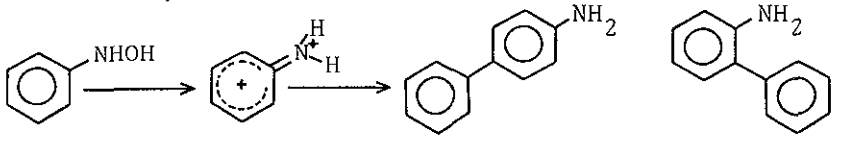
REACTION OF ARYLHYDROXAMIC ACIDS WITH BENZENE

Yasuyuki Endo, Toshiharu Ohta, Koichi Shudo, and Toshihiko Okamoto

Faculty of Pharmaceutical Sciences, University of Tokyo,
Hongo, Tokyo, Japan

Arylhydroxamic acids were reacted with benzene in the presence of trifluoromethanesulfonic acid to form aminobiphenyl derivatives. This reaction was applied to an intramolecular cyclization for the synthesis of dibenz(b,d)azepine and dibenz(b,d)azocine derivatives.

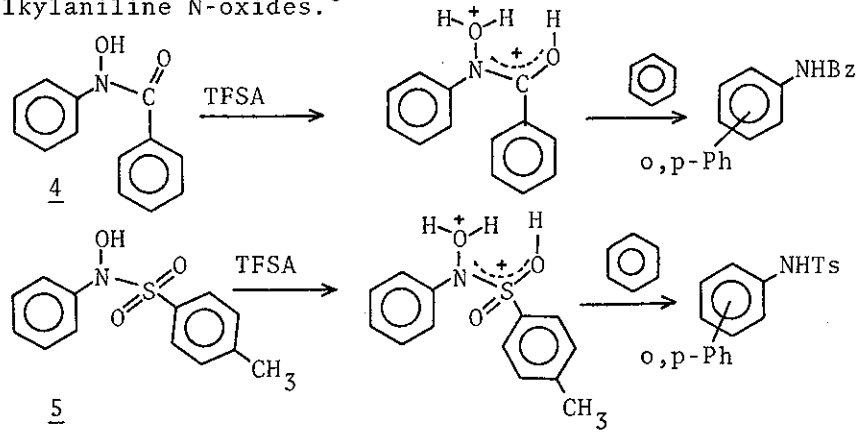
The reaction of N-phenylhydroxylamine[1,2](1) and related compounds[3,4] with benzene yields aminobiphenyls(3a and 3b) and their derivatives. The reaction may involve positively charged nitrogen atoms, probably protonated anilenium ions (immonium benzenium ions).[1,3]



1 2 3a 3b

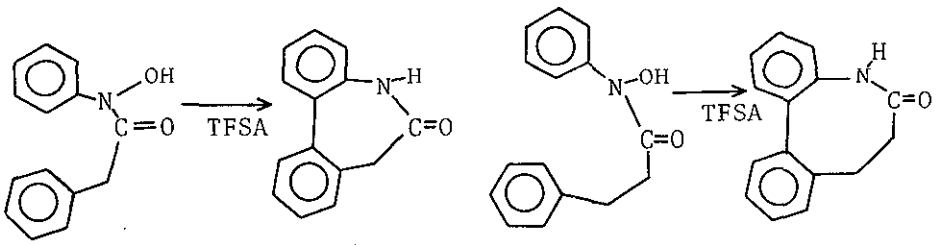
In this paper we wish to report a similar phenyl coupling reaction in arylhydroxamic acids.

N-Benzoyl-N-phenylhydroxylamine (4) in benzene was heated under reflux for 2 hr in the presence of 5-8 equiv. of trifluoromethanesulfonic acid (TFSA) and 10-20 equiv. of trifluoroacetic acid (TFA), and the products identified were N-benzoates of 2-aminobiphenyl and 4-aminobiphenyl in yields of 10 and 38 %, respectively. Similarly, in the presence of TFSA--TFA but at room temperature, N-p-toluenesulfonyl-N-phenylhydroxylamine (5) gave N-p-toluenesulfonates of 3a and 3b, in 25 and 36% yields, respectively. If the protonation on the nitrogen atom was important as in the case of the reaction of arylhydroxylamine, it was unexpected that the reaction conditions for (5) was much milder than for (4). It is, however, conceivable provided that the second protonation occurs not at the nitrogen atom but at the carbonyl or sulfonyl oxygen, and the sulfonyl oxygen is more easily protonated than the carbonyl oxygen.[5] Thus the following scheme is a very possible mechanism in accordance with the proposed mechanism for phenylation of arylhydroxylamines[1] and dialkylaniline N-oxides.[3]



Since arylhydroxamic acids are more stable than arylhydroxylamines and amine N-oxides, and are obtained easily, we have attempted an application to an intramolecular cyclization, which may be a useful synthetic tool for phenyl coupling reaction.

As anticipated, N-benzoylphenylhydroxylamine(4) in the presence of 30 equiv. of TFSA at 80° , gave only N-benzoyl-4-trifluoromethanesulfonyloxy-aniline in 81% yield. Heating N-phenacetyl-N-phenylhydroxylamine(6) in the presence of TFSA at 80° for 4hr, gave 5,7-dihydro-6H-dibenz(b,d)azepin-6-one(7), m.p. 232-233°, in 76% yield. The structure was identified by comparing its infrared spectrum with the authentic sample.[6,7] In the reaction methylene chloride can be used as the solvent. Similarly, N-phenylpropionyl-N-phenylhydroxylamine(8) gave 5,6,7,8-tetrahydrodibenz(b,d)azocin-6-one(9), m.p. 119-120° , in 41% yield. The structure of (9) was deduced from elemental analysis, mass; m/e 223(M^+), nmr (2.7-2.9δ,m,2H; 3.0-3.2δ,m,2H 6.4δ,m,1H; 7.0δ,m,2H; 7.25δ,m,3H; 7.5δ,m,2H), ir(C=O 1675cm^{-1}), and uv (λmax; 248nm, ε=11000).



6 7 8 9

The present reaction is simple and the yield is fairly good. We are trying to extend this reaction to more complex systems.

References.

1. T.Okamoto,K.Shudo and T.Ohta, J.Amer.Chem.Soc. 1975 , 97 , 7184
2. E.Bamberger, Ann. 1921 , 424 , 233,297
   J.H.Parish and M.C.Whiting, J.Chem.Soc. 1964 , 4713
3. K.Shudo,T.Ohta,Y.Endo and T.Okamoto, Tetrahedron Lett. 1977, 105
4. T.Ohta,K.Shudo and T.Okamoto, Tetrahedron Lett. 1977 , 101
5. R.J.Gillespie and T.Birchall, Can.J.Chem. 1963 , 41 , 148
6. R.F.C.Brown and M.Butcher, Tetrahedron Lett. 1971 , 667
7. M.J.S.Dewar,C.Kaneko and M.K.Bhattacharjee, J.Amer.Chem.Soc. 1962,84,4884

Received, 5th August, 1977