Synthesis of Some N-Substituted Indoles

A.M. Hamdy
Dept. of Chemistry, College of Science, University of Mosul , Mosul , Iraq
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Abstract
Condensation of aniline with benzaldehyde and its substituents affords the corresponding N-arylidene anilines (1-9). The reaction of these compounds with indole in basic medium gave the corresponding 1,2-diaryl-2-(N-indolyl) methyl amines (N-substituted indoles) (10-18). The new synthesized compounds are characterized by using physical and spectral methods.

Keywords: N-substituted indoles, heterocyclic compounds

Introduction
Numerous reactions involving the formation of Schiff bases have been studied[1,2].

In this work, it was demonstrated that N-arylidene anilines (1-9) would form 1,2-diaryl-2-(N-indolyl) methyl amines (10-18) as a crystalline products, when reacted with indole through a base-catalyzed addition reaction [3].

Heterocyclic substances including indoles are found in several natural products with interesting biological activities and many studies have used the indole heterocycle as a core-function[4]. The N1- and C3-positions of the indole nucleus are relatively electron rich and react with various types of electrophiles[5].

In the present study, the aim was to introduce functionality in the N1-position while leaving C3-positions unsubstituted. Although functionalized indole ring systems have been found frequently in biologically active molecules, indole derivatives as multicomponent reaction partners are rather under-represented[6].

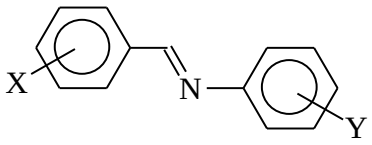
Experimental
Melting points were measured on Electrothermal 9300 melting point apparatus and are uncorrected. IR spectra were recorded in KBr disc using a Bruker, FT-IR, spectrophotometer Tensor 27. UV spectra were obtained by Shimadzu UV-Visible spectrophotometer UV-1650 PC using chloroform as solvent.

Synthesis of N-arylidene anilines (Schiff bases) (1-9)
These compounds had been synthesized by the following two methods:

Method (A)[7]
Equimolar of substituted aniline, benzaldehyde (0.02 mole) in (30 ml) methanol was mixed. The reaction mixture was refluxed for (24 hours), the solvent was then evaporated under vacuum and the solid was collected, recrystallized from xylene.

Method (B)[8]
Equimolar of substituted aniline, benzaldehyde (0.02 mole) and trimethyl amine (3 ml) was mixed in (30 ml) benzene and then refluxed for (24 hours). The solvent was then evaporated under vacuum and the solid was collected, washed with petroleum ether (60-80 °C) and recrystallized from xylene. The physical and spectral data for these compounds are recorded in Table (1). The spectral data were in an agreement with the reported values[9,10].

Table (1): Physical and spectral data of compounds (1-9)

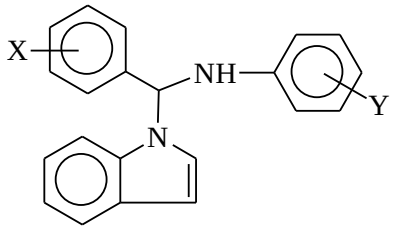


Comp. No.	X	Y	m.p. °C		Colour	Yield %	U.V ($CHCl_3$) λ_{max} (nm)	IR (KBr) ν (cm^{-1})	
			Ment.	Lit.[11]				C=N	Others
1	H	H	41-42	40-41	Yellow	68	364	1626	-
2	H	4-Br	45-47	-	Gray	83	320	1626	-
3	H	2-NO_2	60-61	64-65	Orange	60	307	1631	1335, 1580 (sym., asym) NO_2
4	H	4-OMe	40-41	42-43	Yellow	81	326	1622	1371 OMe
5	3-NO_2	4-Br	73-75	-	Yellow	86	326	1613	1430, 1548 (sym., asym) NO_2
6	2-NO_2	4-Br	89-90	-	Yellow	78	324	1607	1280, 1555 (sym., asym) NO_2
7	2-Cl	4-Br	57-58	-	Brown	68	316	1625	-
8	2-NO_2	4-NO_2	111-112	-	Yellow	73	320	1600	1350, 1617 (sym., asym) NO_2
9	2-NO_2	4-OMe	74-75	-	Orange	75	308	1618	1277, 1600 (sym., asym) NO_2 1385 OMe

Synthesis of 1,2-Diaryl-2-(N-indolyl) methyl amines (10-18)[12]

Indole (0.01 mole, 1.17 gm) with (30 ml) of 1.5% ethanolic NaOH was stirred for (15 min), then (0.01 mole) of desired N-arylidene aniline was added to the mixture. The mixture was refluxed for (2 hours), then cooled. The solid thus formed was recrystallized from ethanol to give the products (10-18). The physical and spectral data for these compounds are recorded in Table (2), which illustrates some physical properties and valid spectral data which in comparison with the reported values[9,10] seemed in a good agreement.

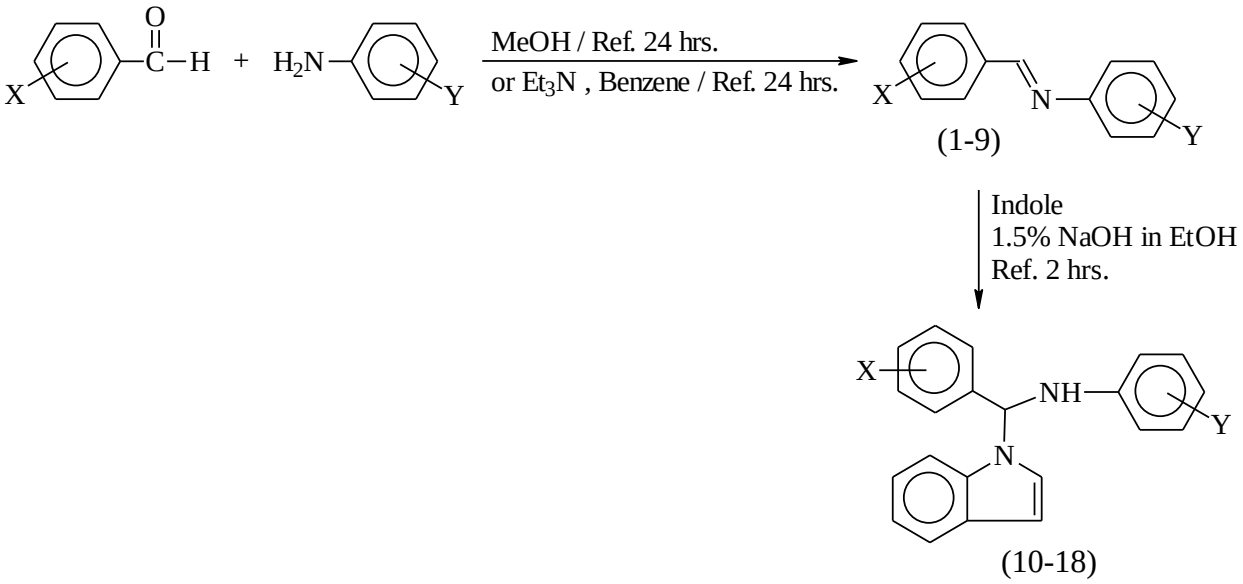
Table (2): Physical and spectral data for compounds (10-18)



Comp. No.	X	Y	Decom. °C	Colour	Yield %	U.V ($CHCl_3$) λ_{max} (nm)	IR (KBr) ν (cm^{-1})		
							C=C	N-H	Others
10	H	H	235	White	60	284	1511	3418	-
11	H	Br	270	Brown	42	282	1530	3417	-
12	H	2-NO_2	227	Yellow	46	284	1525	3418	1446, 1573 (sym., asym) NO_2
13	H	4-OMe	265	Brown	51	288	1600	3417	1450 OMe
14	3-NO_2	4-Br	240	Brown	56	272	1590	3407	1449, 1568 (sym., asym) NO_2
15	2-NO_2	4-Br	278	Brown	77	276	1592	3352	1447, 1564 (sym., asym) NO_2
16	2-Cl	4-Br	282	White	80	272	1612	3396	-
17	2-NO_2	4-NO_2	258	Deep gray	80	282	1545	3360	1443, 1562 (sym., asym) NO_2
18	2-NO_2	4-OMe	275	Brown	60	278	1552	3352	1449, 1564 (sym., asym) NO_2 1308 OMe

Results And Discussion

In this work, the synthesis of the titled compounds (10-18) was carried out in two steps as shown in Scheme (1).

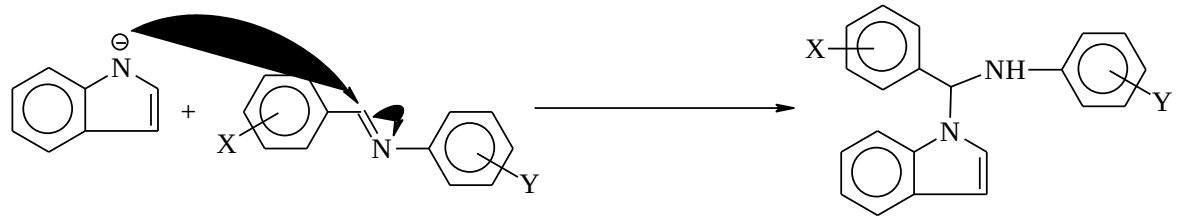


Scheme (1)

According to Scheme (1), N-arylidene anilines (1-9) were synthesized through the condensation of substituted aniline, and variety of substituted benzaldehydes (method A and B).

The IR spectra for these compounds showed a significant absorption bands in the region (1600-1626 cm^{-1}) for (C=N) group. The UV spectra gave λ_{max} at (307-364 nm), the increasing of λ_{max} is due to conjugation[13].

N-Arylidene anilines reacted with indole in basic medium. The reaction proceeds through anionic attack of the electron pair of nitrogen atom in indole to the carbon atom of (C=N) group of the conjugated system, to afford the final products (10-18), which can be illustrated by the following mechanism[14].



The spectral data for the synthesized compounds (10-18) are in quite good agreement with their proposed structures. The IR spectra showed two significant absorption bands in the region (3352-3418 cm^{-1}) for (N-H) function and (1511-1612 cm^{-1}) for (C=C) function. Furthermore, in these spectra the absence of (C=N) absorption bands of the parent compounds (1-9) clearly indicated the fusing between compounds (1-9) and indole. Finally, the UV spectra for these compounds gave λ_{max} at (272-288 nm) in a clear decrement when compared to the starting materials which may be related to the conjugation vanishing.

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تحضير بعض N- معوضات الاندول

اوس مردان حمدي

قسم الكيمياء، كلية العلوم، جامعة الموصل ، الموصل ، العراق

(تاريخ الاستلام: ٢٧ / ١ /٢٠٠٨ ، تاريخ القبول: ٢٩ / ٥ / ٢٠٠٨)

الملخص

تتكاثف الالديهايدات الاروماتية مع الانيلين ومعوضاته لتعطي مركبات N-ارايليدين انيلين (قواعد شيف) (١-٩). ان تفاعل هذه المركبات مع الاندول في الوسط القاعدي يؤدي الى تكوين مركبات ٢،١-ثنائي اريل-٢-(N-اندوليل) مثيل امين (N-اندولات معوضة) (١٠-١٨). تم اقتراح الصيغ التركيبية للمركبات المحضرة باستخدام الطرق الفيزياوية والطيفية المتوفرة.

الكلمات المفتاحية: N-معوضات الاندول، المركبات الحلقية غير المتجانسة.