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THE FACILE BENZYLATION OF AROMATIC NITRILES BY MEANS OF BENZYL ALCOHOL AND SODIUM

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C-Benzylation of acetophenone and related aromatic ketones leading to α-monobenzylated ketones by means of benzyl alcohol and potassium hydroxide has been reported[1] by one of us(S.M.) as an extension of the Sprinzak's C-benzylation of fluorene[2], pyridine and quinoline homologs[3]. This communication deals with the facile C-benzylation of phenylacetonitrile and its homologs by means of benzyl alcohol and sodium.

C-Benzylation of phenylacetonitrile(I,R=C_6H_5) was previously attempted by Sprinzak[4] by means of benzyl alcohol and potassium hydroxide but the product was α,β-diphenylpropionic acid which was yielded in 45% yield. Apparently hydrolysis of nitrile(I,R=C_6H_5) to acid and subsequent loss of the reactivity were inevitable under the Sprinzak's procedure conditions.

Therefore, in the present study, attention was directed to the protection of nitriles from hydrolysis. The method consists of heating a mixture of phenylacetonitrile(I,R=C_6H_5) and benzyl alcohol in the presence of sodium and benzyl acetate. α,β-Diphenylpropionitrile(II,R=C_6H_5) was obtained in 85.2% yield.

$$R\text{-}CH_2CN + C_6H_5CH_2OH \xrightarrow{Na,\ C_6H_5CH_2OAc} \underset{C_6H_5\text{-}CH_2}{R\text{-}CH\text{-}CN} + H_2O$$

I II

Use of equivalent amount of benzyl acetate proved to be essential since this ester is more readily hydrolyzed than nitrile. Actually, in the absence of benzyl acetate phenylacetic acid was formed as sodium salt and yields of the product (II) were automatically much lower.(average of two runs: 33%)

Yields of various benzylated nitriles are excellent with an exception of α-benzyl-o-chlorophenylacetonitrile(TABLE I) and this method apparently provides a facile benzylation of aromatic nitriles.

TABLE I α-Benzylated Nitrile[a] , $\underset{C_6H_5\text{-}CH_2}{R\text{-}CH\text{-}CN}$

R	M.p.	Yield,%[b]
Phenyl	57-58	85.2
o-Chlorophenyl	63-64.5[c]	39.0
p-Chlorophenyl	85-85.5[c]	82.6
1-Naphthyl	76-77	64.0
2-Naphthyl	96-97	75.5
2-Pyridyl	66-67[c]	84.0
2-Quinolyl	66-67[c]	54.3

a) All compounds were identified by elemental analyses,infrared spectra or comparison with the authentic specimens.

b) Yields are based on nitriles.

c) New compounds.

To our knowledge this work represents the first instance of benzyl alcohol and sodium being used in benzylation reactions. Studies on mechanism and extension of the reaction to a variety of active methylene compounds are under way. The following procedure is illustrative:

To a solution of sodium benzylate in benzyl alcohol prepared from sodium(1.5 g.) and benzyl alcohol(20 ml.) was added dropwise at 170° a mixture of phenylacetonitrile(5.9 g.) and benzyl acetate(10 g.). The resulting mixture was stirred and refluxed for 2 hours at 170-180° and poured into water. The resulting solution was extracted with ether, the ethereal layer dried over anhydrous potassium carbonate and distillation gave α,β-diphenylpropionitrile(8.8 g., 85.2%), b.p. 150-155°/14 mm., m.p. 57-58°.(from ethanol). IR ν_{max}^{KBr} cm^{-1} : 2227(C≡N)

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