

Motivation & Introduction

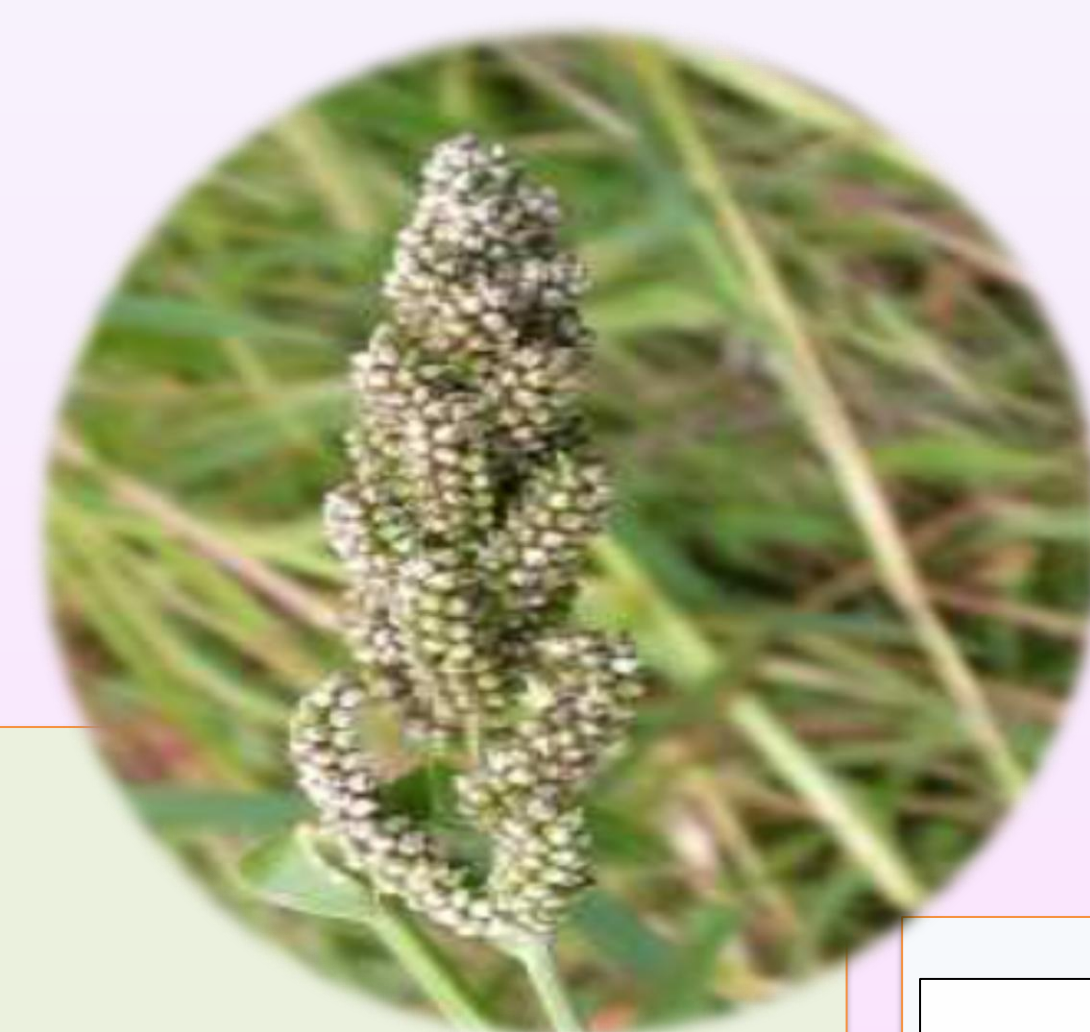
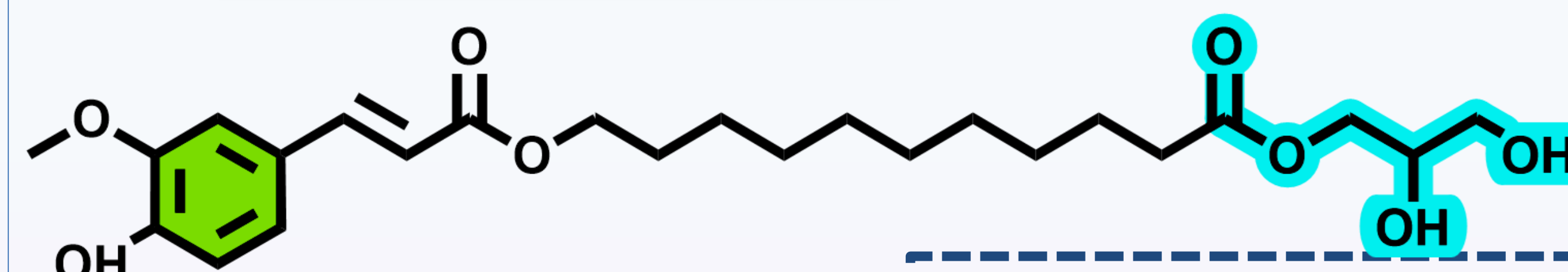
•Structured lipids (SLs), including monoacylglycerols (MAGs), are tailor-made biocompatible lipids with promising nutraceutical and pharmaceutical applications. MAGs, mainly used in food formulations, also exhibit antimicrobial activity with minimal side effects. It can be synthesized using simpler and more sustainable methods.

•Due to their amphiphilic nature (hydrophilic glycerol backbone + hydrophobic fatty acid chain + phenolic group), phenolic MAGs are suitable for applications in drug delivery, cosmetics, and functional foods.

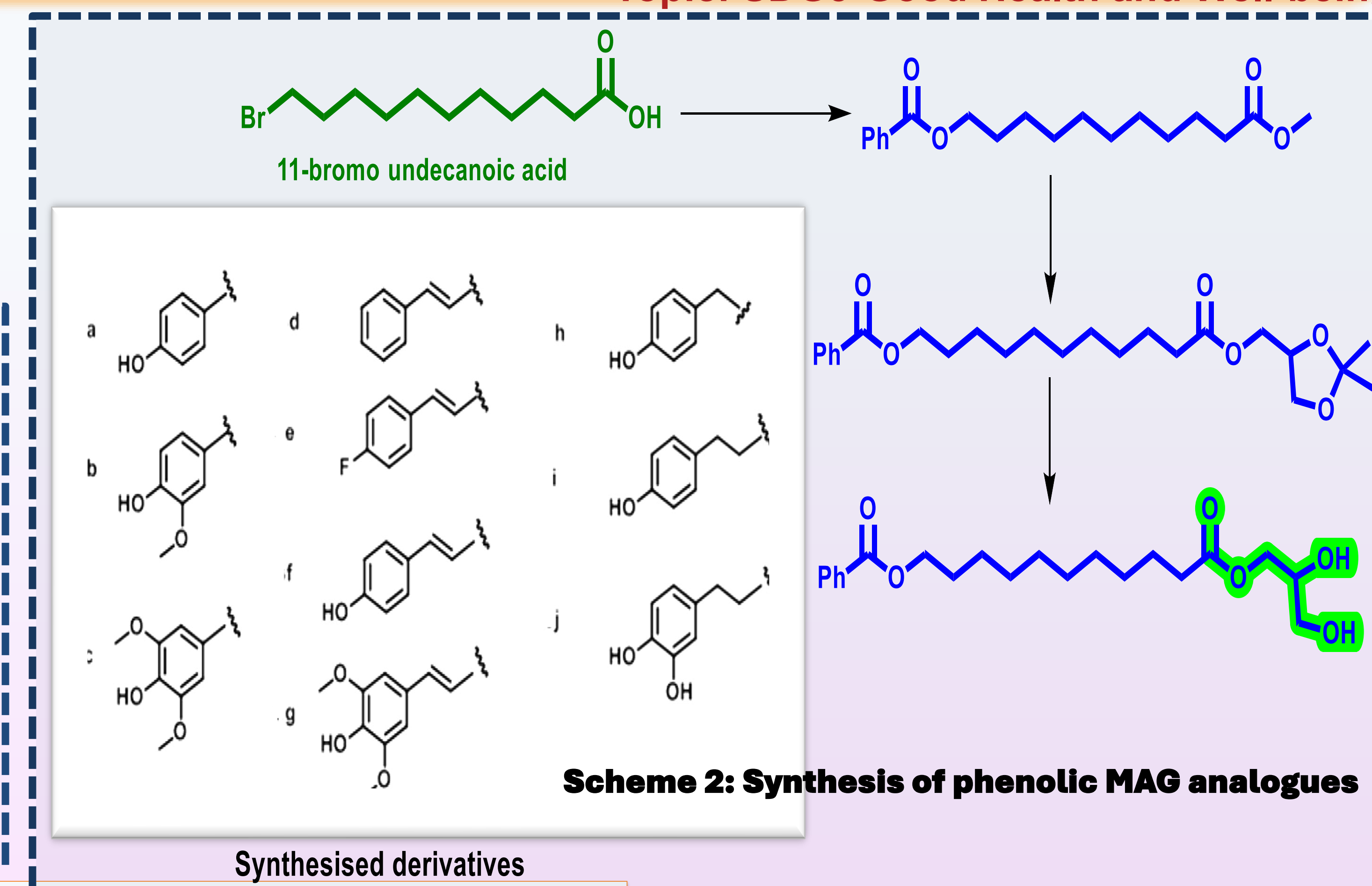
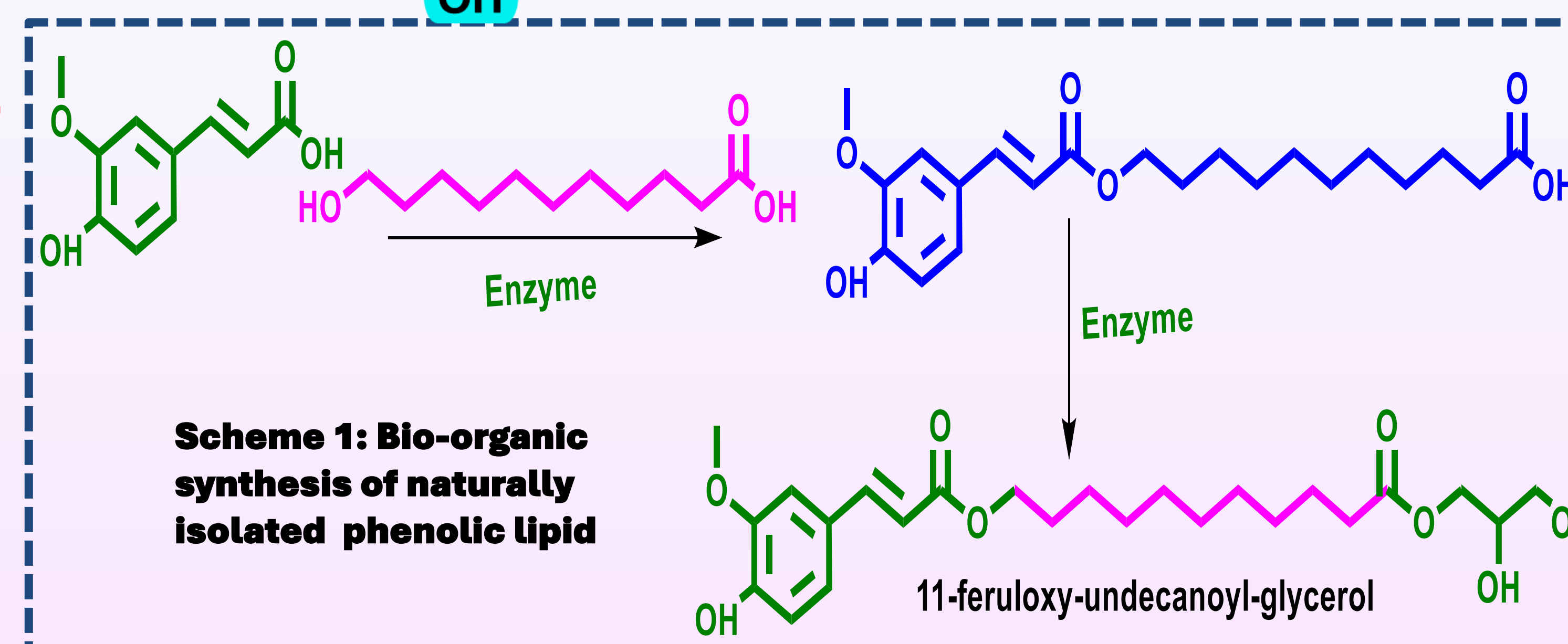
•This work focuses on designing, synthesizing, and evaluating natural phenolic lipid-inspired analogues for enhanced stability and bioactivity.

Results & Discussion

Materials & Methods



11-feruloxyl-undecanoyl glycerol isolated from *Echinola utilis*



Biological evaluation of synthesised phenolic lipid via Scheme 1

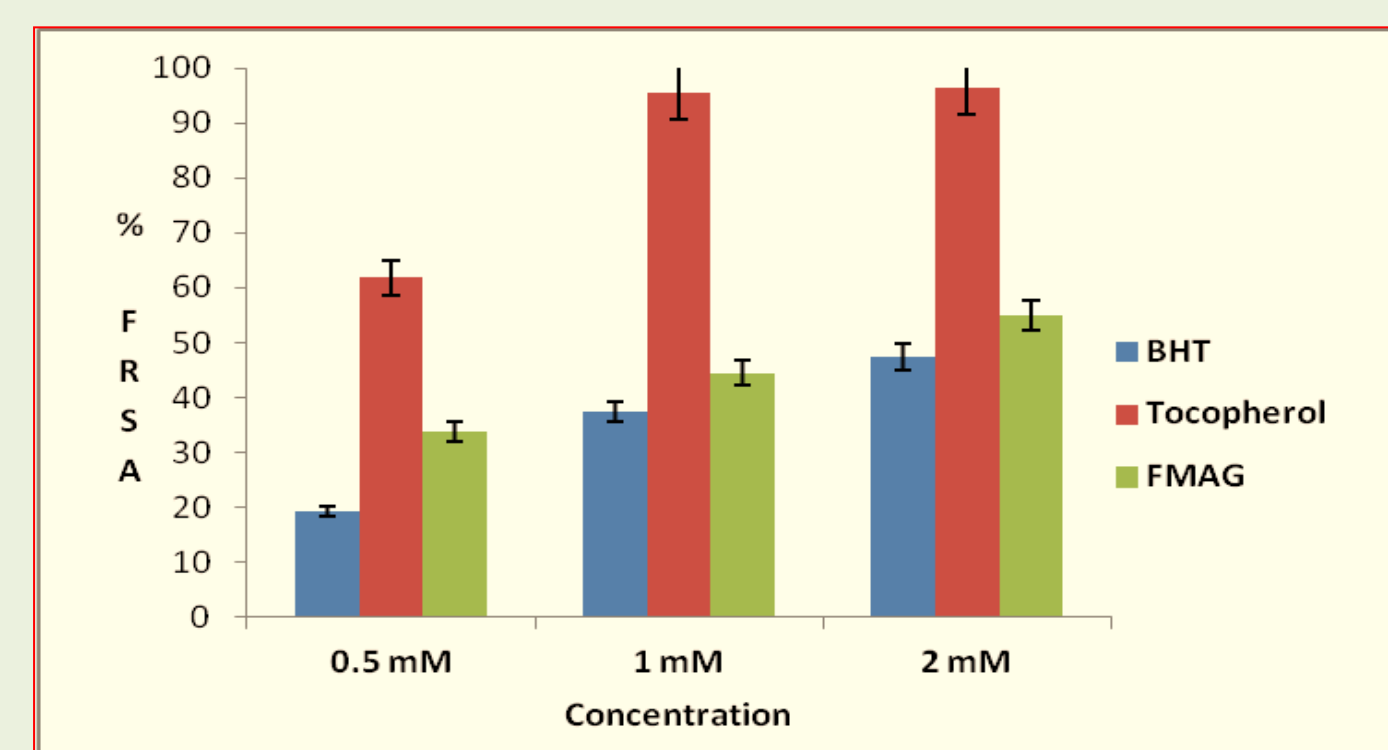
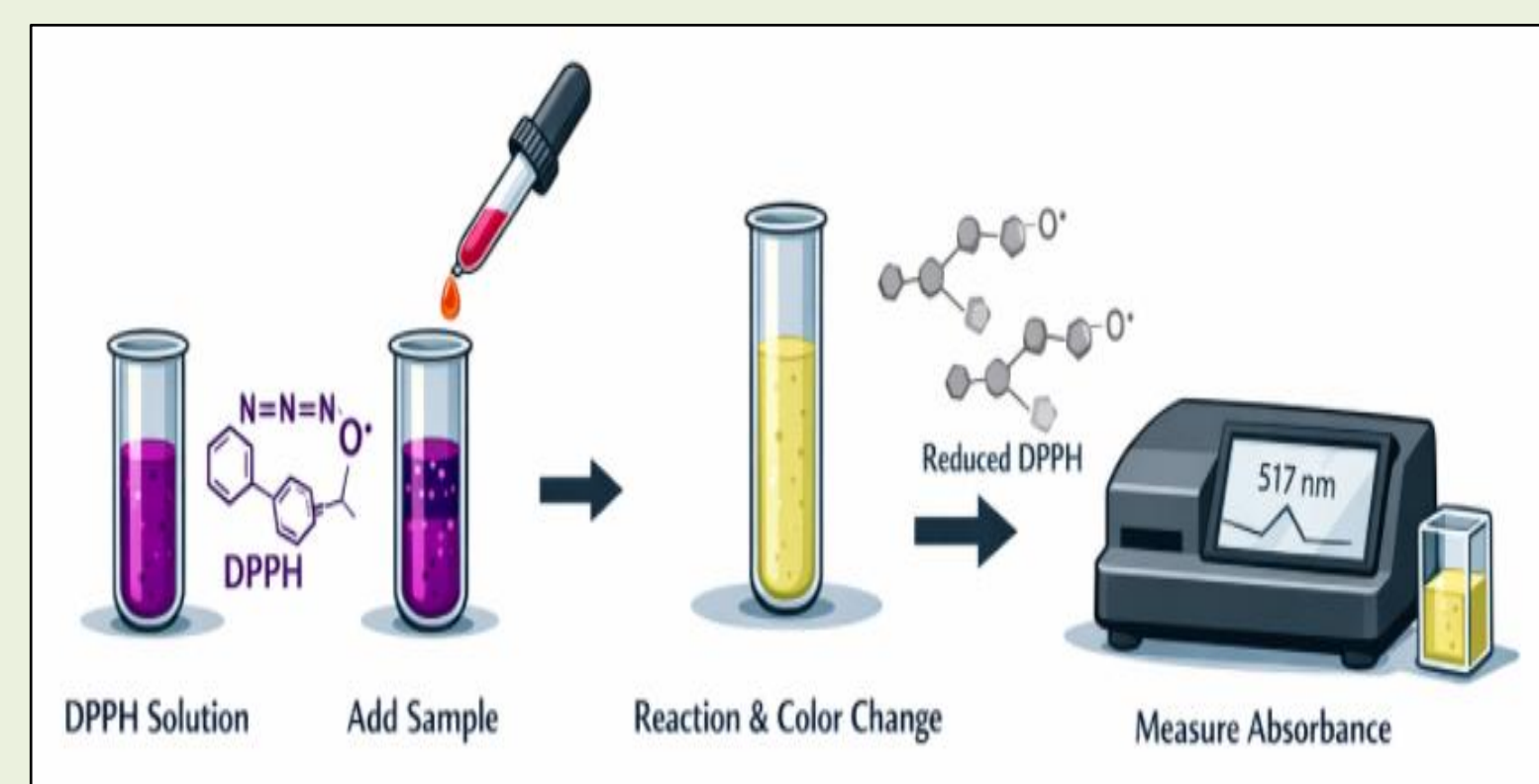


Fig 1: DPPH antioxidant assay

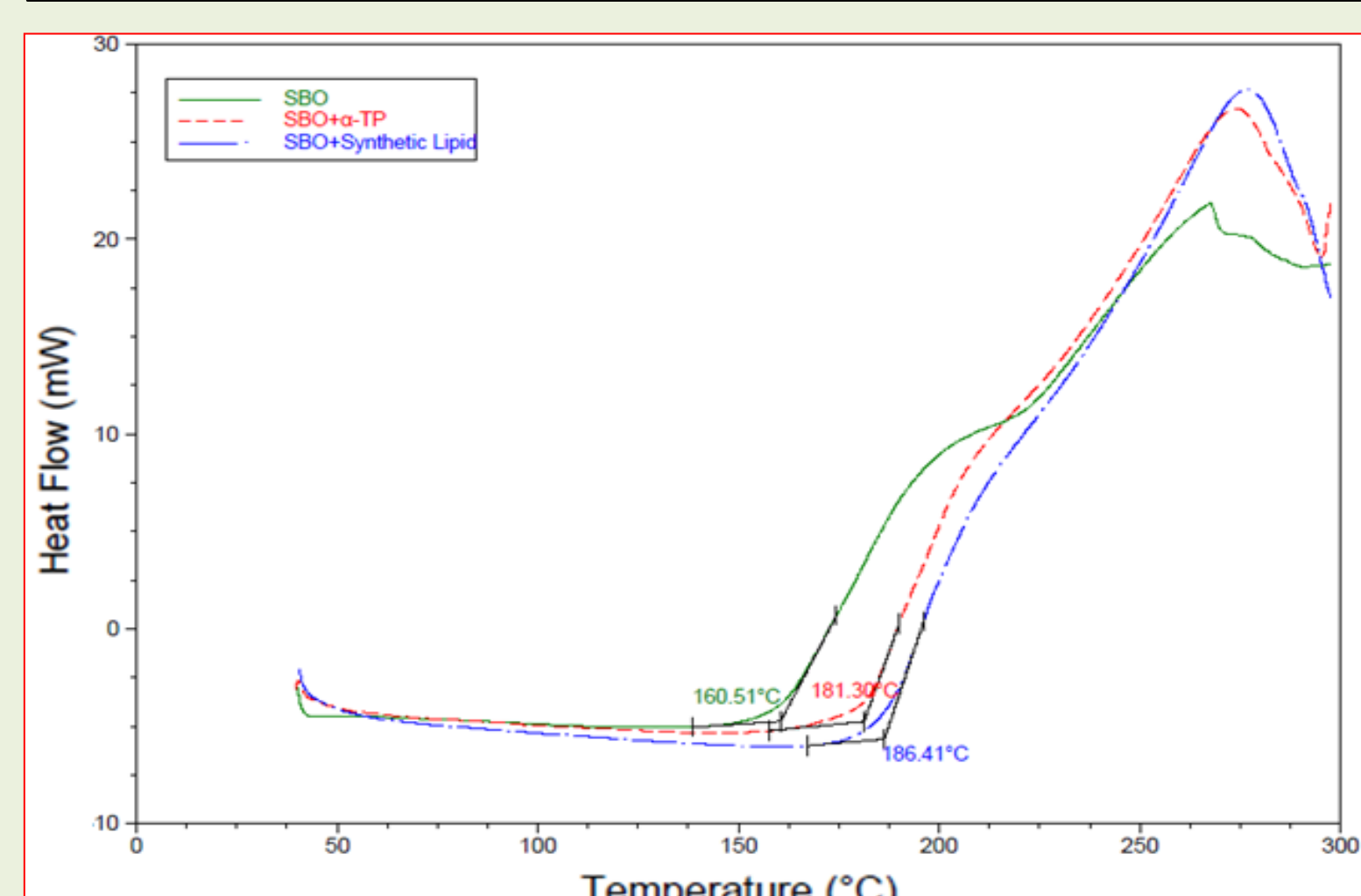


Fig 2: DSC antioxidant assay

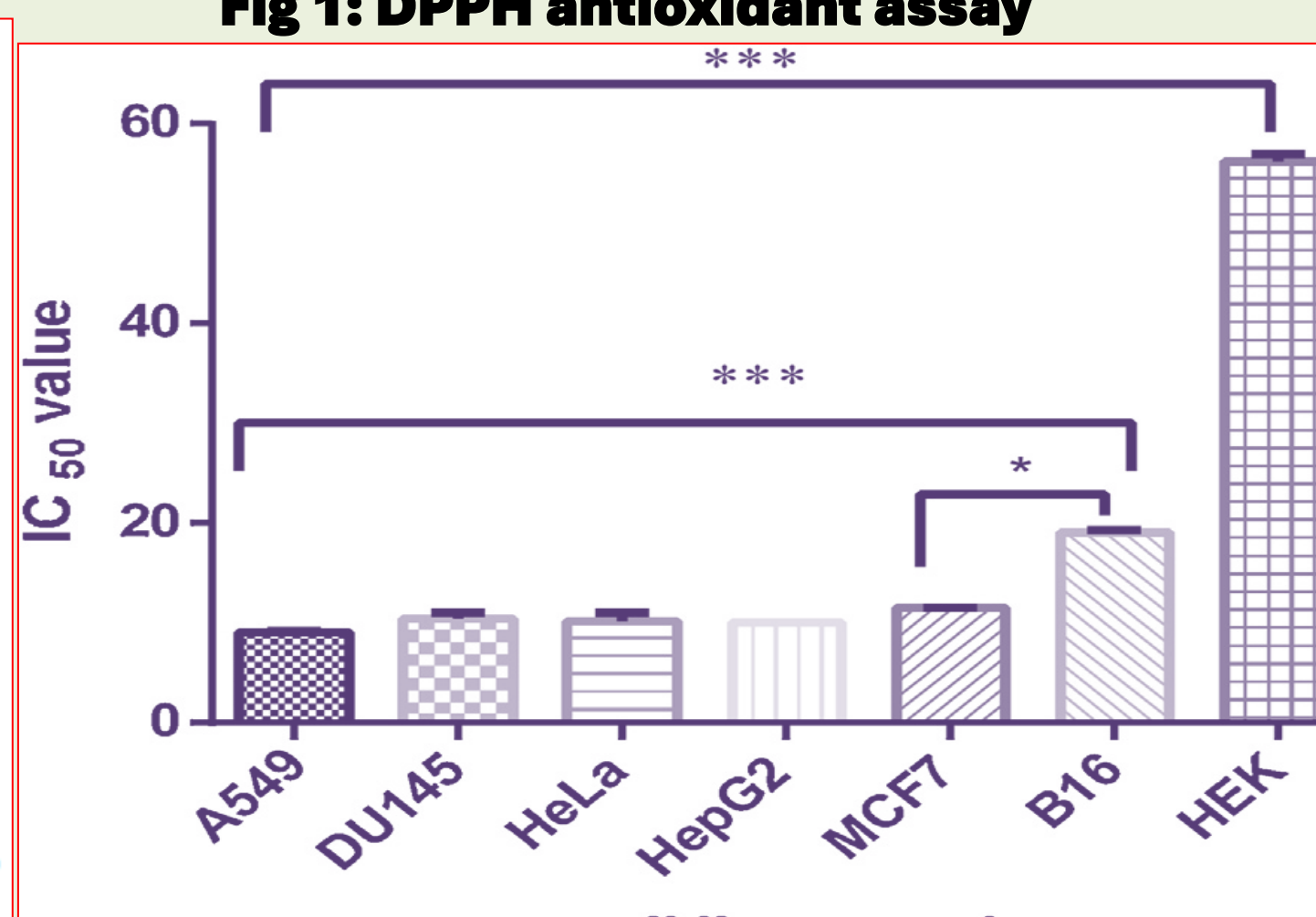


Fig 3: Cytotoxicity assay

Anti-oxidant assay: Oxidation inhibition of soybean oil using a differential scanning calorimeter was found to be 186°C for the synthesized phenolic lipid, while that of standard tocopherol is 180°C.

Cytotoxicity: Against A549 and HeLa cell lines with IC₅₀ values of 9.102 and 9.866 μM, respectively.

Conclusion

- A bio-organic synthetic route was designed for the synthesis of phenolic MAGs
- Coumaric acid and ferulic acid derivatives showed promising anti-microbial and anti-cancer properties.
- All phenolic MAGs showed very good antioxidant properties on par with standard BHT.
- The prepared compounds can be explored for cosmetic applications due to their promising biological activities

References

Johny, J., et al. (2019). *Bioorganic synthesis, characterization and evaluation of a natural phenolic lipid*. *Biotechnology Reports*, 24, e00375. <https://doi.org/10.1016/j.btre.2019.e00375>

Gandhi, B., Juliya, J., et al. (2021). *Antioxidant and biological activities of novel structured monoacylglycerol derivatives with phenolic acids*. *European Journal of Lipid Science and Technology*, 123, 2100056. <https://doi.org/10.1002/ejlt.202100056>

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- Antioxidant assay: sinapic derivatives showed better than standard BHT.
- Anti-microbial: coumaric derivative showed zone of inhibition 8.5mm and 9.5 mm on par with standard, with a minimum inhibitory concentration (MIC) of 6.25 μM mL⁻¹.
- Anti-cancer: most of the compounds, except 8h, i, j, showed very good anti-cancer effect with an IC₅₀ value less than 10, with a selectivity index >2.
- Coumaric acid derivative exhibited the strongest anticancer activity against DU145 cells, with the lowest IC₅₀ value (7.3 μM), indicating the highest potency among all tested derivatives.
- Sinapic and p-coumaric acid-based derivatives showing enhanced bioactivity.

Biological evaluation of synthesised phenolic lipid (a-j)

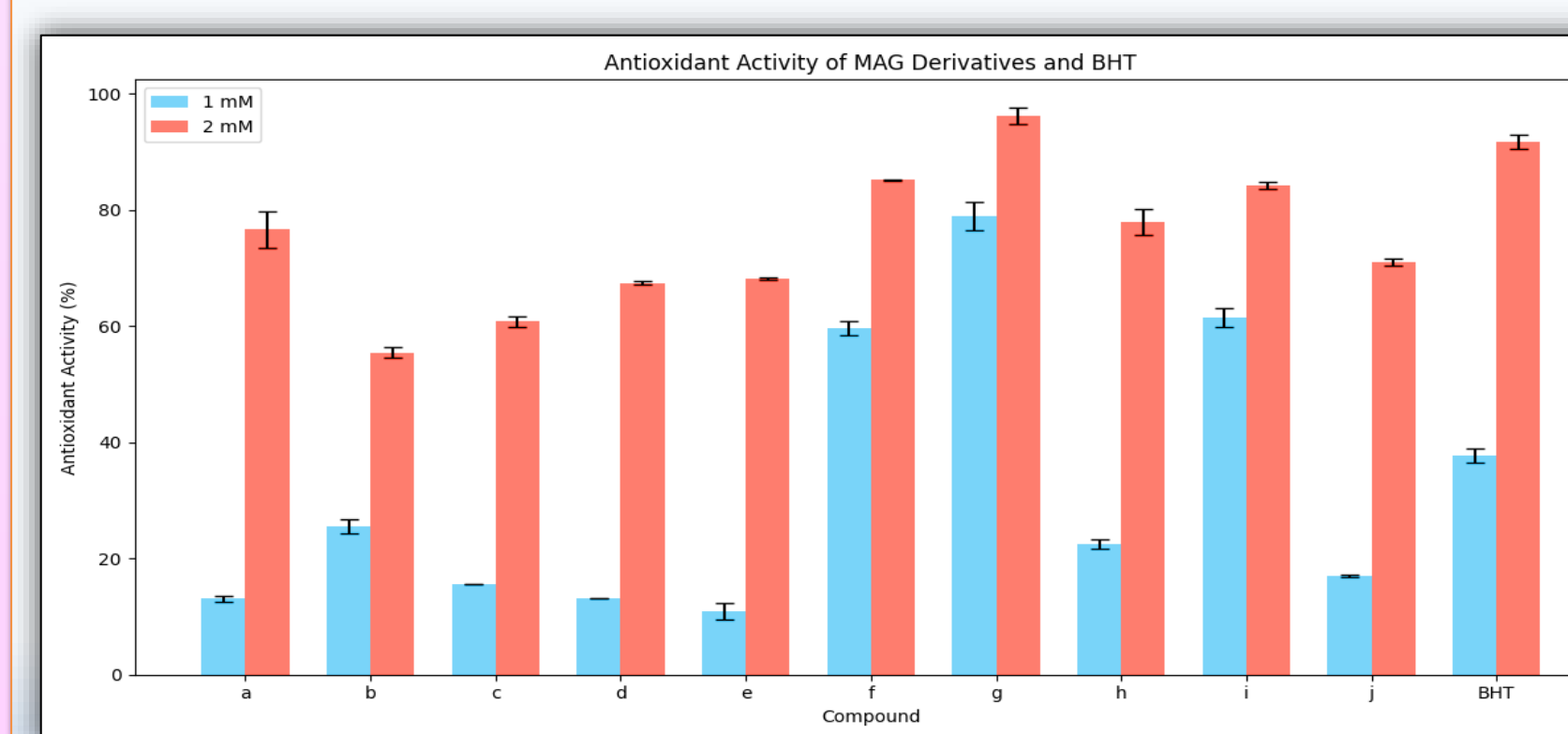
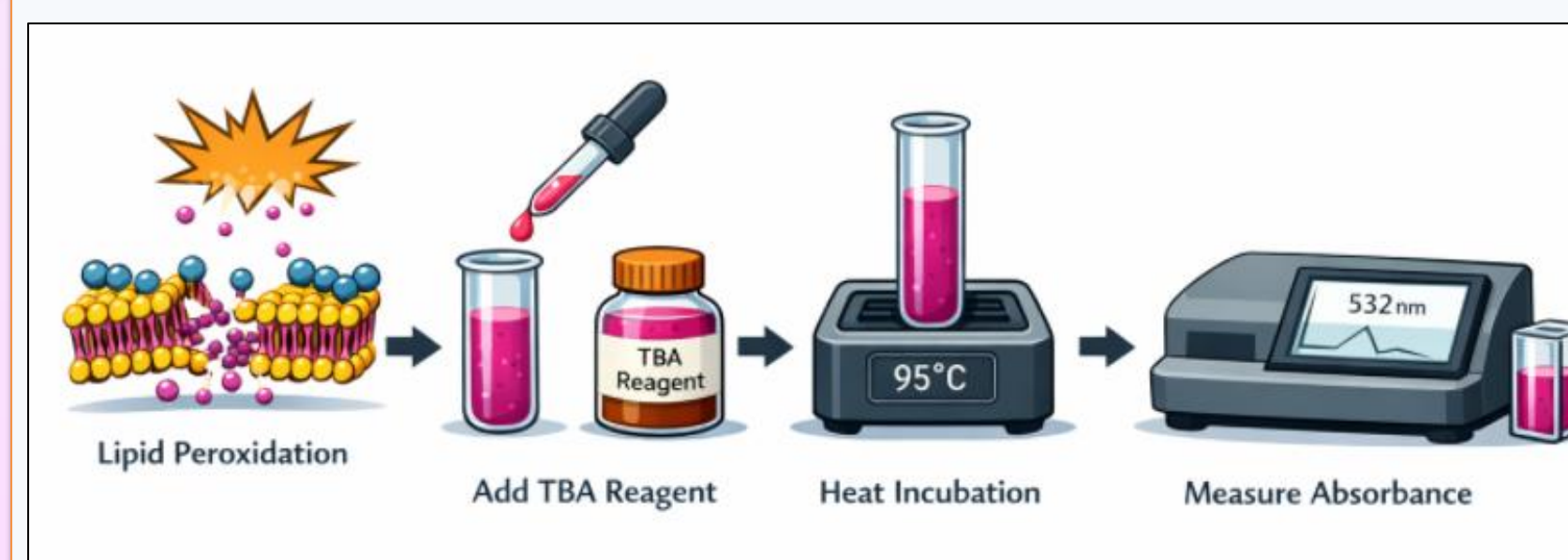


Fig 4: TBARS antioxidant assay

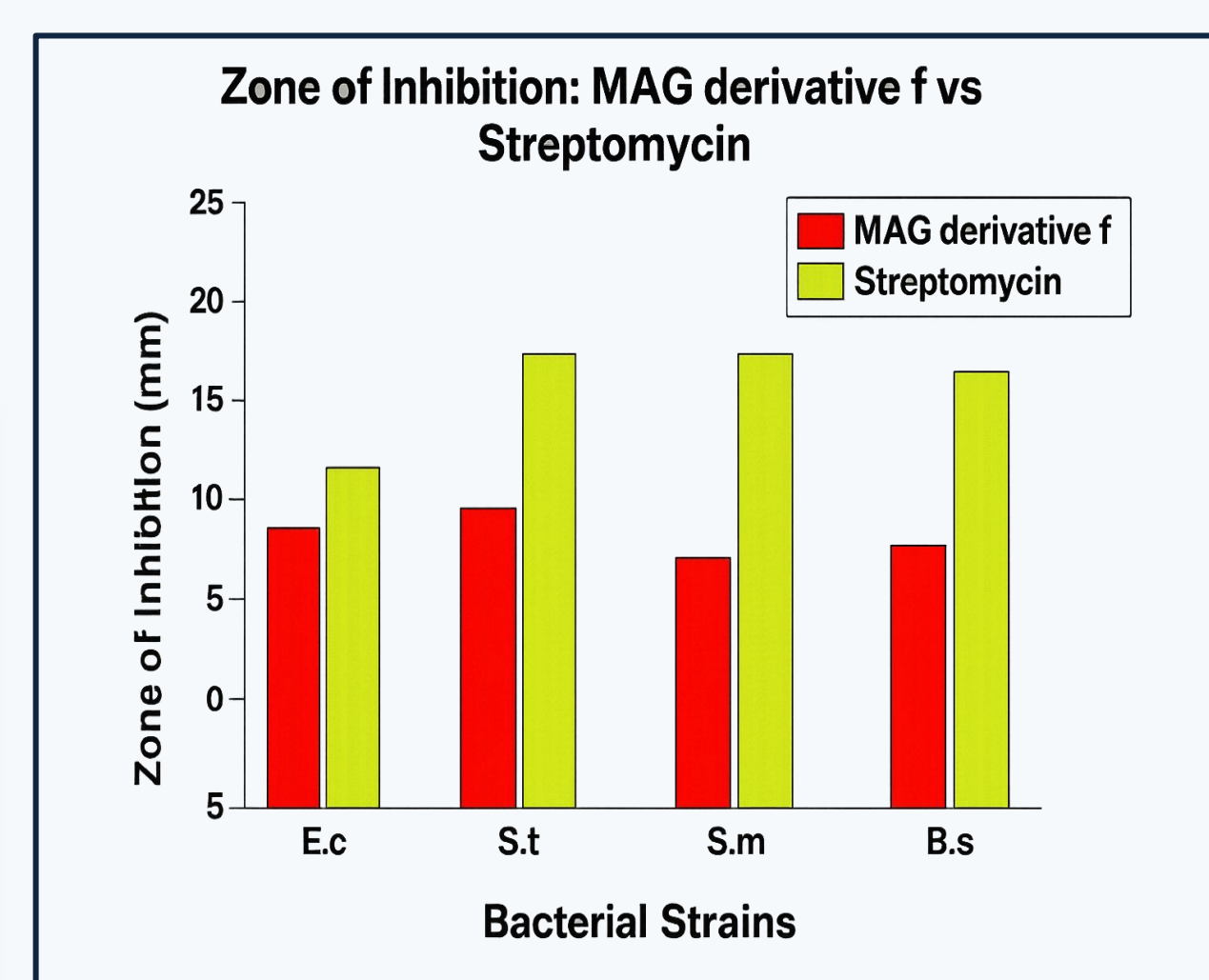


Fig 5: Antimicrobial evaluation of compound f

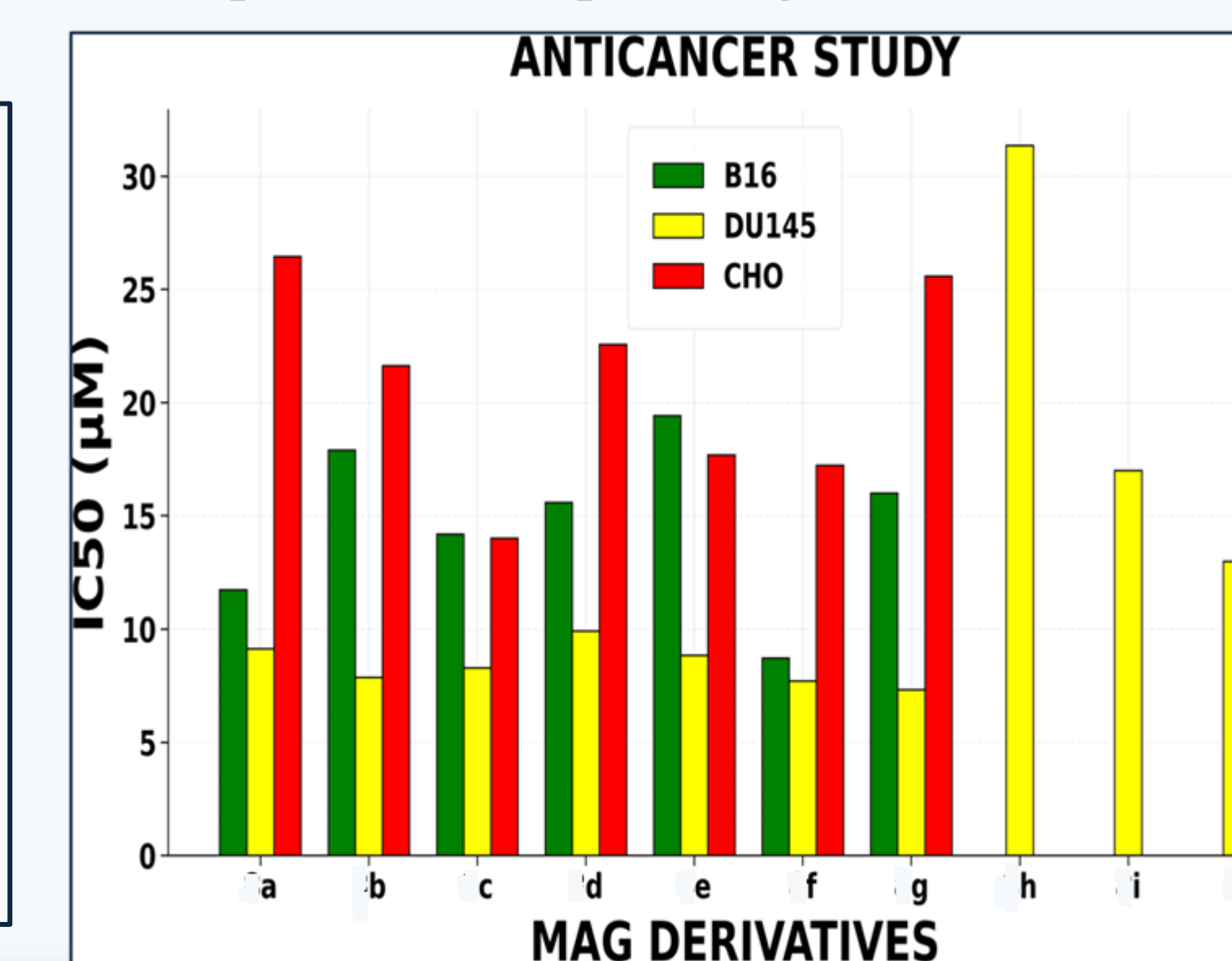


Fig 6: Cytotoxicity assay