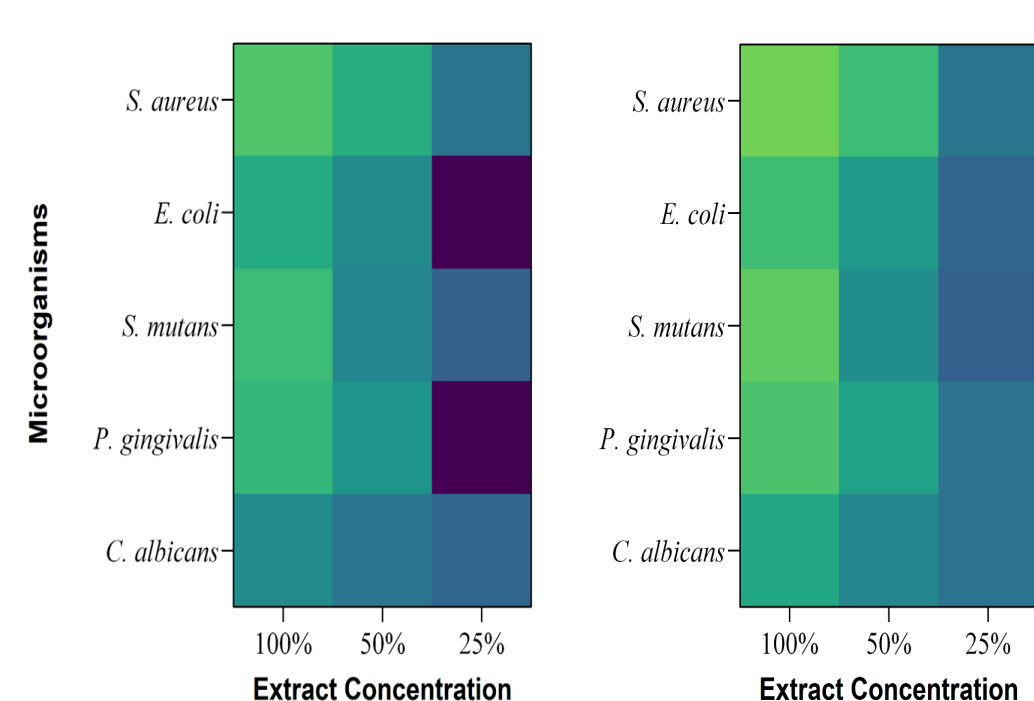

Figure 3. Heatmap of antimicrobial activity of (A) *Echinacea purpurea* and (B) *Chenopodium formosanum* methanolic extract (EME) against the five microorganisms across three concentrations (100%, 50%, 25%) in Disk Diffusion Assay.

Note: 1. Cells represent mean inhibition zone diameters (mm), with color intensity indicating antimicrobial potency (yellow/green = higher inhibition; blue/purple = lower inhibition). 2. S. aureus, *Staphylococcus aureus*; E. coli, *Escherichia coli*; S. mutans, *Streptococcus mutans*; P. gingivalis, *Porphyromonas gingivalis*; C. albicans, *Candida albicans*.
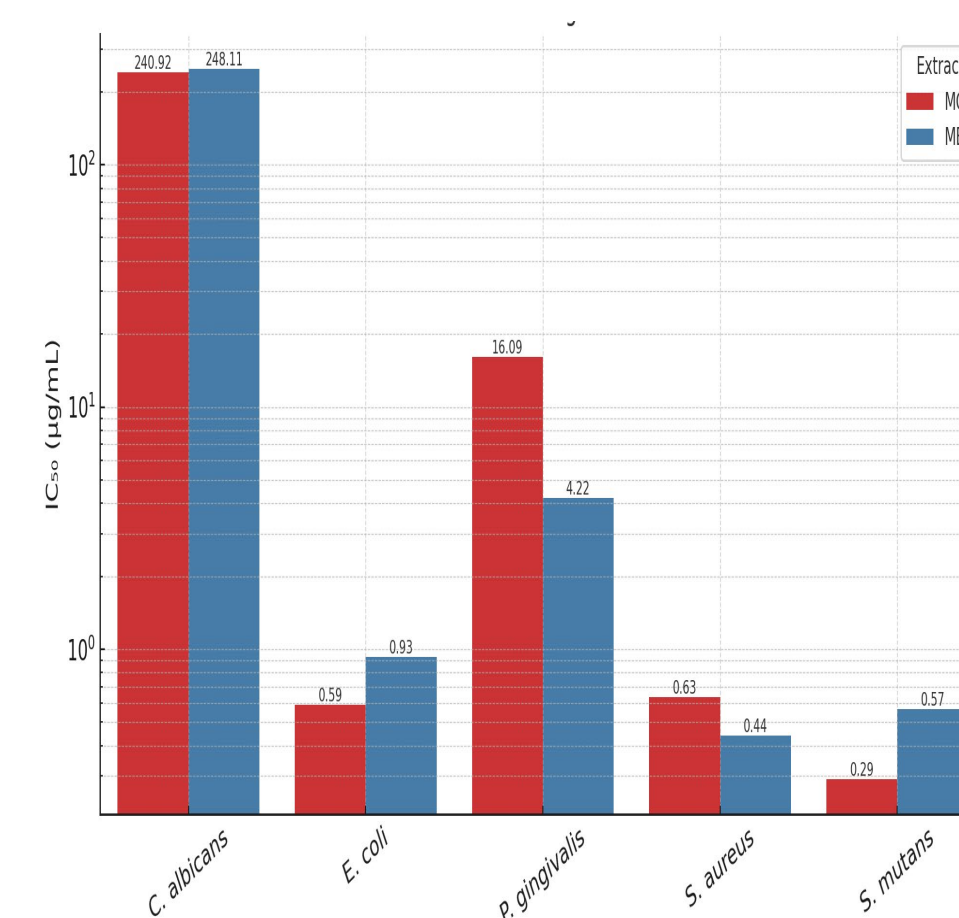

Figure 4. Comparative IC$_{50}$(µg/mL) of *Echinacea purpurea* methanolic extract (EME/MEE) and *Chenopodium formosanum* methanolic extract (CME/MCE) across the five microorganisms in MIC Assay. Bars represent mean ± SD (n = 3).

CONCLUSION

- Both plant extracts demonstrated promising antimicrobial and anti-biofilm activity.
- *C. formosanum* extract consistently exhibited **stronger antibacterial activity** and slightly superior biofilm inhibition.
- MIC and biofilm data suggest that these extracts may complement or partially replace synthetic agents in oral hygiene applications.