4-Acetylaminofluorene-N^{15}[1]

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4-Acetylaminofluorene, an isomer of the carcinogenic 2-acetylaminofluorene,[3] has been prepared from 2,5-dinitrofluorene[4] and from 4-nitrophenanthraquinone.[5]

Although the main purpose of our research was to prepare the N^{15} compound for eventual metabolic study the procedure can be used for an alternative simple preparation of 4-acetylaminofluorene.

EXPERIMENTAL[6]

Diphenic acid. This acid can be prepared from anthranilic acid[7] but as pure phenanthrene[8] was on hand, it was prepared by a procedure which offers the following two advantages: (1) simplicity of operation and (2) faster preparation of large quantities of pure acid. To a warm stirred solution of 126 g. of *pure* phenanthrene in 1 liter of acetic acid was added 950 ml. of 30% hydrogen peroxide. The temperature was kept at 90–95° for 1–2 hours. Then 200 ml. of acetic anhydride was added (exothermic reaction). The temperature was kept at 90–95° for 3–5 more hours. The mixture was cooled with an ice-salt bath and filtered. Solution of the crystals in aqueous sodium carbonate, followed by filtration and treatment of the cold filtrate with a slight excess of hydrochloric acid gave 95 g. (55%) of white crystals, m.p. 229–232°. Lit. m.p. 226–228°.[7]

4-Carbamylfluorene-N^{15}. The diphenic acid was cyclized with sulfuric acid to 4-fluorenonecarboxylic acid, m.p. 223–224°.[9] The fluorenone was reduced with hydrazine and sodium hydroxide in ethylene glycol solution by the standard procedure to 4-fluorenecarboxylic acid in 65% yield and m.p. 190–191° (toluene). Lit. m.p. 191–192°.[10] Treatment of the latter acid with thionyl chloride formed the 4-fluorenecarbonyl chloride in 95% yield and m.p. 75–76° (hexane). Lit. m.p. 75°.[11]

To a solution of 0.81 g. of ammonium nitrate (containing 64 atoms-% N^{15} as $N^{15}H_4$) in 10 ml. of anhydrous dimethylformamide was added 5 ml. of triethylamine. The flask containing the mixture was stoppered and cooled in an ice-salt bath with frequent shaking for 5–10 minutes. Then a solution of 2.52 g. of 4-fluorenecarbonyl chloride in 10 ml. of dimethylformamide was quickly added. Again the flask was stoppered, cooled, and shaken vigorously for 15 minutes. The mixture was allowed to come to room temperature with occasional shaking over 30 minutes. The addition of 100 ml. of 5% aqueous sodium hydroxide caused an immediate precipitation of product; 1.8 g., (86%), m.p. 216–218°. A small amount, when crystallized from alcohol, yielded colorless needles, m.p. 218–220°. Lit. m.p. 215–216°.[11]

For the preparation of base material in 90–95% yield, an acetone solution of the carbonyl chloride was added to excess, cold, concentrated ammonia (*d.* 0.9).[11] From this amide, base 4-acetylaminofluorene can be obtained readily.

Methyl N-4-fluorenyl carbamate-N^{15}. A hot solution of 1.2 g. of 4-carbamylfluorene-N^{15} in 60 ml. of methanol was added to a cold stirred solution of 1.6 g. of sodium in 100 ml. of methanol. To the cold mixture 0.64 ml. of bromine was added dropwise. The liquid was refluxed for 20 minutes, evaporated to $^2/_3$ volume and poured into 800 ml. of water. Filtration gave 1.25 g. (91%) of colorless crystals, m.p. 121–123°. A small amount, when crystallized from hexane, gave colorless needles, m.p. 124–125°.

Anal. Calc'd for $C_{15}H_{13}N^{15}O$: C, 75.0; H, 5.4. Found: C, 75.3; H, 5.4.

4-Aminofluorene-N^{15}. To a refluxing solution of 1.2 g. of methyl N-4-fluorenyl carbamate-N^{15} in 10 ml. of 95% ethanol was added dropwise a solution of 5.6 g. of potassium hydroxide in 20 ml. of water. The mixture was refluxed for 30 minutes and 30 ml. of water was added. Cooling followed by filtration gave 0.87 g. (96%) of colorless needles, m.p. 112–114°. A small amount, when crystallized from hexane, gave a melting point of 115–116°. Lit. m.p. 115–116°,[4] 116–117°.[5]

4-Acetylaminofluorene-N^{15}. A solution of the amine in benzene was acetylated with acetic anhydride.[4] A 90–95% yield of colorless needles, m.p. 197.5–198°, was obtained. Crystallization from heptane-benzene gave an 85–90% yield of long fan-shaped masses of fine needles, m.p. 200–201°. Lit. m.p. 200–201°,[4] 204–205°.[5]

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Quinoxaline Studies. VIII. Decahydroquinoxaline[1]

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Mousseron and Combes[2] reported the preparation of 2,3-tetramethylenepiperazine by ammonolysis of 2-(β-chloroethylamino)cyclohexyl chloride. Unfortunately they reported no physical properties for the substance, but only the m.p. of a nitroso derivative. Beck, Hamlin, and Weston[3] prepared decahydroquinoxaline by a ring closure of 2-(β-aminoethylamino)cyclohexanol.

The purpose of this paper is to report the synthesis of decahydroquinoxaline by the stepwise reduction of quinoxaline to tetrahydroquinoxaline and thence to decahydroquinoxaline.

Negative results were obtained when quinox-

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