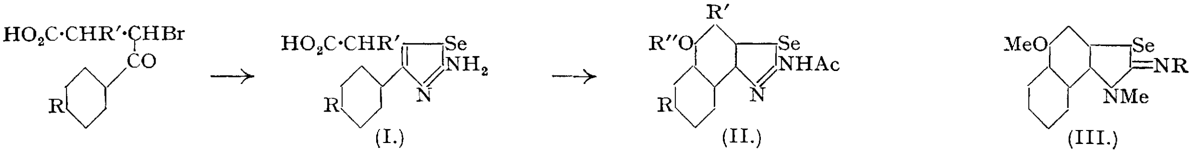
NOTES.

Naphtha-1′ : 2′ : 4 : 5-selenazoles. By Edward B. Knott.

The author (this vol., p. 455) has described the condensation of thiourea with β-bromo-β-aroylpropionic acids and β-bromo-β-benzoyl*iso*butyric acid, the resulting 2-amino-4-phenylthiazole derivatives being cyclised to derivatives of 4′-hydroxynaphtha-1′ : 2′ : 4 : 5-thiazole. These syntheses have now been applied to the selenazole series.



Selenourea condensed smoothly with β-bromo-β-benzoylpropionic acid, the 4-methyl derivative, and β-bromo-β-benzoyl*iso*butyric acid in the presence of sodium carbonate to yield *2-amino-4-phenylselenazole-5-acetic acid* (I; R, R′ = H), the *4′-methyl* homologue (I; R = Me; R′ = H), and *α-5-(2-amino-4-phenylselenazole)propionic acid* (I; R = H; R′ = Me). All three acids were readily cyclised with acetic anhydride, giving *2-acetamido-4′-acetoxynaphtha-1′ : 2′ : 4 : 5-selenazole* (II; R, R′ = H, R″ = Ac) and the 6′- and *3′-methyl* homologues (II; R = Me, R′ = H, R″ = Ac, and R = H, R′ = Me, R″ = Ac). Hydrolysis of (II; R, R′ = H; R″ = Ac) in warm aqueous sodium hydroxide yielded *2-acetamido-4′-hydroxynaphtha-1′ : 2′ : 4 : 5-selenazole* (II; R, R, R″ = H), isolated as its *dihydrochloride*. The aminophenol obtained by more energetic hydrolysis was easily oxidised on contact with air and readily reduced aqueous silver nitrate. Methylation of (II; R, R′, R″ = H) yielded two products which, by analogy with the results of Hunter and Jones (J., 1930, 2199, etc.), are probably *2-imino-4′-methoxy-3-methyl-2 : 3-dihydronaphtha-1′ : 2′ : 4 : 5-selenazole* (III; R = H) and its *acetyl* derivative (III; R = Ac).

Experimental.—(Microanalyses are by Drs. Weiler and Strauss, Oxford. M. p.'s are not corrected.) *2-Amino-4-phenylselenazole-5-acetic Acid.*—Selenourea (2·46 g., 0·02 mol.) was dissolved by refluxing in alcohol (20 c.c.); β-bromo-β-benzoylpropionic acid (5·14 g.; 0·02 mol.) was added, and the mixture boiled for 10 minutes. Anhydrous sodium carbonate (3·0 g.) was added, and the heating continued for 5 minutes; carbon dioxide evolution had then ceased, and a mass of crystals had separated. Water (50 c.c.) was added to dissolve these. The solution was then filtered from a little selenium and neutralised with dilute acetic acid. The bulky pink precipitate recrystallised from aqueous alcohol, in which it is sparingly soluble, forming glistening needles, which commenced to decompose at 196° and had m. p. 253° (95% yield) (Found: C, 46·9; H. 3·5; N, 9·85. $C_{11}H_{10}O_2N_2Se$ requires C, 47·0; H, 3·55; N, 9·95%).

4′-Methyl derivative. This formed buff plates from aqueous alcohol, m. p. 246 (decomp.), in 91% yield (Found: N, 9·45. $C_{12}H_{12}O_2N_2Se$ requires N, 9·5%).

α-5-(2-Amino-4-phenylselenazole)propionic Acid.—By proceeding as for the above, the *acid* was obtained in 87% yield as colourless crystals from aqueous *iso*propyl alcohol, m. p. 250° (decomp.) (Found: N, 9·4. $C_{12}H_{12}O_2N_2Se$ requires N, 9·5%).

2-Acetamido-4′-acetoxynaphtha-1′ : 2′ : 4 : 5-selenazole.—(I; R, R′ = H) (2 g.), anhydrous sodium acetate (0·5 g.), and acetic anhydride (10 c.c.) were refluxed for 2 hours, causing partial precipitation of the product. The anhydride was decomposed with water, and the orange grains washed with methyl alcohol, leaving a yellow solid which was crystallised from alcohol (300 c.c.). It formed glistening lemon plates (85% yield), which began to decompose at 260° and had m. p. 290° (Found: N, 7·9. $C_{15}H_{12}O_3N_2Se$ requires N, 8·0%).

2-Acetamido-4′-acetoxy-6′-methylnaphtha-1′ : 2′ : 4 : 5-selenazole, obtained in a similar way from (I; R = Me; R′ = H), formed buff plates from alcohol, m. p. 295° (Found: N, 7·8. $C_{16}H_{14}O_3N_2Se$ requires N, 7·75%).

2-Acetamido-4′-acetoxy-3′-methylnaphtha-1′ : 2′ : 4 : 5-selenazole was prepared similarly from (I; R = H; R′ = Me), but 10 minutes' refluxing sufficed for complete reaction. From acetic anhydride, it formed glistening pink plates, m. p. 292—294° (Found: N, 7·65. $C_{16}H_{14}O_3N_2S$ requires N, 7·75%).

Hydrolysis of (II; R, R′ = H; R″ = Ac).—(*a*) The cyclisation product (2 g.) was dissolved by gentle warming in N-aqueous-alcoholic sodium hydroxide and acidified. The free naphthol could not be obtained crystalline, but on dissolving it in alcohol and adding concentrated hydrochloric acid, pink needles of *2-acetamido-4′-hydroxynaphtha-1′ : 2′ : 4 : 5-selenazole dihydrochloride* separated, which decomposed above 300° (Found: N, 7·4; Cl, 17·6. $C_{13}H_{12}O_2N_2Cl_2Se$ requires N, 7·4; Cl, 17·9%).

(*b*) The naphthaselenazole was refluxed for 1 hour with 2N-aqueous sodium hydroxide (5 mols.) in an equal volume of alcohol. The liquor was concentrated, and neutralised with acetic acid, giving a yellow solid which darkened on exposure to air. It could not be crystallised. It reduces aqueous silver nitrate readily and is probably 2-amino-4′-hydroxynaphtha-1′ : 2′ : 4 : 5-selenazole.

Methylation of (II; R, R′, R″ = H). To a suspension of (II; R, R′ = H; R″ = Ac) (5 g.) in alcohol (100 c.c.), an excess of 2N-sodium hydroxide (200 c.c.) was added, and the mixture shaken until the solid dissolved. The solution was warmed to 50°, and methyl sulphate added in 2-c.c. portions until precipitation was complete. The solid, washed with aqueous sodium hydroxide and water, was dissolved in hot alcohol and allowed to cool. Colourless threads separated (1·1 g.) (m. p. 246° after one further crystallisation) of what is probably *2-acetimido-4′-methoxy-3-methyl-2 : 3-dihydronaphtha-1′ : 2′ : 4 : 5-selenazole* (III; R = Ac) (Found: N, 8·5. $C_{15}H_{14}O_2N_2Se$ requires N, 8·3%). The alcoholic filtrate from the first recrystallisation gave a buff solid on concentration (2·9 g.). From benzene then methanol it formed small, colourless, silky needles, m. p. 202°, and was probably *2-imino-4′-methoxy-3-methyl-2 : 3-dihydronaphtha-1′ : 2′ : 4 : 5-selenazole* (III; R = H) (Found: N, 9·5. $C_{13}H_{12}ON_2Se$ requires N, 9·6%). When these crystals were covered with dilute hydrochloric acid, they turned to an oil which dissolved on shaking.—RESEARCH LABORATORIES, KODAK LTD., WEALDSTONE, MIDDLESEX. [*Received, April 11th*, 1945.]

The Nitration of 3-Acetamidoacetophenone. By WILLIAM A. WATERS.

STUDIES of the nitration of *m*-substituted aromatic amines have been few, and there are not many recorded instances of the isolation and characterisation of all three possible *o*- and *p*-substituted nitro-amines. In the case of 3-acetamidoacetophenone it has been possible to effect the separation of the three possible nitro-*m*-amino-ketones and to characterise each by conversion into previously known substances.

4-Nitro-3-aminoacetophenone crystallises in red plates, m. p. 163°; it was characterised by deamination to 4-nitroacetophenone. *6-Nitro-3-aminoacetophenone* is bright yellow (m. p. 150°), and the *2-nitro*-isomer orange-brown; these two bases were characterised by conversion into chloro-nitro-acetophenones, which on oxidation with sodium hypobromite or with alkaline permanganate gave known chloronitrobenzoic acids.

3-Acetamidoacetophenone was prepared from acetophenone by nitration according to Evans, Watson, and Morgan (J., 1935, 1172), reduction of the pure *m*-nitro-compound with iron chippings (compare Morgan and Moss, *J. Soc. Chem. Ind.*, 1923, **42**, 461 T), and then acetylation.

Nitration was carried out by adding powdered 3-acetamidoacetophenone (20 g.) slowly to a stirred mixture of fuming nitric acid (20 c.c.; *d* 1·5) and acetic anhydride (40 c.c.) kept at 5—10°. The stirring was continued for 10 minutes after all the material had dissolved, and the product was then isolated by pouring on ice, filtering it off, and washing it with dilute sodium carbonate solution. Decomposition set in if the temperature of the reaction mixture rose above +15°. The product was dissolved in 1 l. of boiling water, filtered, and allowed to cool slowly. Long needles of 2 *nitro-3-acetamidoacetophenone* separated first, but later the solution became cloudy and a mixture of other isomers was also deposited. By reheating and filtering it whilst still warm, the 2-nitro-isomer could be separated (*ca.* 6 g.). After crystallisation from dilute alcohol it formed long pale yellow needles, m. p. 165° (Found: C, 54·2; H, 5·1; N, 13·1. $C_{10}H_{10}O_4N_2$ requires C, 54·05; H, 4·5; N, 12·6%).

2-Nitro-3-aminoacetophenone, obtained by hydrolysis with alcoholic sulphuric acid, crystallised from dilute methyl alcohol in orange-brown needles, m. p. 92° (Found: C, 53·1; H, 4·8; N, 15·3. $C_8H_8O_3N_2$ requires C, 53·3; H, 4·5; N, 15·6%), and its *benzoyl* derivative crystallised from ethyl alcohol in needles, m. p. 128° (Found: C, 63·5; H, 4·4; N, 10·1. $C_{15}H_{12}O_4N_2$ requires C, 63·4; H, 4·3; N, 9·9%).

2-Nitro-3-aminoacetophenone was converted by the Sandmeyer reaction into *3-chloro-2-nitroacetophenone*, which, from alcohol, formed pale orange plates, m. p. 97° (Found: C, 48·1; H, 3·1. $C_8H_6O_3NCl$ requires C, 48·1; H, 3·0%); on oxidation with sodium hypobromite, or with alkaline permanganate, this gave 3-chloro-2-nitrobenzoic acid, m. p. 235° (Beilstein gives 235°) (Found: equiv., 202. Calc.: 201·5).

Separation of the more soluble isomers of 2-nitro-3-acetamidoacetophenone could not be effected easily by crystallisation, but by extraction of the aqueous mother-liquors with chloroform, evaporation, and subsequent hydrolysis there was obtained a mixture of bases from which *4-nitro-3-aminoacetophenone* (*ca.* 6 g.) was isolated. This crystallised from methyl alcohol in bright red plates, m. p. 163° (Found: C, 53·8; H, 4·7; N, 15·7%); its *acetyl* derivative formed short bright yellow needles, m. p. 121° (Found: C, 54·3; H, 4·8; N, 12·7%), and its *benzoyl* derivative, orange needles, m. p. 125° (Found: C, 63·4; H, 4·3%).

4-Nitro-3-aminoacetophenone was characterised by deamination (by diazotisation in alcohol) and isolation of 4-nitroacetophenone, m. p., and mixed m. p. with an authentic specimen, 80—81°.

Mother-liquors from the crystallisation of 4-nitro-3-aminoacetophenone deposited a small quantity of bright yellow needles, which, after repeated crystallisation from dilute methyl alcohol had m. p. 150° and consisted of *6-nitro-3-aminoacetophenone* (Found: C, 53·3; H, 4·8; N, 15·2%). This crystallised well from dilute acetic acid. Its *acetyl* derivative formed short fine needles, m. p. 150° (Found: C, 54·0; H, 4·7; N, 12·8%). The amine was characterised by conversion, by the Sandmeyer reaction, into *3-chloro-6-nitroacetophenone*, which crystallised from dilute methyl alcohol in pale yellow needles, m. p. 62° (Found: C, 48·3; H, 3·3%); this on oxidation with sodium hypobromite gave 3-chloro-6-nitrobenzoic acid, m. p. 137—138° (Beilstein gives 137°, 139°).

Further quantities of 6-nitro- and of 4-nitro-3-aminoacetophenone could be separated by hydrolysis of the middle fractions of the acetyl derivatives and subsequent repeated crystallisation, but a complete separation of the whole of the nitration mixture into pure substances was not effected.—UNIVERSITY SCIENCE LABORATORIES, DURHAM. [*Received, May 16th*, 1945.]