Graduation Project – Bachelor's
Chem 499

Comparative Study on the Synthesis of Chalcone Using Conventional and Solvent-Free Methods.

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Introduction

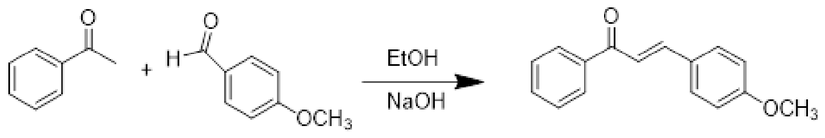
Chalcone ($C_{15}H_{12}O$) is an α,β-unsaturated aromatic compound found naturally and synthetically. It exhibits antibacterial, antioxidant, anti-inflammatory, and anticancer activities, making it important in green chemistry. This study aims to prepare the chalcone derivative 3-(4-methoxyphenyl)-1-phenylprop-2-en-1-one using both conventional and green methods.

Objectives

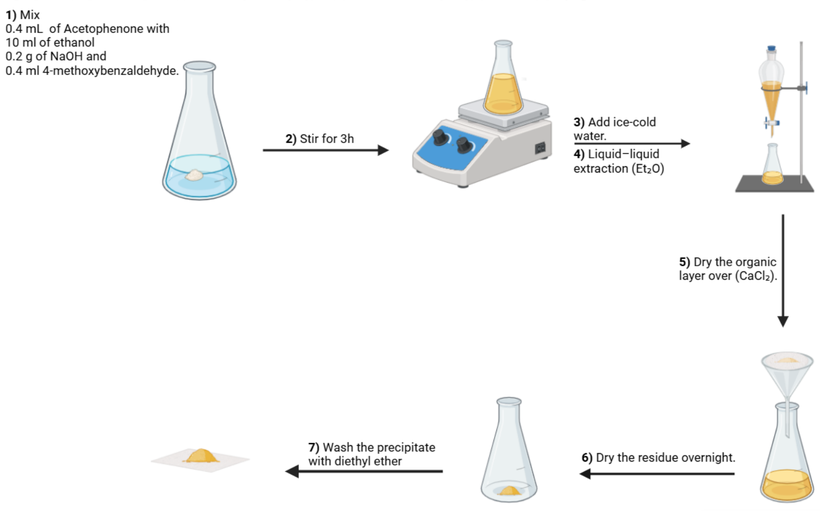
- To synthesize 3-(4-methoxyphenyl)-1-phenylprop-2-en-1-one using conventional and green methods.
- To compare the products using melting point (mp), thin-layer chromatography (TLC), infrared spectroscopy (IR), and nuclear magnetic resonance (NMR) analyses.
- To evaluate the efficiency and environmental impact of the green method.

Method

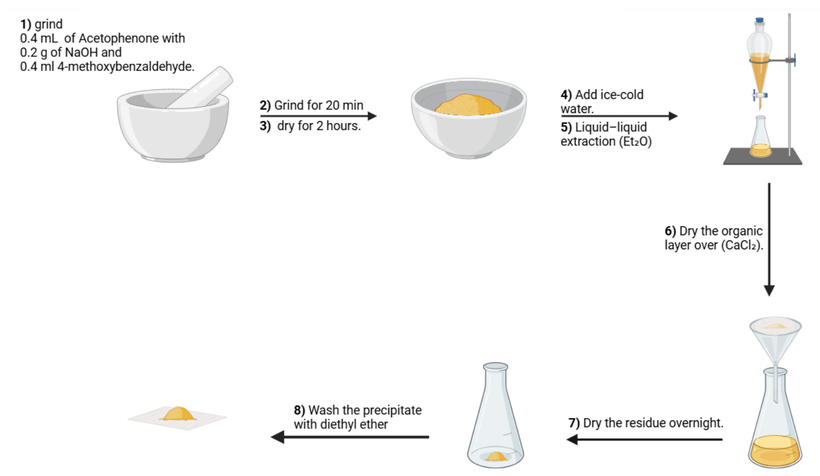
Reaction Equation:



Conventional method with Yield: 12.5%



Solvent-free method with Yield: 43.13%



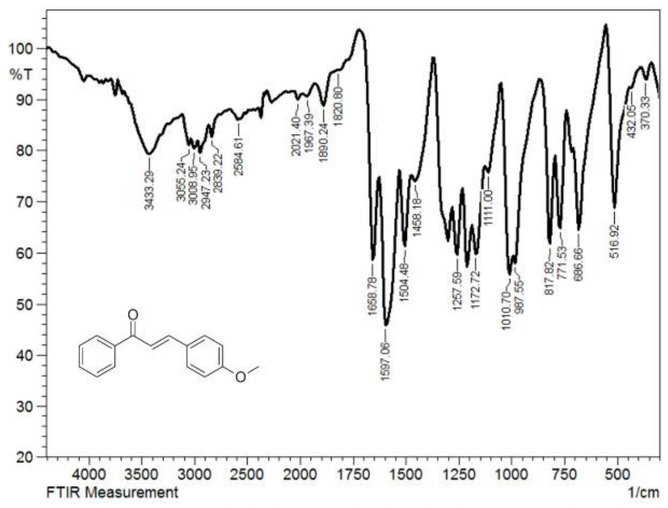
Results

The chalcone derivative was successfully synthesized by both the conventional and solvent-free methods, with melting points of 60–62 ° C and 54–56 ° C, respectively.

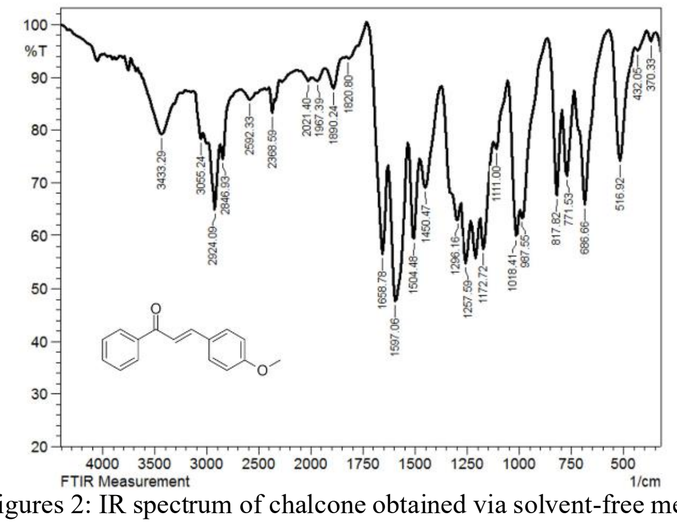
IR spectrum (cm^{-1}) (Figures 1 & 2):

The IR spectra of the product obtained from both the conventional and solvent-free methods exhibited identical characteristic absorption bands.

1658 (C=O), 1597 (C=C alkene),1504 (C=C aromatic rings), 3055 (sp^2 C–H), 2930 and 2850 (sp^3 C–H), 1110 (C–O methoxy group).



Figures 1: IR spectrum of chalcone obtained via conventional method.



Figures 2: IR spectrum of chalcone obtained via solvent-free methods.

^{1}H-NMR spectra ($CDCl_3$), δ (ppm) (Figure 3):

3.84(s, 3H, O–CH_3), 6.9(d, J =10Hz, 2H, p-OMe ring), 7.6(d, J =10Hz ,2H ,p-OMe ring),8.0(d, J =5Hz ,2H ,H_o), 7.48(t, J =7.5Hz ,2H, H_m), 7.58(t, J =7.5Hz,1H, H_p), 7.4(d, J =15Hz ,1H ,H-2), 7.8(d, J =15Hz,1H ,H-3).

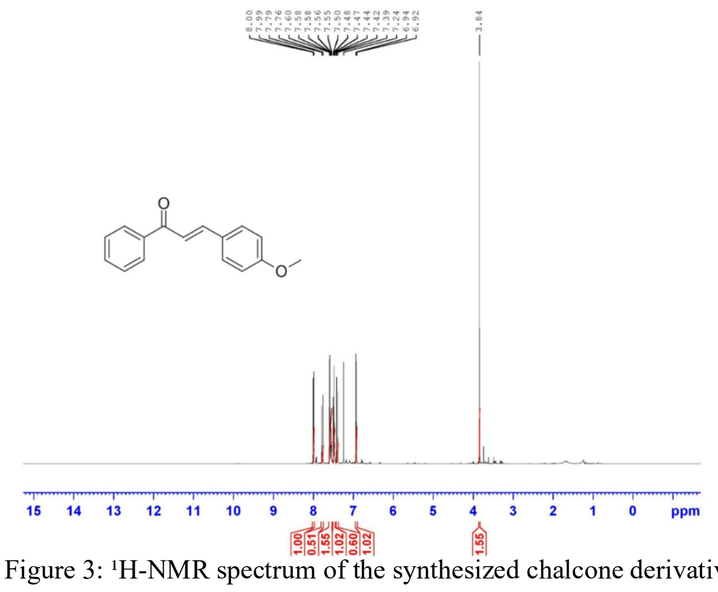


Figure 3: ^{1}H-NMR spectrum of the synthesized chalcone derivative.

Results

^{13}C-NMR spectrum ($CDCl_3$), δ (ppm) (Figure 4):

55(methoxy carbon), 114-161(sp^2 hybridized carbon), 190(C=O).

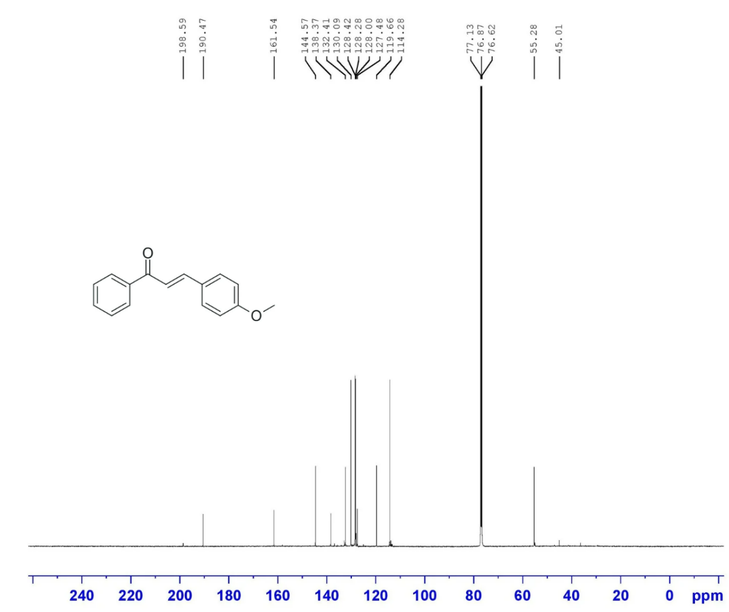


Figure 4: ^{13} C-NMR Spectrum of chalcone.

Conclusions

The solvent-free (green) method gave a higher yield of chalcone (43.13 %) than the conventional method (12.5 %). IR, ^{1}H-NMR, and ^{13}C-NMR analyses confirmed the expected chalcone structure, demonstrating that the green method is more efficient under the conditions used.

References

References available via QR code

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