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MANUFACTURE OF SUBSTITUTED AMINOPHENOLS

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9 Claims. (Cl. 260—128)

This invention relates to an improved process for the manufacture of substituted aminophenols.

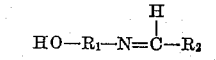
The ordinary method of obtaining mono-benzylated amines by the interaction of benzyl chloride and the amine is totally inapplicable in the case of aminophenols. As shown by Bakunin, Gazz. Chim. Ital., 36, II, 211 (1906), the aminophenols react so energetically with benzyl chloride that the dibenzyl compound is formed to a large extent. No method of control now known can prevent this reaction of the primary product. The product obtained by Bakunin, even by the use of a limited amount of benzyl chloride, consisted of a mixture of mono-benzyl aminophenol and dibenzyl aminophenol, with the latter predominating. It was thus necessary to purify the product and the operation is entirely impractical on a commercial scale.

A method for the production of p-benzyl amino phenol by the reduction of benzal p-aminophenols with zinc dust and sodium hydroxide is disclosed in German Patents 211,869 and 213,592 of 1909. This process is far more satisfactory than any other which has heretofore been employed, although the product contains oily impurities which are difficult to remove. In accordance with this patent, the reaction is caused to take place at ordinary room temperatures of 15 to 25° C. or higher, preferably being carried out at temperatures of 50 to 60° C. When the reaction is carried out at these temperatures, the crude product is quite impure and is difficult to purify. Also, the yield is objectionably low.

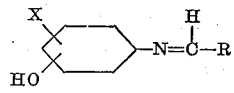
An object of this invention is to provide an improved process for the manufacture of substituted aromatic amino compounds. A further object is to provide a process whereby higher yields of a purer product than has been heretofore obtainable may be obtained. Other objects are to advance the art. Still other objects will appear hereinafter.

These objects may be accomplished according to the present invention which comprises the reduction of Schiff's bases of aromatic amines and particularly Schiff's bases of aminophenols with zinc dust and sodium hydroxide at temperatures not higher than 10° C. We have found that, if the reduction is carried out below 10° C., the crude product is solid and is much purer than may be obtained by any process which has been known heretofore. Much higher yields are obtained and the product may be readily purified by crystallization. Also, less time is required for the reaction to go to completion.

This process is applicable to all Schiff's bases of aromatic amines and particularly to Schiff's bases of aminophenols. The Schiff's bases of aminophenols have the general formula



wherein R_2 represents an alkyl, aralkyl or aryl group and R_1 represents an aryl nucleus such as phenyl or naphthyl, containing no reducible substituents. These compounds may also be termed N-alkylidene and N-aralkylidene amino phenols. The preferred compounds have the general formula:



wherein R represents an alkyl, aralkyl or aryl group devoid of reducible substituents and which may or may not have non-reducible substituents, X preferably represents any non-reducible substituent and in which the phenyl group is devoid of reducible substituents. Among the compounds which have been successfully treated in accordance with our invention are the following:

Benzal-p-amino phenol
Benzal-2-aminophenol
Benzal-3-aminophenol
Benzal-4-amino-2-methyl phenol
Benzal-4-amino-3-methyl phenol
4-methyl benzal-4'-amino phenol
Anisal-4-amino phenol
Salicylal-4-amino phenol
Furfural-4-amino phenol
Butyral-4-amino phenol
Heptal-4-amino phenol

In order to more clearly illustrate our invention, the preferred mode of carrying the same into effect, and the advantageous results to be obtained thereby, the following example is given:

Example

Fifty parts of benzol p-aminophenol and 29 parts of zinc dust were suspended in 200 parts of water and the mixture cooled to 0–5° C. The liquid was agitated vigorously and 105 parts of 30% sodium hydroxide added dropwise during 1½ hrs. After about four hours, the color of the reaction mass changed from a yellow green to gray. The mixture was stirred for another hour and then poured into 400 parts of approximately 15% hydrochloric acid. The acid solution was heated to boiling and filtered. Only solid metallic zinc was removed by this filtration and no hydrochloric acid insoluble oil was found.

The filtrate was neutralized with sodium carbonate solution and the solid p-benzyl aminophenol filtered off. It was recrystallized from about 150 parts toluene and there was thus obtained 41 parts of white crystals melting at 86.5–88° C., corresponding to a yield of 82% of theory. The melting point of the pure compound is 89° C.

When the above procedure was repeated with the exception that the temperature was maintained at 20–25° C., a considerable quantity of oily material was obtained in the filtration of the hydrochloric acid solution. The crystallization of the crude benzylaminophenol gave 26 parts of a product melting at 85–6° C., corresponding to a yield of 52%.

It is of course, not necessary that the reaction be carried out exactly as given in the example. Greater or smaller proportions of zinc dust, sodium hydroxide and water may be used without materially affecting the results. The zinc dust should be in a proportion equal to or greater than one gram atom per gram mole of the Schiff's base used and the sodium hydroxide should be in a proportion equal to or greater than two gram moles per mole of Schiff's base employed.

The procedure may be varied without departing from the spirit of the invention. For example, the zinc rust has been added in portions during the addition of the sodium hydroxide. Also, the benzal aminophenol and the zinc dust have been added in portions during the addition of the sodium hydroxide. In another variation, the sodium hydroxide was all introduced at the start and the benzal aminophenol and zinc added in portions during one hour. It is also possible to add all three reactants at the start. It is only essential that the temperature during the reduction be kept at or below 10° C. The process is also applicable to other compounds such as 4-benzal-amino-1-napthol, 7-benzal-amino-2-napthol and the N-alkylidene and aralkylidene derivatives of aminobenzene sulfonic acids, aminobenzene carboxylic acids and aminothiophenols.

It will thus be seen that this invention provides an easy and simple means of obtaining mono alkyl or aralkyl substituted aromatic amines and particularly the mono aralkyl aminophenols which were heretofore obtainable only with difficulty. The yields obtained by our method are considerably in excess of those obtained by earlier known methods and the products are obtained in a much purer state, simplifying the work of purification and reducing the losses incurred in purification.

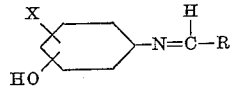
While we have disclosed a process employing certain reagents in specific amounts, it will be readily apparent to those skilled in the art that many variations may be made in the method, ingredients and proportions thereof employed without departing from the spirit of our invention. Accordingly, the scope of our invention is to be limited solely by the appended claims construed as broadly as is permissible in view of the prior art.

We claim:

1. The process which comprises reducing a Schiff's base of an aromatic amino compound of the benzene or naphthalene series by means of zinc and caustic alkali at temperatures below 10° C.

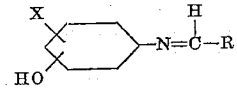
2. The process which comprises reducing a member of the group consisting of N-alkylidene and N-aralkylidene derivatives of aminophenols, aminosulfonic acids of the benzene series, aminocarboxylic acids of the benzene series and aminothiophenols by means of zinc and caustic alkali at temperatures below 10° C.

3. The process which comprises reducing a compound of the type:



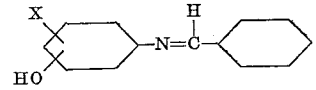
wherein R represents a member of the group consisting of alkyl, aralkyl and aryl groups devoid of reducible substituents and X represents a non-reducible substituent, by means of zinc and caustic alkali at temperatures below 10° C.

4. The process which comprises reducing a compound of the type:



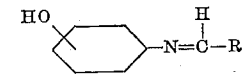
wherein R represents an aryl group devoid of reducible substituents and X represents a non-reducible substituent, by means of zinc and caustic alkali at temperatures below 10° C.

5. The process which comprises reducing a compound of the type:



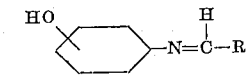
wherein X represents a non-reducible substituent, by means of zinc and caustic alkali at temperatures below 10° C.

6. The process which comprises reducing a compound of the type:



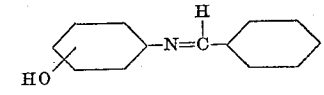
wherein R represents a member of the group consisting of alkyl, aralkyl and aryl groups devoid of reducible substituents, by means of zinc and caustic alkali at temperatures below 10° C.

7. The process which comprises reducing a compound of the type:



wherein R represents an aryl group devoid of reducible substituents, by means of zinc and caustic alkali at temperatures below 10° C.

8. The process which comprises reducing a compound of the type:



by means of zinc and caustic alkali at temperatures below 10° C.

9. The process which comprises reducing benzal p-aminophenol by means of zinc and caustic alkali at temperatures below 10° C.

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