SYNTHESIS OF AZINES FROM CARBONYL COMPOUNDS IN A SOLVENT-FREE CONDITION

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Abstract

In an environmentally benign solventless system, aldehydes and ketones were readily converted to their corresponding azines with hydrazine sulfate, sodium hydroxide and alumina in high yield.

Introduction

Azines, $R^1R^2C{=}N{-}N{=}CR^1R^2$, have achieved great significance in organic synthesis [1-3]. Many studies have shown that azines are good synthones for obtaining heterocyclic compounds such as pyrazols, purines and pyrimidines [4]. These compounds can be utilized for some useful synthetic transformations [5] and they constitute an important class of compounds with unexpected biological activities [6]. The ability of azines derived from 2-pyridinecarbaldehyde as poly-dentate ligand to form very stable complexes with different cations is well known [7].

Azines usually generated from carbonyl compounds and hydrazine hydrate and acetic acid in ethanol [8]. However, this method suffers from disadvantages such as low yields of products, long reaction time, mixture of products, and difficult operating conditions.

Since the early work of Toda [9], application of solid state organic chemistry has been currently under intensive investigation and has been recently reviewed [10-14].

In this connection, we wish to report herein a solid state method for preparation of azines from aldehydes and ketones using hydrazine sulfate, sodium hydroxide and alumina under a solvent free condition (Scheme 1).

The reactions were proceeded very fast and completed in 2-10 min. The results are summarized in Table 1. Aromatic and α, β-unsaturated aldehydes were converted to the corresponding azines at room temperature in more than 90% yield (Entries 1-6), while higher temperature were necessary for conservation of ketones (Entries 7-13).

The purity of this products was determined by ^{1}H NMR, IR spectra and melting point. In aldehyde azines ^{1}H NMR spectra, the CH group of HC=N– appeared around δ 8.0-9.0 as a singlet and in IR spectra, the C=N group was observed around 1610-1650 cm^{-1}.

Another noteworthy feature of the method lies in the exclusive reaction of aldehydes with hydrazine sulfate irrespective of the presence of ketones.

When equivalent amounts of ketones and aldehydes were treated with hydrazine sulfate, only aldehydes were selectively converted to the corresponding azines (Scheme 2).

In conclusion, the reported procedure is an interesting, easy and novel method for the preparation of azines. In addition, high yields of products, short reaction time, ease of work up, and low cost make the above method preferable to other existing methods.

Experimental Section

All yields refer to isolated products. The products were purified by column chromatography or preparative

Keywords: Azines; Synthesis; Solvent-free; Alumina

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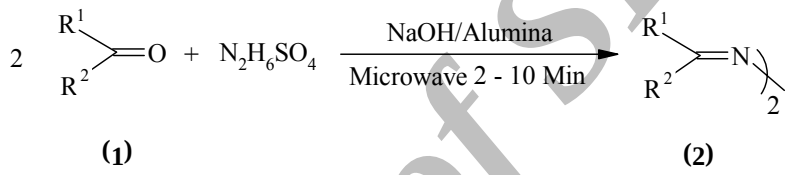
Table 1. Synthesis of Azines from Aldehydes and Ketones Under Microwave Irradiation

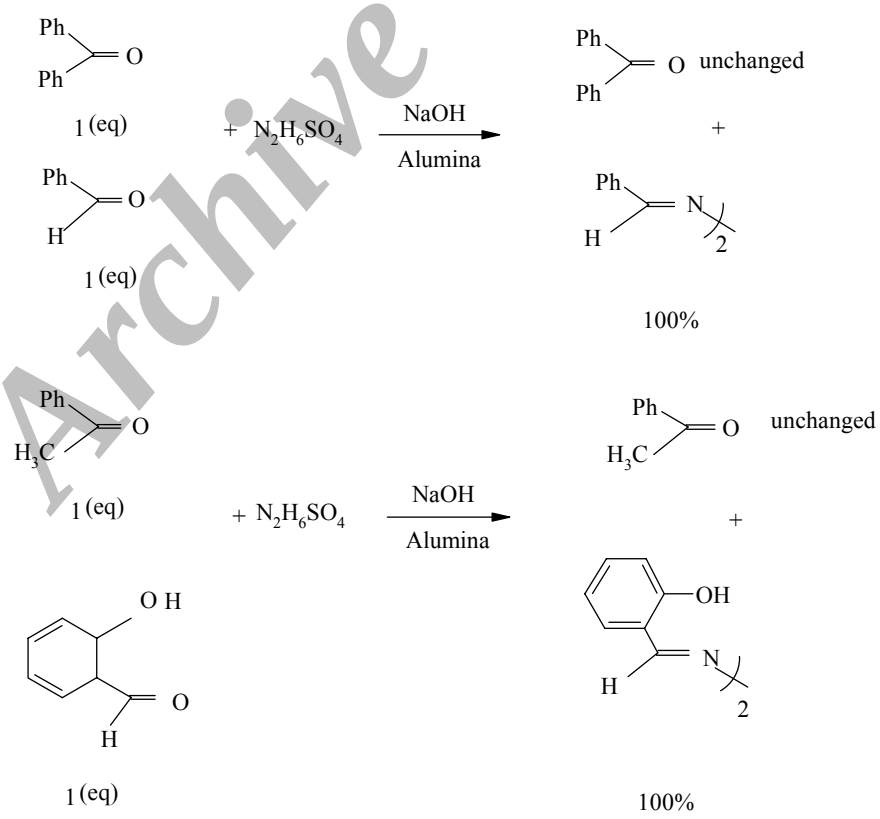
Entry	R1	R2	T°C	Time (min)	Yield,a,b (%)	Found (m. p.°C)	Reported (Lit.8)
1	Ph	H	r.t	2	87	92-93	93
2	4-MeOC6H4	H	r.t	2	95	174	172-175
3	2-HOC6H4	H	r.t	2	95	216	216-217
4	3-NO2C6H4	H	r.t	3	90	195-196	194-197
5	4-Me2NC6H4	H	r.t	2	92	215	215-217
6	PhCH = CH	H	r.t	4	94	163	162
7	Ph	CH3	50	5	80	123	122
8	Ph	Ph	50	7	80	161-162	162
9	PhCH(OH)	Ph	60	7	75	157	157
10	PhCO	Ph	60	7	80	202-203	202
11	2-quinaldyl	Ph	60	10	30	168	167
12	2-quinaldyl	t-C4H9	60	10	50	173	172-173
13	–(CH2)5–		80	9	75	35-37	37

[a] All products were identified by comparison with authentic samples (IR, NMR, M.P).
[b] Isolated yields.



(1) **(2)**

Scheme 1



Scheme 2

TLC (Thin Layer Chromatography) and recrystalization from ethanol. Melting points were determined by Buchi 510 apparatus and were not corrected. IR spectra were recorded on Perkin Elmer 781 spectrophotometer, ^{1}H NMR spectra on Burker 80 spectrometer.

A Typical Procedure

A mixture of 0.212 g (2 mmol) of benzaldehyde, 0.13 g (1 mmol) of hydrazinesulfate and 0.1 g sodium hydroxide was grounded thoroughly in a mortar and supported on neutral aluminum oxide (1 g Aldrich, Brock-mann 1 150 mesh). The reaction mixture was grinded for 2 min and the completion of the reaction was monitored by TLC. After completion of the reaction, 15 ml of water was added and the solution was extracted with chloroform (3×5 ml). The combined extracts were dried on $MgSO_4$ and evaporation of solvent under vacuum gave benzalazine in 98% yield.

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