

# On the Electrolytic Reduction of 3*n*-Phenyl-4-ketodihydroquinazoline

By

Hidemaru Itomi

(Received June 16, 1930)

---

Recently G. Kawada and T. Kon<sup>1</sup> stated, in their communication with regard to the preparation of orexine, that 3*n*-phenyl-4-ketodihydroquinazoline can be electrochemically reduced to the corresponding 4-ketotetrahydroquinazoline and tetrahydroquinazoline only with great difficulty. Now the difficulty with which the above-mentioned ketodihydroquinazoline is reduced was thought by Prof. M. Matsui not very hard to overcome, and he suggested that I should take up the problem with the object of investigating how the electrolytic reduction of 3*n*-phenyl-4-ketodihydroquinazoline really takes place.

The 3*n*-phenyl-4-ketodihydroquinazoline used in the experiments was prepared according to the method of Kawada and Kon and obtained as shining scaly crystals melting at 137°—138°.

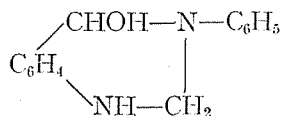
Experiment 1.—For electrolysis a solution consisting of 5 grams of the quinazoline, 50 c.c. of 50% sodium carbonate solution and 200 c.c. of alcohol was taken as the catholyte, and an electric current of 1 ampere was passed for 4 hours at 25°. As the cathode, a lead plate 133 sq. cm. in area was taken, and a current of carbon dioxide was always passed into the cathode chamber during the electrolysis. When the electrolysis was over, the cathode solution, now greenish in colour was evaporated to drive off the alcohol and cooled, whereupon a lot of crystals separated out. The crystalline substance was treated with hot ligroin to dissolve out the original substance and the residue was recrystallized from dilute alcohol. Scaly crystals green in

---

1. Bulletin of the Imperial Hygienic Laboratories 35, 131 (1929)

colour and melting at  $170^{\circ}$ — $171^{\circ}$  were obtained with a yield of 40%. They were easily soluble in alcohol and acetic acid and with difficulty in ether and benzene. The results of analysis and molecular weight determination were as follows: 0.0895 gm. substance gave 0.2424 gm.  $\text{CO}_2$  + 0.0498 gm.  $\text{H}_2\text{O}$ ; C=73.5%, H=6.2% (Calc. for  $\text{C}_{11}\text{H}_{11}\text{ON}_2$ , C=74.0%, H=6.2%). 0.1898 gm. substance dissolved in 16.26 gm. of absolute alcohol elevated the boiling point of alcohol by  $0.06^{\circ}$ . Mol. wt. = 201 (calc. 226)

The substance easily formed an acetyl derivative crystallizing in leaflets and did not combine with bromine. Thus it was confirmed to be 3-n-phenyl-4-oxytetrahydroquinazoline.



Experiment 2.—A similar experiment was conducted, sodium acetate being substituted for sodium carbonate, and a small quantity of acetic acid was added to the cathode solution from time to time to neutralize free alkali. The catholyte became coloured pink after electrolysis, but gave no definite reduction product except some brown resinous matter.

Experiment 3.—Electrolysis in the sodium carbonate solution containing 3 grams of the quinazoline, 50 c.c. of 10% sodium carbonate solution and 200 c.c. of alcohol was again carried out with a platinum plate of 50 sq. cm. as the cathode. The temperature was maintained at  $50^{\circ}$ — $60^{\circ}$  and an electric current of 1.5 amperes was passed for 5 hours, a current of carbon dioxide being constantly passed into the cathode solution. After the electrolysis, the cathode solution was filtered and left to stand, when a substance crystallizing in needles separated out. It melted at  $118^{\circ}$ — $119^{\circ}$  and was found to dissolve in alcohol, ligroin, ether and benzene.

It was also soluble in acids, with which it combined so as to form a salt. The results of analysis were as follows: 0.1090 gm. substance gave 0.3194 gm.  $\text{CO}_2$  + 0.0649 gm.  $\text{H}_2\text{O}$ ; C=79.95%, H=6.67% (Calc. for  $\text{C}_{11}\text{H}_{11}\text{N}_2$ , C=80.00%, H=6.66%).

The yield was calculated to be 66%.

A copper plate covered with platinum black was found to act as a very effective cathode. In an experiment conducted with such an

electrode under conditions exactly similar to those described above, the yield of 3-n-phenyl-tetrahydroquinazoline was raised to 72%.

Experiment 4.—Electrolysis in a sodium acetate solution was again undertaken with platinum as the electrode. The catholyte consisted of 3 grams of the quinazoline, 30 c.c. of 10% sodium acetate solution and 200 c.c. of alcohol. An electric current of 0.7 ampere was passed at 30° for 5 hours. In this case the cathode solution became coloured green, and 3-n-phenyl-4-oxytetrahydroquinazoline melting at 170°—171° was produced with a yield of 30%. At higher temperatures the reduction was observed to proceed further. In an experiment conducted at 50°—60° by passing an electric current of 1 ampere for 6 hours 3-n-phenyltetrahydroquinazoline was produced with a yield of 30% together with 3-n-phenyl-4-oxytetrahydroquinazoline, the yield of which was calculated to be 17%.

Experiment 5.—To see whether the 4-oxycompound also undergoes electrolytic reduction in the same way, it was subjected to electrolysis under conditions similar to those used in experiment 3, but no 3-n-phenyltetrahydroquinazoline was produced.

### Summary

1. Electrolytic reduction of 3-n-phenyl-4-ketodihydroquinazoline was studied, slightly alkaline solutions being used as the catholyte.
2. For complete reduction a platinum cathode was found most effective, especially when it was used in the form of platinum black.
3. By using a lead cathode in a sodium carbonate solution 3-n-phenyl-4-oxytetrahydroquinazoline was obtained as the intermediate reduction product.
4. Addition of hydrogen to the double bond between carbon and nitrogen was observed to take place most easily.

The writer takes this opportunity warmly to thank Professor Motooki Matsui at whose suggestion and under whose kind guidance the work was conducted.

---