

ELECTROSYNTHESIS OF AMPHETAMINE

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[Received: 1991 November; Revised 1992 June; Accepted: 1992 June]

Amphetamine is a central nervous system stimulant and also used in the treatment of obesity through suppression of appetite. In this paper, an electro-synthesis of amphetamine from phenylacetone oxime is reported.

Key words: Phenylacetone oxime, amphetamine, nickel black, palladium black

INTRODUCTION

1-phenyl - 2-aminopropane (amphetamine) is used as a medicinal agent for the treatment of obesity through suppressing appetite or resisting sleep [1]. It is chemically prepared by treating phenylacetone with formic acid and ammonia under Leuckart-Wallach conditions [2] or by reducing phenylacetone oxime [3]. In this paper, an electrochemical reduction of phenylacetone oxime is described. The possibility of synthesising primary amine from various aldoximes and ketoximes using deposited nickel black electrodes was established earlier [4–6]. In the present investigation, phenylacetone oxime is reduced over deposited nickel black and palladium black in aqueous alcoholic sulphuric acid or ammonium sulphate medium.

EXPERIMENTAL

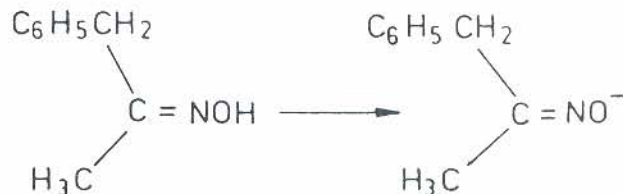
The synthesis of amphetamine was carried out in two stages starting from phenylacetone. The first step was the preparation of phenylacetone oxime by the condensation of phenylacetone and hydroxylamine hydrochloride in alkaline medium [7]. The second stage was the preparation of amphetamine by electroreduction of phenylacetone oxime.

The electrolysis of phenylacetone oxime was carried out in a one litre beaker. A deposit of nickel black or palladium black was used as the cathode and two pieces of lead plates were used as anodes. The anodes were placed in a ceramic porous cup which served as the anode compartment. The catholyte was alcohol–water mixture [1 : 1] containing either 5% ammonium sulphate or 5% aq. HCl in which the oxime was dissolved. The anolyte was 10% aqueous sulphuric acid. The temperature of the cell was maintained around 298K. The pH of the electrolyte was maintained around 8.5 by adding ammonia in the case of ammonium sulphate electrolyte. The electrolyte was stirred by a glass stirrer. The current density employed for the electrolysis was around 5 amp/dm⁻² and the cell voltage around 12V. After the reaction was over, the solution was distilled to remove the alcohol. Any unreacted starting material was extracted with ether. The remaining solution was basified with sodium hydroxide and the liberated amine was distilled out at its boiling point of 473K–476K.

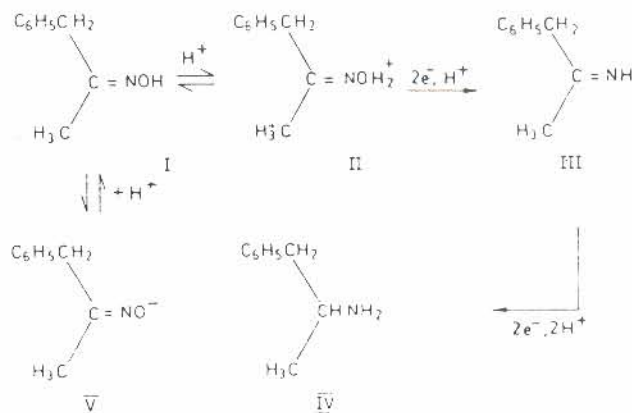
RESULTS AND DISCUSSIONS

In the present study, the reduction was carried out with nickel black and palladium black cathodes in both acidic and ammonical conditions. In acidic medium, both nickel black and palladium black reduced phenylacetone oxime to amphetamine. The yield

of amphetamine was 30% with the palladium black cathode and 8–10% with the nickel black cathode. However, in basic medium, phenylacetone oxime could not be reduced with nickel black or palladium black cathodes. This may be due to conversion of the oxime to the conjugate base.



It has been shown that the reduction of the oxime group at the DME consumes four electrons, the reduction product being the corresponding amine [8–11]. The imine is the likely intermediate in oxime reduction to the amine [11]. Based on this, the following mechanism may be assumed:



Under acidic conditions the rate of protonation of phenylacetone oxime is high and proceeds from I and IV. Under basic conditions, the rate of conversion of I to IV is high and hence no reduction of phenylacetone oxime takes place.

Moreover, the concentration of adsorbed hydrogen is very high in palladium black cathode as compared to that in nickel black cathode; hence the product yield is higher with palladium black than with nickel black.

CONCLUSION

The reduction of phenylacetone oxime is feasible on palladium black cathode in aqueous alcoholic acidic medium in a divided cell. However, a surface analytical study of deposits of group VIII metals may provide more information on the reduction of oximes in general and of phenylacetone oxime in particular.

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