

# NITROMETHANE CONJUGATE ADDITION TO 2-[(1E,3E)-4-ARYLBUTA-1,3-DIEN-1-YL]-4H-CHROMEN-4-ONES

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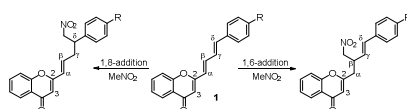
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## Introduction

Following previous work of our research group,<sup>1-3</sup> herein, the reactivity of the extended 3,2:α,β,γ,δ-triunsaturated system of chromones **1** in conjugate addition reactions with nitromethane was addressed. In comparison with 2-styrylchromones, the presence of a third unsaturation extends the π-conjugated system on chromones **1** and allows δ-position to become a novel site for nucleophilic attack (possible 1,8-conjugate addition) (Scheme 1). This feature enables the synthesis of multisubstituted heterocyclic derivatives with new stereocenters.

## Abstract

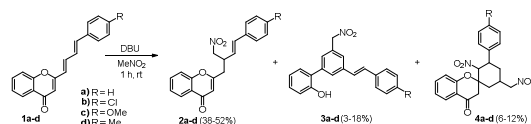
Conjugate addition reaction of nitromethane to the extended π-conjugated system of several chromone derivatives afforded the 1,6-conjugate addition products, together with structure complex oxygen heterocycles through tandem processes.



Scheme 1. Possible sites of conjugate addition to chromones **1**.

## Nitromethane conjugate additions

The DBU-catalyzed addition reaction of nitromethane, under neat conditions, to chromones **1** afforded the β-(nitromethyl)chromones **2** (1,6-conjugate addition) as major products (higher *R<sub>f</sub>*), together with (*E*)-5'-(nitromethyl)-3'-styryl-[1,1'-biphenyl]-2-ol and 3'-aryl-2'-nitro-5'-(nitromethyl)spiro[chromane-2,1'-cyclohexan]-4-one (lower *R<sub>f</sub>*) derivatives **3** and **4**, respectively, as minor products. These byproducts result from the addition of a second molecule of nitromethane, in tandem processes (Scheme 2). The structural elucidation of all compounds was accomplished by NMR (Figures 1-3).



Scheme 2. Nitromethane conjugate addition to chromones **1**.

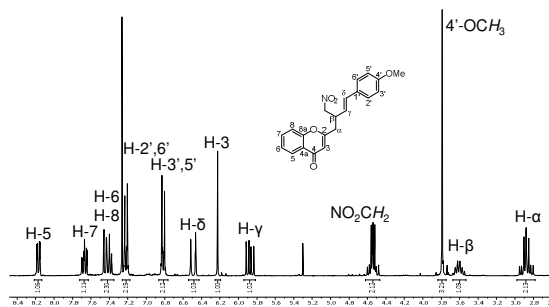
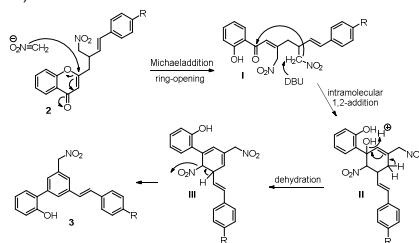


Figure 1. <sup>1</sup>H NMR spectrum of β-(nitromethyl)chromone **2c**.

The formation of derivatives **3** could be explained based on the Michael addition of a nitromethane anion to C-2 of β-(nitromethyl)chromones **2** along with chromone ring opening to give intermediates **I**. A DBU-catalyzed intramolecular 1,2-addition led to intermediates **II**, which upon dehydration affords intermediates **III**, that affords derivatives **3** after HNO<sub>2</sub> elimination (Scheme 3).



Scheme 3. Proposed mechanism towards the formation of compounds **3**.

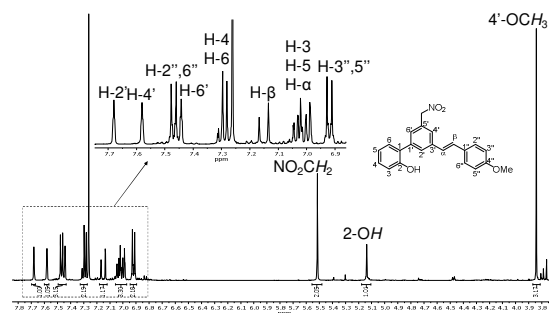
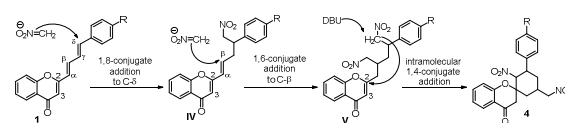


Figure 2. <sup>1</sup>H NMR spectrum of (*E*)-3'-(4-methoxystyryl)-5'-(nitromethyl)-[1,1'-biphenyl]-2-ol (**3c**).

The plausible mechanism for the formation of derivatives **4** involves the 1,8-conjugate addition of a nitromethane anion to C-δ of chromones **1**, affording intermediates **IV**. Then, the 1,6-conjugate addition of another nitromethane anion to C-β of **IV** gives intermediates **V**, which undergoes DBU-catalyzed intramolecular 1,4-conjugate addition to C-2 leading to the formation of the spiro trisubstituted cyclohexanes **4** (Scheme 4).



Scheme 4. Proposed mechanism towards the formation of compounds **4**.

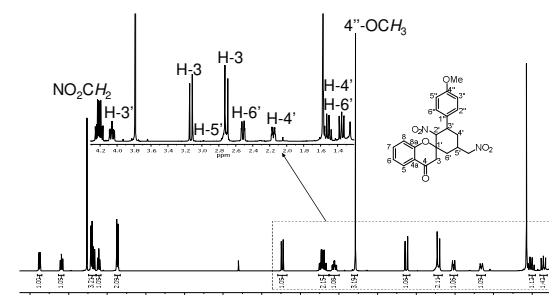


Figure 3. <sup>1</sup>H NMR spectrum of 3'-(4-methoxyphenyl)-2'-nitro-5'-(nitromethyl)spiro[chromane-2,1'-cyclohexan]-4-one (**4c**).

## Conclusion

The conjugate addition reaction of nitromethane to chromones **1** afforded β-(nitromethyl)chromones **2** as major products, as well as compounds **3** and **4** as minor ones, which are formed through tandem processes, due to the competition of 1,6 and 1,8 addition reactions.

## References

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