

Synthesis of new Schiff's Bases via Suzuki coupling reaction

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Abstract

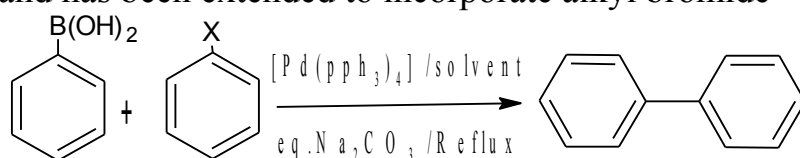
A series of novel Schiff bases have been prepared from the condensation reaction of benzil with 4- chloro aniline compound , the product have been treated with many derivatives of(2-, 3-, 4-, 2,3-, 3,4-fluoro) phenyl boronic acids by Suzuki coupling reaction to give new schiff bases.

These compounds have been characterized by spectroscopic methods (FT-IR, UV-VIS.), TLC and melting point.

Keywords: Schiff's base ; Suzuki coupling; Phenyl boronic acids .

Introduction

The Suzuki reaction is the organic reaction of an aryl or vinyl boronic acid with an aryl or vinyl halide catalyzed by a palladium (0) complex^(1, 2).It is widely used to synthesize poly olefins, styrenes and substituted biphenyls and has been extended to incorporate alkyl bromide ⁽³⁾.Scheme (1)⁽⁴⁾ .



Scheme 1: Suzuki Coupling

The reaction also works with pseudohalides, such as triflates (OTf), instead of halides⁽⁵⁾. Boronic esters and organotrifluoroborate salts may be used instead of boronic acids⁽⁶⁾. The Suzuki reaction couples boronic acids (containing an organic substituent) to halides⁽⁷⁾. The reaction relies on a palladium catalyst such as tetrakis(triphenylphosphine)palladium to effect part of the transformation^(8,9). In part due to the stability, ease of preparation and low toxicity of the boronic acid compounds. There is currently widespread interest in applications of the Suzuki coupling, many coupling reactions have found their way into pharmaceutical industry and into conjugated organic materials ⁽¹⁰⁾. Schiff bases have been widely used in many fields, e.g. in biological, inorganic , analytical and in drug .synthesis⁽¹¹⁾

Experimental

The melting points were measured on staurat (M.P./SMP3) apparatus (Melting points are uncorrected). The FT-IR spectra were recorded on shimadzu FT-IR -8400S spectrophotometer using KBr disc. The UV-VIS. spectra were recorded on shimadzu UV-VIS. (1600 spectrophotometer). Analytical silica gel TLC plates 60 F₂₅₄ were supplied from Merck. All reagents were obtained from commercial suppliers and were used without further purification.

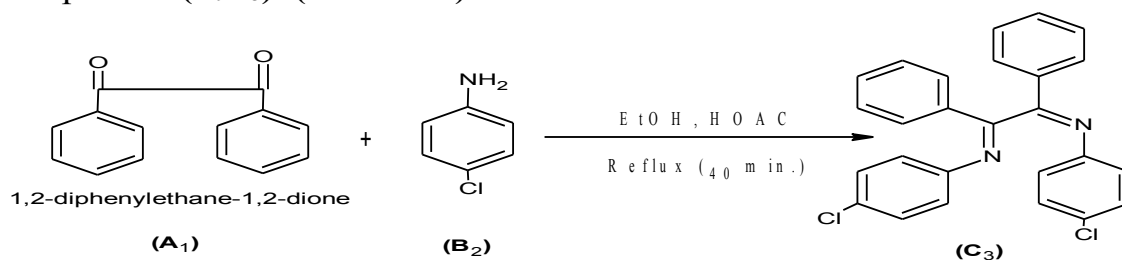
General Procedure: Synthesis of Schiff's base compound (**C₃**) via condensation reaction of 1,2-diphenylethane-1,2-dione(**A₁**) with p- chloro aniline (**B₂**) ⁽¹²⁾.

A mixture of (4.2g , 0.02 mole) of 1,2-diphenylethane-1,2-dione (**A₁**) , (0.5g ,0.04mole) of p- chloro aniline (**B₂**) ,20 ml ethanol and 2 drops of glacial acetic acid , was refluxed for 40 min. then left to cool in a bath of ice-water , whereby yellowish crystals separated out . The crystals were filtered , washed with 2% HCl , then with water and re-crystallized absolute ethanol to give Schiff base compound (**C₃**).

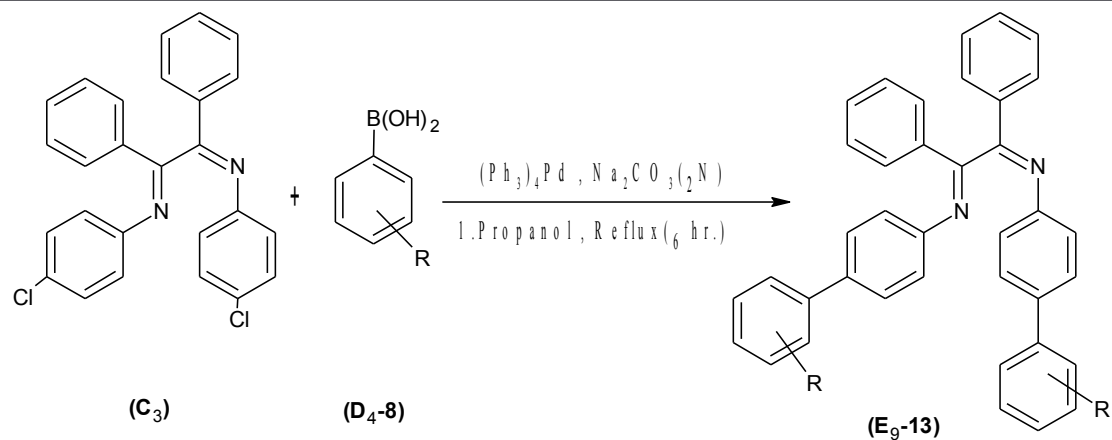
(Scheme 2).

General Procedure: Suzuki coupling reactions of phenyl boronic acids with schiff base compound (**C₃**)⁽¹³⁾. [Synthesis of comp. (**E₉₋₁₃**)].

In two-necked round bottom flask under an atmosphere of nitrogen gas was placed correct amount of catalyst (0.02 mg) [Pd(Ph₃P)₄] with solution (made up by mixing (0.43g , 0.001mole) schiff base compound(**C₃**) , (0.002 mole) fluoro phenyl boronic acids(**D₄₋₈**) , 5 ml Na₂CO₃(2N) and 15 ml n-propanol) . The mixture was heated vigorously under reflux (water condenser) for 6 hour using a heating mantle and maintaining rapid stirring. The reaction progress can be monitored by TLC (n-Hexane- Ethyl acetate 2:1) . After the reaction was completed, the mixture was allowed to cool slowly to R.T. and then cool in ice-bath. The solid product obtained was filtered off and recrystallized from diethyl ether to give coloured compounds (**E₉₋₁₃**). **(Scheme 3).**



Scheme 2 : Preparation of Schiff Base compound

R	Ent.	 Scheme 3 : Preparation of E₉₋₁₃ compounds
2-F	E ₉	
3-F	E ₁₀	
4-F	E ₁₁	
2,3-F	E ₁₂	
3,4-F	E ₁₃	

Results & Discussion

The aim of this work is to synthesize new Schiff's bases containing poly aromatic rings and two groups azomethine via Suzuki coupling reaction . The formation of carbon–nitrogen double bond plays important role in organic synthesis. This can be achieved by the reaction of aldehydes and amines in acidic medium which leads to synthesis of Schiff bases (imines) ⁽¹⁴⁾. Palladium catalyzed reactions have several advantages including functional group tolerance, low sensitivity of organopalladium compounds towards water and air ⁽¹⁵⁾. The mechanism for the Suzuki coupling involves three steps: 1) Oxidizing addition; 2) Ligand substitution (Transmetallation); 3) Reductive elimination. The palladium (0) species is generated under the reaction conditions from $(\text{Ph}_3\text{P})_4\text{Pd}$ ⁽¹⁶⁾. The boronic acid reduces the Pd (II) to Pd (0) ⁽¹⁷⁾. The palladium (0) complex then oxidatively adds to the aryl halide (Schiff base derivative (**C**₃)). The halide is then substituted by fluoroboronic acid derivatives (**D**₄₋₈) to give a palladium di aryl complex. Reductive elimination from this complex occurs to give the new organic products and regenerate the Pd(0)catalyst . In Suzuki coupling oxidative addition is often the slowest step (Rate Determining Step = RDS) ⁽¹⁸⁾. The Suzuki reaction in organic synthesis are that it is very versatile, tolerates numerous functional groups and usually works under gentle conditions and the boronic acids are insensitive to water and oxygen ⁽¹⁹⁾.

Synthesis of starting material (**C**₃=4-chloro-*N*-{2-[(4-chlorophenyl)imino]-1,2-diphenyl ethylidene}aniline) which based on the condensation reaction between 1,2-diphenyl ethane-1,2-dione (**A**₁) with 4-chloro aniline (**B**₂) in ethanol . Their structures were confirmed by FT-IR spectra which show $\nu(\text{cm}^{-1})$ 3120 (arom.CH) , 1620 (C=C group) , 1680

(C=N) , for 620 (C-Cl) .Finally treatment of (C₃)with derivatives of fluoro phenyl boronic acids (D₄₋₈) via Suzuki coupling reaction gives new schiff bases (E₉₋₁₃). The structures were determined by (FT-IR, UV-VIS) spectra⁽²⁰⁾. Physical and spectral data were listed in **Table (1 and 2)**.

Table (1) Physical data of prepared compounds

Colour	R _f	M.P.C°	Yield (g, %)	M.Wt. g/mol	Mol.Stru.	Ent.
yellow	-----	226-225	7, 82	429.3	C ₂₆ H ₁₈ Cl ₂ N ₂	C ₃
L*.Yellow	0.64	242-241	0.30 , 60	548.6	C ₃₈ H ₂₆ F ₂ N ₂	E ₉
D*.Yellow	0.62	242-241	0.35 , 70	548.6	C ₃₈ H ₂₆ F ₂ N ₂	E ₁₀
yellow	0.60	244-243	0.38 , 76	548.6	C ₃₈ H ₂₆ F ₂ N ₂	E ₁₁
Orange	0.54	254-253	0.45 , 75	584.6	C ₃₈ H ₂₄ F ₄ N ₂	E ₁₂
Brown	0.55	256-255	0.40 , 66	584.6	C ₃₈ H ₂₄ F ₄ N ₂	E ₁₃

*L= Light, D = Dark

C₃= 4-chloro-N-{2-[(4-chlorophenyl)imino]-1,2-diphenylethylidene}aniline .

E₉ = N,N'-[-1,2-diphenylethane-1,2-diylidene]bis(2'-fluorobiphenyl-4-amine) .

E₁₀ = N,N'-[-1,2-diphenylethane-1,2-diylidene]bis(3'-fluorobiphenyl-4-amine) .

E₁₁ = N,N'-[-1,2-diphenylethane-1,2-diylidene]bis(4'-difluorobiphenyl-4-amine) .

E₁₂ = N,N'-[-1,2-diphenylethane-1,2-diylidene]bis(2',3'-difluorobiphenyl-4-amine) .

E₁₃ = N,N'-[-1,2-diphenylethane-1,2-diylidene]bis(3',4'-difluorobiphenyl-4-amine) .

Table (2) Spectral data of prepared compounds

FTIR ν cm ⁻¹ (KBr disk)					λ_{max}	Comp.
C=C _{Ar} .	C-F	C-Cl	C=N	C-H _{Ar} .	EtOH	NO.
1533.51	-----	775.47	1630.50	3065.75	265.50	C ₃
1525.82	1013.16	-----	1620.39	3047.50	255.00	E ₉
1520.37	1012.53	-----	1615.24	3055.65	253.50	E ₁₀
1530.70	1011.37	-----	1610.44	3045.70	250.50	E ₁₁
1547.48	1022.54	-----	1590.66	3020.55	248.50	E ₁₂
1518.65	1018.73	-----	1588.72	3025.70	240.00	E ₁₃

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الخلاصة

سلسلة من قواعد شف الجديدة المحضرة من تفاعل التكاثر بين مركب البنزيل مع 4-كلورو انيلين ، وتم معالجة الناتج مع عدة مشتقات من (2-، 3-، 4-، 3،2-، 3، 4-فلورو) حوامض البورونيك ، عن طريق تفاعل ازدواج سوزوكي حيث تم الحصول على قواعد شف جديدة . تم تشخيص المركبات الناتجة بالطرق الطيفية (الأشعة تحت الحمراء ، الأشعة فوق البنفسجية والمرئية) ، كروماتوغرافيا الطبقة الرقيقة ، درجات الانصهار .