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A NEW ROUTE TO 1-PHENYLNAPHTHALENES BY CYCLOADDITION: A SIMPLE AND SELECTIVE SYNTHESIS OF SOME NAPHTHALENE LIGNAN LACTONES

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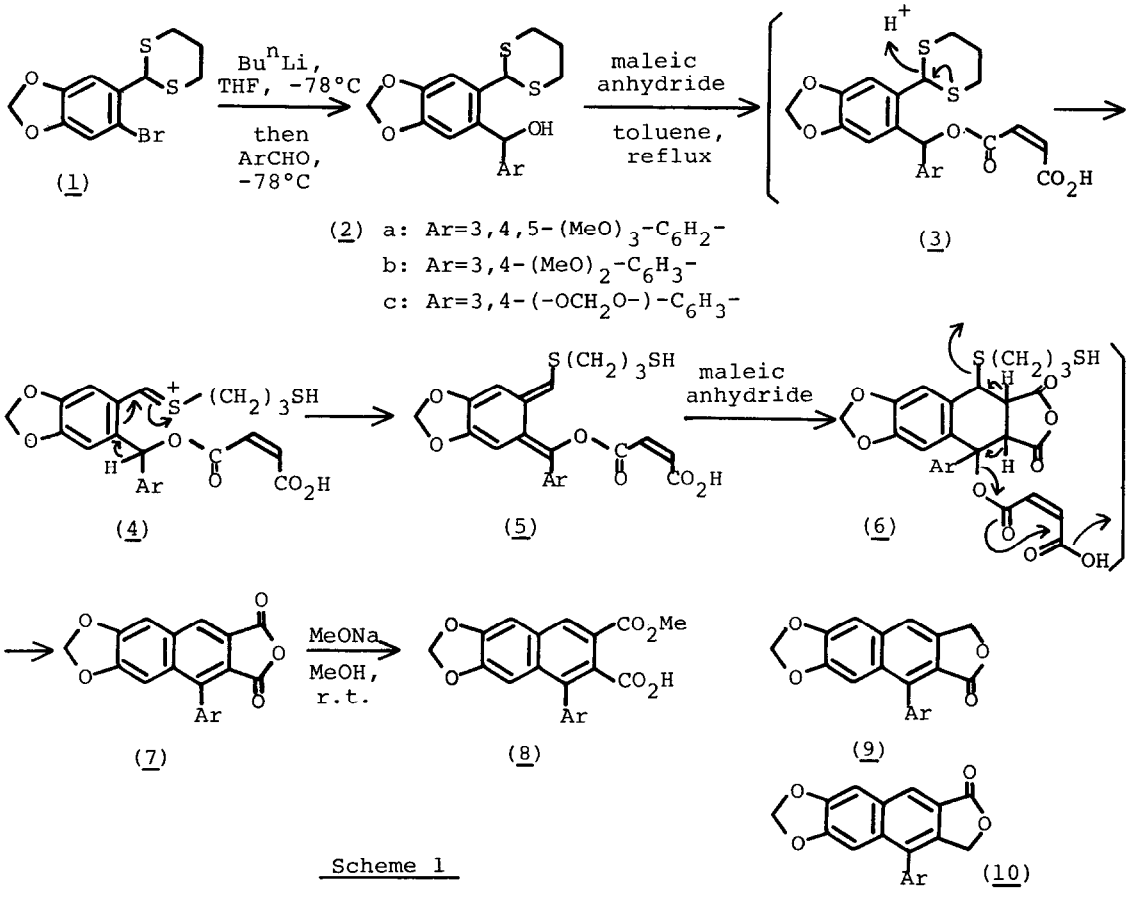
Abstract: 2-(2-Dithianyl)benzhydrols (2 a-c) undergo facile cycloaddition reaction with maleic anhydride under thermal conditions to give 1-phenylnaphthalenes (7 a-c) in one step. The naphthalenes (7 a-c) have been converted into the naphthalene lignan lactones, (9 a-c) and (10 a-c).

Annulation of a benzene derivative giving a naphthalene framework generally requires multi steps. We report here a new one-pot annulation method generating 4-phenylnaphthalene derivatives and their conversion into some



Scheme 1

compound	2	7	8	9	10
a	69.3% mp 208-209°C	38.7% mp 270-272°C	mp 292-295°C	79.8% from 7a mp 270-272°C (lit.[2] mp 271-272°C)	61.6% mp 283-284°C
b	71.2% mp 185-187°C	38.5% mp 271-273°C	mp 277-279°C	75.8% from 7b mp 227°C (lit.[3] mp 227°C)	49.5% mp 233-236°C (lit.[7] mp 234-236°C)
c	78.4% mp 74-75°C	23.9% mp 248-249°C	mp 221-223°C	76.1% from 7c mp 272-275°C (lit.[4] mp 276°C)	53.7% mp 270-272°C (lit.[8] mp 265-271°C)

naphthalene lignan lactones. The formation of 1-phenylnaphthalenes (7 a-c) could be simply carried out by treating 2-(2-dithianyl)benzhydrols (2 a-c), easily synthesized from the 2-bromo-(2-dithianyl)benzenes (1) by treating with n-butyllithium followed by the benzaldehydes, with five fold excess of maleic anhydride in boiling toluene for few hours (Table). We assume that the reaction involved the following five steps of sequence (Scheme 1): (i) acylation of (2) with maleic anhydride to give a half ester (3); (ii) protonation on dithian generating a sulfonium salt (4) and subsequent deprotonation to give an o-quinodimethane (5); (iii) cycloaddition of (5) with maleic anhydride to give a tetracyclic intermediate (6); (iv) double elimination of propane-1,3-dithiol and maleic acid moieties to generate a naphthalene (7).

The naphthalenes (7 a-c) thus obtained were treated with sodium methoxide in methanol at room temperature to give the corresponding half esters (8 a-c), selectively, which, on reduction with lithium triethylborohydride[1] followed by acid work-up yielded the corresponding lignan lactones, dehydroanhydropicropodophyllin (9a),[2] chinensin (9b),[3] and taiwanin C (9c),[4] respectively. On the other hand, reduction of the anhydrides (7 a-c) with sodium borohydride[5] yielded the corresponding lignan lactones, 5'-methoxyretrochinensin (10a),[6] retrochinensin (10b),[7] and justicidin E (10c),[3,8] after separation of the regio isomers, respectively. Since these types of the naphthalene lignans are known to exhibit potent piscicidal activity[8] and antitumor activity,[9] the present synthesis possesses significant value.

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