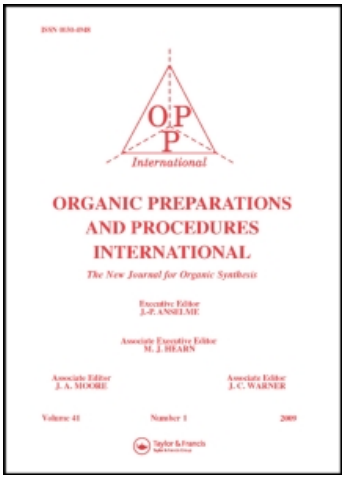

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A MODIFICATION OF THE PECHMANN REACTION

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A MODIFICATION OF THE PECHMANN REACTION

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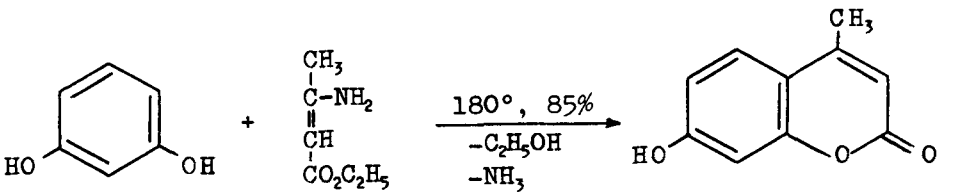
The condensation of ß-ketonic esters with phenols in the presence of concentrated sulfuric acid yields coumarin derivatives. Other condensing agents that have been used are $AlCl_3$, $POCl_3$, $ZnCl_2$, H_3PO_4, HCl, and P_2O_5. This reaction, which is commonly known as the Pechmann reaction [1], has found extensive application and has been used for the synthesis of several naturally occurring coumarins.

We have now found that enamine derivatives of ß-ketonic acids condense smoothly at elevated temperatures with phenolic compounds without any catalyst. Thus the condensation between resorcinol, the most frequently used phenolic compound in the Pechmann reaction, and ethyl ß-aminocrotonate takes place at about 180° yielding 7-hydroxy-4-methyl-coumarin.



We have used the present procedure successfully with a number of phenolic heterocycles[2], where the usual Pechmann conditions gave only very poor results.

Experimental

7-Hydroxy-4-methyl-coumarin (4-Methylumbelliferone)[3]

A mixture of 11.0 g. (0.1 mole) of resorcinol and 12.9 g. (0.1 mole) of ethyl ß-aminocrotonate was heated under nitrogen in an oil bath at 190° under a short (10 cm.) air condensor for 30 - 35 min.[4] Ethanol and ammonia were liberated during the first 20 - 25 min. The resulting oily reaction mixture crystallized when it was digested with dil. methanol. The yield was 15 g. (85%) of nearly pure coumarin, as shown by TLC. One recrystallization from ethanol yielded a product which melted at 185°, and did not depress the melting point of an authentic sample[3].

References

1. S. Sethna and R. Phadke, "The Pechmann Reaction" in Organic Reactions, Vol. 7, 1-58 (1953).

2. T. Kappe et al., unpublished results.
The heterocyclic compounds include: 4-hydroxy-coumarin, 4-hydroxy-α-pyrones, 4-hydroxy-α-pyridones, and 2-hydroxy-quinolizin-4-ones.

3. A. Russel an J. R. Frye, Organic Syntheses, Vol. 21, 22 (1941); Coll. Vol. III, 281 (1955).

4. With high melting heterocyclic compounds we have used successfully nitrobenzene as reaction medium.

(Received September 10, 1968)