

AGRICULTURAL FUNGICIDES

IV.* PREPARATION OF 2- AND 4-iodo-3,5-DINITROBENZOATES

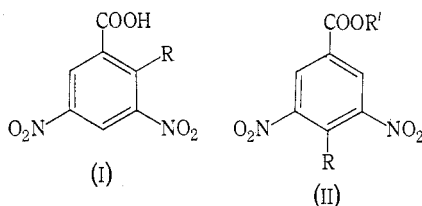
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Aromatic compounds containing a halogen or thiocyanato substituent activated by the presence of nitro groups in *ortho* and *para* positions are well known to be fungitoxic.¹ In connection with our study² of the comparative effectiveness of halogen and thiocyanato groups as fungal toxiphores in dinitrobenzenes we required esters of 2- and 4-iodo-3,5-dinitrobenzoic acids for biological testing. We now report their preparation.

There are three obvious routes to these acids, namely, di-nitration of *o*- and *p*-iodobenzoic acids, replacement of the chlorine atom by iodine in the corresponding chlorodinitrobenzoic acids, and diazotization of the appropriate amine followed by a Sandmeyer-type reaction. Preliminary experiments indicated that *o*- and *p*-iodobenzoic acids were not as readily converted into their 3,5-dinitro derivatives by nitration as the corresponding chlorobenzoic acids,³ and attempts to replace the chlorine group of 2-chloro-3,5-dinitrobenzoic acid by iodine using alkali iodide have not been successful⁴ (cf.⁵). We therefore chose the last method, which has proved successful for the preparation of 2- and 4-thiocyanato-3,5-dinitrobenzoates.⁶

2-Amino-3,5-dinitrobenzoic acid was diazotized in concentrated sulphuric acid and the diazonium solution was allowed to react with potassium iodide in aqueous acetic acid. By this means, 2-iodo-3,5-dinitrobenzoic acid (I; R = I) was obtained in good yield. An earlier study⁴ of this reaction gave an impure product. 2-Iodo-3,5-dinitrobenzoic acid was converted into its methyl and ethyl esters by acid-catalysed esterification. 4-Iodo-3,5-dinitrobenzoic acid (II; R = I, R' = H) and its esters were prepared similarly from 4-amino-3,5-dinitrobenzoic acid.



* Part III, *Aust. J. Chem.*, 1967, **20**, 2293.

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¹ Summers, L. A., *Rev. pure appl. Chem.*, 1968, **18**, 1.

² Summers, L. A., and Black, A. L., *Naturwissenschaften*, 1968, **55**, 299.

³ E.g. Berkenheim, A. M., and Lur'e, S. I., *J. gen. Chem. USSR*, 1936, **6**, 1043 (*Chem. Abstr.*, 1937, **31**, 1780).

⁴ Goldstein, H., and Grampoloff, A. V., *Helv. chim. Acta*, 1932, **15**, 1102.

⁵ Ward, E. R., and Marriott, J. E., *J. chem. Soc.*, 1963, 2151.

⁶ Black, A. L., and Summers, L. A., *Aust. J. Chem.*, 1967, **20**, 2293.

As expected, the iodine atom in these compounds is very reactive. For example, 2-iodo-3,5-dinitrobenzoic acid was readily converted into 2-methylamino-3,5-dinitrobenzoic acid (I; $R = CH_3NH$) by methylamine in aqueous ethanol, and ethyl 4-iodo-3,5-dinitrobenzoate into ethyl 4-amino-3,5-dinitrobenzoate (II; $R = NH_2$; $R' = Et$) by aqueous ammonia. The results of biological tests on the dinitroiodobenzoates will be reported elsewhere in due course.

Experimental

Microanalyses were by the Australian Microanalytical Service. Infrared spectra were determined with a Perkin-Elmer 237 instrument.

2-Iodo-3,5-dinitrobenzoic Acid

2-Amino-3,5-dinitrobenzoic acid (5 g) was dissolved in concentrated sulphuric acid (24 ml) and diazotized below 10° with a solution of sodium nitrite (2 g) in concentrated sulphuric acid (10 ml). After agitation for 1 hr the solution was diluted with acetic acid (80 ml) and filtered. The solution was added slowly with stirring to an ice-cold aqueous solution of potassium iodide (3.9 g), ice being added to maintain the temperature below 5° . A yellow precipitate formed and was collected after 24 hr. After washing the precipitate with water it was crystallized twice from benzene and once from aqueous ethanol to afford pale yellow crystals of 2-iodo-3,5-dinitrobenzoic acid, m.p. 223° (Found: C, 25.8; H, 1.2; N, 8.0; I, 35.8. Calc. for $C_7H_3IN_2O_6 \cdot 0.25C_2H_5OH$: C, 25.75; H, 1.3; N, 8.0; I, 36.3%) (60% yield). The compound tenaciously retained solvent of crystallization which could not be removed even after heating under vacuum for 1 hr at 100° . Similar analyses were obtained on three different samples. The acid noted by Goldstein and Grampoloff⁴ to be impure had m.p. 219° . Heating the acid for 5 hr with methanol and a trace of concentrated sulphuric acid gave the methyl ester, m.p. 113° (almost colourless crystals, from methanol) (Found: C, 27.45; H, 1.4; N, 7.85; I, 35.7. Calc. for $C_8H_5IN_2O_6$: C, 27.3; H, 1.4; N, 8.0; I, 36.1%). The ethyl ester had m.p. 117° (almost colourless needles, from ethanol) (Found: C, 29.75; H, 2.1; N, 7.7; I, 34.6. Calc. for $C_9H_7IN_2O_6$: C, 29.5; H, 1.9; N, 7.65; I, 34.7%).

4-Iodo-3,5-dinitrobenzoic Acid

This was prepared similarly (in 55% yield) from 4-amino-3,5-dinitrobenzoic acid. M.p. 237 – 238° (pale yellow crystals, from aqueous ethanol) (Found: C, 25.1; H, 0.9; N, 8.3; I, 37.0. Calc. for $C_7H_3IN_2O_6$: C, 24.9; H, 0.9; N, 8.3; I, 37.6%). The methyl ester had m.p. 164° (straw-coloured crystals, from methanol) (Found: C, 27.3; H, 1.5; N, 8.0; I, 35.5%), and the ethyl ester had m.p. 169° (straw-coloured crystals, from ethanol) (Found: C, 30.0; H, 2.2; N, 7.4; I, 34.8%).

2-Methylamino-3,5-dinitrobenzoic Acid

This compound, m.p. 228° , was obtained as yellow crystals (75%) by treating 2-iodo-3,5-dinitrobenzoic acid with a slight excess of aqueous methylamine solution in boiling ethanol for 5 min. The infrared spectrum was identical with that of a sample prepared similarly from 2-chloro-3,5-dinitrobenzoic acid. Recorded melting points^{7,8} range from 228 to 233° .

Ethyl 4-Amino-3,5-dinitrobenzoate

This compound, m.p. 114° , was obtained (80%) by treating ethyl 4-iodo-3,5-dinitrobenzoate with a slight excess of ammonia in boiling ethanol for 5 min. The infrared spectrum was identical with that of a sample prepared similarly from ethyl 4-chloro-3,5-dinitrobenzoate. Salkowski⁹ gives m.p. 114° .

⁷ Ullmann, F., *Liebigs Ann.*, 1909, **366**, 83.

⁸ Kaufmann, A., and De Petherd, V. P., *Ber. dt. chem. Ges.*, 1917, **50**, 342.

⁹ Salkowski, H., *Liebigs Ann.*, 1872, **163**, 10.