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A NEW SYNTHESIS OF 4,5-DIMETHOXYBENZOCYCLOBUTENE, 4,5-METHYLENEDIOXY-BENZOCYCLOBUTENE AND 4-METHOXYBENZOCYCLOBUTENE

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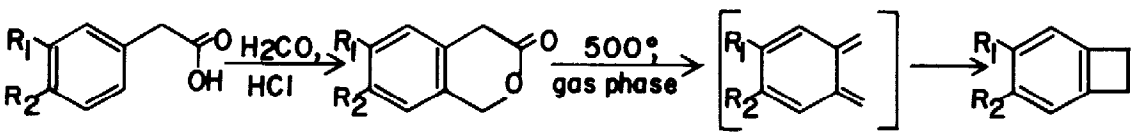
Benzocyclobutenes with oxygenated substituents on the aryl ring (e.g., 4) have recently been shown to be of considerable utility in the synthesis of berberines[1], spirobenzylisoquinolines[2], 3-arylisoquinolines[3], benzocarbazoles[4], yohimbines[5], tetracyclines[6], and in the first synthesis of chelidonine.[7] These syntheses utilize the Diels-Alder reactivity of dienes (e.g., 3) derived from benzocyclobutenes by electrocyclic ring opening. The Diels-Alder reactions of 3a, generated by thermolysis of 4a, have been considered in terms of frontier orbital theory[8] and ease of electrocyclic ring opening of benzocyclobutenes, including 4a and 4b, has been related to their ^{13}C-nmr chemical shifts.[9] A major limitation in the use of benzocyclobutenes such as 4 have been their synthesis.

We wish to report that benzocyclobutenes 4, containing oxygenated substituents on the aryl ring, can be efficiently prepared by the pyrolysis of isochromanones 2. Isochromanones 2 were sublimed in a stream of nitrogen (20 ml/min) at three torr over a coiled nichrome wire at 500° and the pyrolysate was collected in a cold trap at -78°. The crude pyrolysate was washed with base to remove unreacted 2 and was then purified by either vacuum distillation or recrystallization. In this way 4-methoxybenzocyclobutene (4a) was obtained in 70% yield, 4,5-dimethoxybenzocyclobutene (4b) in 40% yield, and the previously unreported 4,5-methylenedioxybenzocyclobutene (4c) in 90% yield. Isochromanones 2 were prepared by the reaction of phenylacetic acids 1 with formalin and concentrated hydrochloric acid in acetic acid.[10,11]



1 2 3 4

a, $R_1 = -OCH_3$; $R_2 = -H$

b, $R_1 = R_2 = -OCH_3$

c, $R_1, R_2 = -OCH_2O-$

The overall process provides a new and improved synthesis of benzocyclobutenes 4[12] as well as benzocyclobutene itself.[13] The method serves to compliment other recent syntheses[14], none of which readily lend themselves to the preparation of benzocyclobutenes with an oxygenated aryl ring.

References and Notes

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11. All new materials gave satisfactory elemental analyses and gave spectral data (ir, ^{1}H-nmr, ms) in accord with their structures.
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