

Synthesis of Coumarins Through Zinc Chloride-Catalyzed Hydroarylation of Acetylenic Esters by Phenols

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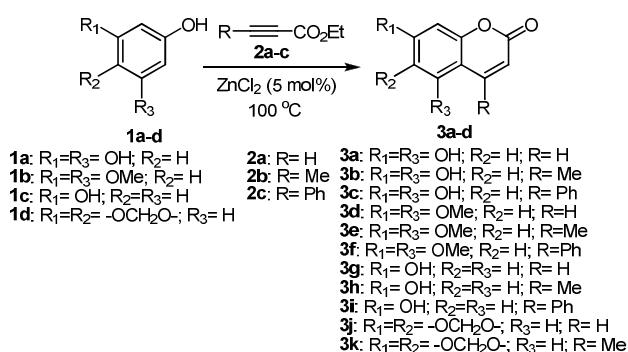
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INTRODUCTION

Coumarins comprise a class of natural products and many of them exhibit a broad range of biological activities.^{1a,b} Several routes have been described to prepare coumarins.^{2a-c} In 1965 Kaufman and coworkers reported the hydroarylation of the ethyl propiolate (**2a**) by fluoroglucinol (**1a**) in the presence of stoichiometric amount of ZnCl₂ leading to the coumarin **3a** in good yield.^{2a} The protocol reported by Kaufman was very few explored in the literature and no attempts to perform the hydroarylation in the presence of catalytic amounts of ZnCl₂ was described. Herein we wish to report the zinc chloride-catalyzed hydroarylation of acetylenic esters **2** by phenols **1** leading to coumarins **3**.

RESULTS AND DISCUSSION

In order to know the scope of this reaction, phenols **1a-d** were allowed to react with the acetylenic esters **2a-c** in the presence of substoichiometric amount of ZnCl₂ (Scheme 1). The hydroarylation of acetylenic ester **2a** by the phenol **1a** in the presence of 5 mol % of ZnCl₂ at 100°C indeed led to the coumarin **3a** (Table 1, entry 1), as previously described in the literature, but this reaction is much more faster than reported by the authors, being complete in only five minutes. Under these conditions, propiolates **2b** and **2c** also reacted very fast with **1a**, leading to the coumarins **3b** and **3c** in excellent yields (entries 2 and 3). Coumarins **3d-k**, were also obtained in good yields (entries 4-11).



Scheme 1. ZnCl₂-promoted hydroarylation of acetylenic acids **2a-c** leading to the coumarins **3a-k**.

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Table 1. ZnCl₂ (5mol%) catalyzed synthesis of coumarins.

Entry	1	2	3	Time	Yield (%)
1	1a	2a	3a	5 min	88
2	1a	2b	3b	5 min	84
3	1a	2c	3c	5 min	95
4	1b	2a	3d	30 min	73
5	1b	2b	3e	10 min	77
6	1b	2c	3f	12 h	50
7	1c	2a	3g	30 min	85
8	1c	2b	3h	3 h	88
9	1c	2c	3i	12 h	54
10	1d	2a	3j	1 h	70
11	1d	2b	3k	10 min	31

CONCLUSION

In the presence of 5 mol% of ZnCl₂, activated phenols afforded coumarins in good yields. The method present herein lead to coumarins in better yields when compared to reported procedures based on Platina^{2b} and Palladium^{2c} catalyzed hydroarylation of propiolates described recently and, in addition, is faster and less expensive.

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