

SiO₂ Supported Synthesis of N, N Disubstituted Cinnamamides

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Available online at: www.isca.in, www.isca.meReceived 12th March 2014, revised 3th April 2014, accepted 11th May 2014

Abstract

In the present work SiO₂ was used as solid support for reactants, which increases the rate of reaction and also supports the easy separation of target product from phosphine oxide. Witting reagent (Phosphorous ylide) and aromatic aldehydes supported on SiO₂ were treated under microwave irradiations to obtain respective N, N disubstituted Cinnamamide. This synthetic route was found to be convenient and energy efficient.

Keywords: N, N disubstituted CINNAMAMIDES, SiO₂ support.

Introduction

Nowadays N, N disubstituted Cinnamamides have been received much more attention due to their use in medicinal field^{1,2,3}. Cinnamamides may be used as an intermediate or precursor in many organic syntheses and pharmaceutical formulations^{4,5}. Literature survey exposes the value of cinnamamides and their applications in different fields^{6,7,8}.

Literature survey shows that several reactions were carried out by using solid support like silica and alumina and thousands of compounds were synthesized successfully by this method^{9,10}. But the synthesis of cinnamamides by using solid support remains untouched.

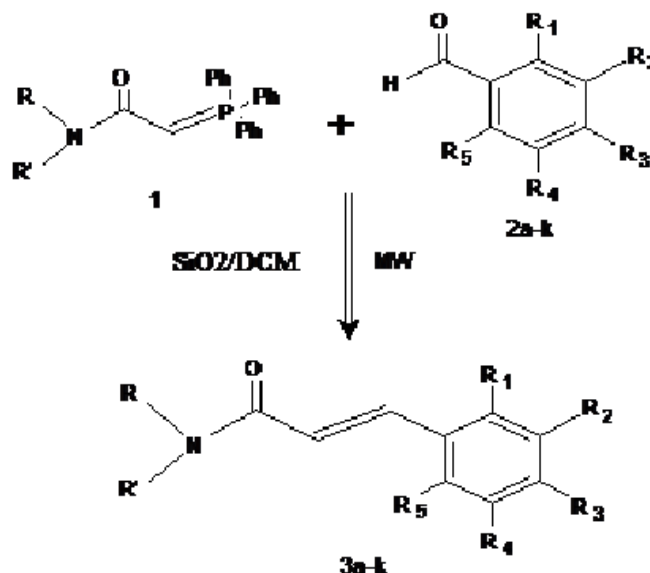
This literature survey encourages the author to undertake the present research work in which series of N, N disubstituted cinnamamides were synthesized under microwave irradiation by using SiO₂ as a solid support^{11, 12}. This synthetic approach was found to be convenient and energy efficient since it minimizes the use of solvent and prolong heating to the reaction mixture.

Material and Methods

All the required chemicals were procured from Sigma Aldrich and S D Fine limited, Mumbai, and used without further purification. Microwave oven used is of LG make, model-MC3283AMPG. The progress of reactions was monitored by Thin Layer Chromatography (TLC plate method). And after completion of reactions, compounds were purified by column chromatography using silica (Mesh-160). Representative compounds were characterized by I.R., ¹H NMR, ¹³C NMR and Mass spectroscopic techniques. Melting Points of compounds were determined by open capillaries method on electro-thermal apparatus.

General Method: SiO₂ (160 mesh, 5.0 g) was added to the solution of appropriate aldehyde (2a-k, 2 mmol) and Wittig

reagent (1, 2.86 g, 2.6 mmol) in dichloromethane (DCM) (10 ml) and reaction mixture was stirred for 2-5 minutes. The solvent was evaporated and remaining powder was air dried and spread in a Petri plate. The content was irradiated in a microwave oven till the completion of reaction (1-3 minutes). The progress of reaction was monitored by thin layer chromatography (TLC). After completion of reaction, the products (3a-k) were separated by column chromatography by using silica mesh-160.



Scheme-1

N, N disubstituted Cinnamamides R & R' = -CH₃, -C₂H₅

Results and Discussion

N,N disubstituted Cinnamamides (3a-k) were prepared by simple and convenient SiO₂ supported reaction pathway and the representative compounds were characterized by suitable techniques and the results were discussed as follows.

Table-1
Various substituent's of the compounds

Entries	R ¹	R ²	R ³	R ⁴	R ⁵	Molecular Formula
3a	H	H	H	H	H	C ₁₁ H ₁₃ NO
3b	H	H	-OCH ₃	H	H	C ₁₂ H ₁₅ N O ₂
3c	H	-OCH ₃	-OCH ₃	H	H	C ₁₃ H ₁₇ N O ₃
3d	H	-OCH ₃	-OCH ₃	-OCH ₃	H	C ₁₄ H ₁₉ N O ₄
3e	H	-OCH ₂ -O-		H	H	C ₁₂ H ₁₃ N O ₃
3f	-NO ₂	H	H	H	H	C ₁₁ H ₁₂ N ₂ O ₃
3g	H	H	-Cl	H	H	C ₁₁ H ₁₂ Cl NO
3h	H	H	-NO ₂	H	H	C ₁₁ H ₁₂ N ₂ O ₃
3i	H	H	-N (CH ₃) ₂	H	H	C ₁₃ H ₁₈ N ₂ O
3j	H	H	-OH	H	H	C ₁₁ H ₁₃ N O ₂
3k	H	H	H	H	H	C ₁₃ H ₁₇ NO

Table-2
List of N, N disubstituted Cinnamamides Prepared

Entries	Compound	Yield (%)	M.P. (°C)
3a	(2E)-N,N-dimethyl-3-phenylprop-2-enamide	72	96
3b	(2E)-3-(4-methoxyphenyl)-N,N-dimethylprop-2-enamide	68	102
3c	(2E)-3-(3,4-dimethoxyphenyl)-N,N-dimethylprop-2-enamide	76	88
3d	(2E)-N,N-dimethyl-3-(3,4,5-trimethoxyphenyl)prop-2-enamide	60	127
3e	(2E)-3-(1,3-benzodioxol-5-yl)-N,N-dimethylprop-2-enamide	66	118
3f	(2E)-N,N-dimethyl-3-(2-nitrophenyl)prop-2-enamide	70	146
3g	(2E)-3-(4-chlorophenyl)-N,N-dimethylprop-2-enamide	64	106
3h	(2E)-N,N-dimethyl-3-(4-nitrophenyl)prop-2-enamide	70	176
3i	(2E)-3-[4-(dimethylamino) phenyl]-N,N-dimethylprop-2-enamide	68	110
3j	(2E)-3-(4-hydroxyphenyl)-N,N-dimethylprop-2-enamide	64	98
3k	(2E)-N,N-diethyl-3-phenylprop-2-enamide	72	104

Spectroscopic data of representative compounds: The IR spectra were recorded on Perkin Elmer spectrometer using KBr Pelletes and ¹HNMR spectra were recorded on Varian; USA makes Mercury plus 400 MHz, NMR Spectrometer by using CDCl₃ with TMS as internal standard. ¹³CNMR spectra were recorded on Varian; USA makes Mercury plus 100 MHz, NMR Spectrometer by using CDCl₃ with TMS as internal standard. The mass spectrum was recorded on Jeol make Accu TOF, Mass Spectrometer.

Entry (3a)(2E)-N,N-dimethyl-3-phenylprop-2-enamide: Composition: C (75.52%), H (7.53%), N (7.98%), O (9.17%) **IR (KBR) cm⁻¹:** 3376,3277,3175,1664, 1656, 1609,1494,1272,1117,986,980, 940,792,760,690,640,530,480. **¹HNMR (300MHz, CDCl₃), δ ppm:** 7.3-7.7 m (5H), 7.6 d (1H) (J= 15.5Hz), 6.48d (1H) (J= 15.5Hz), 3.14 s, (6H) **¹³CNMR (100MHz, CDCl₃), δ ppm:** 12.9, 41, 118.9, 126.4, 128.7, 135.2, 144, 162.8 **MS:** m/e- 175 (M⁺).

Entry (3k)(2E)-N,N-diethyl-3-phenylprop-2-enamide: Composition: C (76.80%), H (8.42%), N (6.90%), O (7.89%) **IR (KBR) cm⁻¹:** 3362,3177,3075,1660, 1652, 1590, 1410, 1252, 978, 960, 790,750,680,640,520,470. **¹HNMR**

(300MHz, CDCl₃), δ ppm: 7.2-7.3m (5H), 7.54 d (1H) (J= 17.5 Hz), 6.98 d (1H) (J= 17.5 Hz), 3.02 q (2H), 1.20 t (3H) **MS:** m/e= 204 (M⁺).

Conclusion

The work described in this article follow the simple witting reaction mechanism and involves the use of SiO₂solid support which gives the protocol of convenient and green synthesis. The reaction conditions may be employed for the synthesis of many other cinnamide and related compounds.

Acknowledgement

The authors are thankful to Anuradha Engineering College, Chikhli,Dist-Buldana for providing all necessary facilities. Author is grateful to University Grants Comission for the award of MANF-JRF. Authors are also thankful to university of pune for providing instrumentation facilities for characterization of compounds.

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