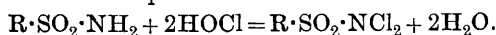


CXCVI.—*N-Halogen Derivatives of the p-Halogen-substituted Benzenesulphonamides.*

By ROBERT REGINALD BAXTER and FREDERICK DANIEL CHATTAWAY.

THE recent employment of the soluble sodium salts of various sulphonmonochloroamides in the treatment of infected wounds (Dakin, *Brit. Med. J.*, August 28th, 1915) has directed considerable attention to these substances. The simpler compounds which have hitherto been used were described some ten years ago (Chattaway, T., 1905, **87**, 145); the present paper contains an account of a number of similar substances containing halogen also in the nucleus, some of which may prove to be of practical utility. The sulphon dichloroamides, which are among the most stable of *N*-halogen derivatives, are easily produced by the action of hypochlorous acid on the sulphonamides:



The salts of the sulphonmonochloroamides produced by the action of alkali hydroxides on the sulphon dichloroamides, $\text{R}\cdot\text{SO}_2\cdot\text{NCl}_2 + \text{NaOH} = \text{R}\cdot\text{SO}(\text{ONa})\cdot\text{NCl} + \text{H}_2\text{O}$ (Chattaway, *loc. cit.*) are very readily soluble in water; they are powerful antiseptics, and are practically non-irritating (Dakin, *loc. cit.*).

The sulphon dibromoamides are produced by the action of hypobromous acid on the sulphonamides, and react with alkali hydroxides to give salts of the monobromoamides,

OF THE *p*-HALOGEN-SUBSTITUTED BENZENESULPHONAMIDES. 1815

N-Halogen derivatives are also readily yielded by acylsulphonamides and sulphonanilides. The *N*-halogen derivatives of the latter are transformed in the ordinary way, the halogen leaving the nitrogen and entering the nucleus when ortho- or para-positions are unoccupied.

EXPERIMENTAL.

The sodium salts of the *p*-halogen benzenesulphonic acids, required as starting points in the preparation of the sulphonyl chlorides, are most advantageously prepared by gradually adding chloro-, bromo-, or iodo-benzene to fuming sulphuric acid (D 1.9 : free SO₃ = 10 per cent.) containing somewhat more than the equivalent amount of sulphur trioxide. The acid should be mechanically stirred during the addition, and the temperature kept below 60°. After remaining for an hour, the cooled mixture is run slowly into about six times its bulk of a saturated solution of salt kept at 0°. The sodium salt of the *p*-halogen-substituted benzenesulphonic acid separates, together with a quantity of sodium chloride, and can be extracted from the mixture, after drying it at 100°, by alcohol. The sodium *p*-halogen-substituted benzenesulphonate crystallises from the hot alcoholic solution in shining white plates. A little di-*p*-halogen phenylsulphone, which is formed in the sulphonation, crystallises out with the sodium salt, and can be removed by washing the latter, when dry, several times with a small quantity of ether.

The dry sodium salts are converted into the corresponding sulphonyl chlorides by thoroughly grinding them with one and a-quarter to one and a-half times the theoretical amount of phosphorus pentachloride. The mixture, which gradually liquefies, after heating on a water-bath for thirty minutes, is cooled, poured on crushed ice, and stirred until the sulphonyl chloride has solidified. This is then collected, washed with ice-cold water, and dissolved in ether. After quickly drying the solution with calcium chloride, the ether is evaporated, leaving the sulphonyl chloride as an oil which solidifies, on cooling, to a white crystalline solid. The sulphonamide is obtained from the sulphonyl chloride by adding it slowly to cooled concentrated aqueous ammonia diluted with an equal bulk of water and thoroughly mixing. After a few hours, the solid sulphonamide is collected and crystallised from water or alcohol.

The *N*-halogen derivatives of the *p*-halogen-substituted benzenesulphonamides are prepared by methods similar to those used in the preparation of the corresponding unsubstituted compounds (Chattaway, *loc. cit.*), and resemble the latter closely in behaviour.

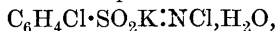
1816 BAXTER AND CHATAWAY: N-HALOGEN DERIVATIVES

p-Chlorobenzenesulphondichloroamide, $C_6H_4Cl \cdot SO_2 \cdot NCl_2$, crystallises in colourless, rhombic prisms, melting at 83° :

0.1563 liberated I = 24 c.c. *N*/10-I. Cl as NCl = 27.28.

$C_6H_4O_2NCl_3S$ requires Cl as NCl = 27.23 per cent.

Potassium *p*-chlorobenzenesulphonchloroamide

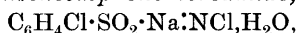


crystallises in glistening, colourless, elongated prisms containing one molecule of water of crystallisation. When heated, it loses its water of crystallisation, and the anhydrous salt then decomposes violently, without previously melting, in the neighbourhood of 160° ; the temperature of decomposition varies somewhat with the rate of heating. It is readily soluble in water, but less readily so in a solution of potassium hydroxide:

0.3830 liberated I = 27.2 c.c. *N*/10-I. Cl as NCl = 12.60.

$C_6H_4O_2NCl_2SK, H_2O$ requires Cl as NCl = 12.57 per cent.

Sodium *p*-chlorobenzenesulphonchloroamide,



crystallises in colourless, elongated prisms. When heated, it loses its water of crystallisation, and the anhydrous salt then decomposes with considerable violence at about 190° , although, as in the case of the potassium salt, the temperature of decomposition varies with the rate of heating.

It is very readily soluble in water, but less so in a solution of sodium hydroxide:

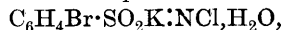
0.2032 liberated I = 16.2 c.c. *N*/10-I. Cl as NCl = 12.94.

$C_6H_4O_2NCl_2SNa, H_2O$ requires Cl as NCl = 12.5 per cent.

p-Chlorobenzenesulphondibromoamide, $C_6H_4Cl \cdot SO_2 \cdot NBr_2$, crystallises in pale yellow, six-sided, rhombic prisms, melting at 102° . Kastle, Keiser, and Bradley (*Amer. Chem. J.*, 1896, **18**, 493) describe it as a yellow, crystalline powder. (Found, Br as NBr = 45.77. $C_6H_4O_2NClBr_2S$ requires Br as NBr = 45.75 per cent.)

p-Bromobenzenesulphondichloroamide, $C_6H_4Br \cdot SO_2 \cdot NCl_2$, crystallises from a mixture of chloroform and light petroleum in colourless, transparent, elongated, rhombic prisms, melting at 108° . Kastle, Keiser, and Bradley (*loc. cit.*) give 106° . (Found, Cl as NCl = 22.98. $C_6H_4O_2NCl_2BrS$ requires Cl as NCl = 22.95 per cent.)

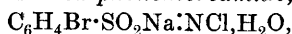
Potassium *p*-bromobenzenesulphonchloroamide,



crystallises in colourless needles, which when heated lose their water of crystallisation and then explode, without previous fusion, at 165° :

0.3460 liberated I = 21.1 c.c. *N*/10-I. Cl as NCl = 10.81.

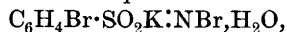
$C_6H_4O_2NClBrSK, H_2O$ requires Cl as NCl = 10.86 per cent.

OF THE *p*-HALOGEN-SUBSTITUTED BENZENESULPHONAMIDES. 1817*Sodium p-bromobenzenesulphonchloroamide,*

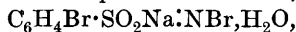
crystallises in colourless needles, which lose their water of crystallisation and then explode, with previous fusion, at 178°. Both this and the potassium salt are readily soluble in water:

0.3190 liberated I=19.8 c.c. *N*/10-I. Cl as :NCl=11.01.
 $\text{C}_6\text{H}_4\text{O}_2\text{NClBrSNa}, \text{H}_2\text{O}$ requires Cl as :NCl=11.43 per cent.

p-Bromobenzenesulphondibromoamide, $\text{C}_6\text{H}_4\text{Br}\cdot\text{SO}_2\cdot\text{NBr}_2$, crystallises in pale yellow, elongated, rhombic prisms, melting and decomposing at 132—133°:

0.7246 liberated I=38.9 c.c. *N*/10-I. Br as NBr=40.26.
 $\text{C}_6\text{H}_4\text{O}_2\text{NBr}_3\text{S}$ requires Br as NBr=40.57 per cent.
Potassium p-bromobenzenesulphonbromoamide,

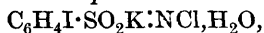
crystallises in white needles, readily soluble in water, which explode, without previous fusion, at 193°:

0.7246 liberated I=38.9 c.c. *N*/10-I. Br as NBr=21.45.
 $\text{C}_6\text{H}_4\text{O}_2\text{NBr}_2\text{SK}, \text{H}_2\text{O}$ requires Br as NBr=21.53 per cent.
Sodium p-bromobenzenesulphonbromoamide,

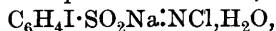
crystallises in colourless needles readily soluble in water, which explode, without previous fusion, at 211°:

0.3420 liberated I=18.9 c.c. *N*/10-I. Br as NBr=22.09.
 $\text{C}_6\text{H}_4\text{O}_2\text{NBr}_2\text{SNa}, \text{H}_2\text{O}$ requires Br as NBr=22.52 per cent.

p-Iodobenzenesulphondichloroamide, $\text{C}_6\text{H}_4\text{I}\cdot\text{SO}_2\cdot\text{NCl}_2$, crystallises from a mixture of chloroform and light petroleum in colourless, elongated, rhombic prisms, melting at 147°:

0.5046 liberated I=57.2 c.c. *N*/10-I. Cl as NCl=20.09.
 $\text{C}_6\text{H}_4\text{O}_2\text{NCl}_2\text{IS}$ requires Cl as NCl=20.15 per cent.
Potassium p-iodobenzenesulphonchloroamide,

crystallises in white needles readily soluble in water, which when heated lose water and then explode, without previous fusion, at 150°:

0.6180 liberated I=33 c.c. *N*/10-I. Cl as NCl=9.47.
 $\text{C}_6\text{H}_4\text{O}_2\text{NClISK}, \text{H}_2\text{O}$ requires Cl as NCl=9.49 per cent.
Sodium p-iodobenzenesulphonchloroamide,

crystallises in colourless plates readily soluble in water, which when heated lose water and then explode, without previous fusion, at 185°:

1818 BAXTER AND CHATTAWAY: N-HALOGEN DERIVATIVES

0.9070 liberated I=50.5 c.c. *N*/10-I. Cl as NCl=9.87.

$C_6H_4O_2NClISNa, H_2O$ requires Cl as NCl=9.92 per cent.

The exact temperatures at which the anhydrous salts of the chloroamides explode or decompose depend upon the rate at which the compounds are heated; the temperatures given are those at which explosion occurs when they are quickly heated in melting-point tubes in a small oil-bath.

The *p*-halogen benzenesulphonyl chlorides react readily in ethereal solution with aliphatic primary amines in the presence of an equivalent amount of pyridine, and form acylbenzenesulphonamides, all of which yield chloro- and bromo-amides.

p-Chlorobenzenesulphonmethylamide, $C_6H_4Cl \cdot SO_2 \cdot NH \cdot CH_3$, crystallises from alcohol in shining white plates, melting at 59°.

p-Chlorobenzenesulphonmethylchloroamide, $C_6H_4Cl \cdot SO_2 \cdot NCl \cdot CH_3$, crystallises from a mixture of chloroform and light petroleum in six-sided, rhombic prisms, melting at 66°. (Found Cl as :NCl=14.71. $C_7H_7O_2NCl_2S$ requires Cl as :NCl=14.77 per cent.)

p-Chlorobenzenesulphonmethylbromoamide, $C_6H_4Cl \cdot SO_2 \cdot NBr \cdot CH_3$, crystallises in pale yellow, rhombic prisms, melting at 99°:

0.3286 liberated I=23.9 c.c. *N*/10-I. Br as :NBr=29.06.

$C_7H_7O_2NClBrS$ requires Br as :NBr=29.22 per cent.

p-Chlorobenzenesulphonbenzylamide, $C_6H_4Cl \cdot SO_2 \cdot NH \cdot CH_2 \cdot C_6H_5$, crystallises in white needles, melting at 108—109°.

p-Chlorobenzenesulphonbenzylchloroamide, $C_6H_4Cl \cdot SO_2 \cdot NCl \cdot CH_2 \cdot C_6H_5$, crystallises in colourless, rhombic prisms, melting at 124°:

0.3100 liberated I=19.85 c.c. *N*/10-I. Cl as NCl=11.35.

$C_{13}H_{11}O_2NCl_2S$ requires Cl as NCl=11.22 per cent.

p-Chlorobenzenesulphonbenzylbromoamide, $C_6H_4Cl \cdot SO_2 \cdot NBr \cdot CH_2 \cdot C_6H_5$, crystallises in pale yellow, rhombic prisms, melting at 112°:

0.4479 liberated I=23.6 c.c. *N*/10-I. Br as NBr=21.16.

$C_{13}H_{11}O_2NClBrS$ requires Br as NBr=21.17 per cent.

The anilides of the halogen-substituted benzenesulphonic acids are conveniently prepared by adding the sulphonyl chloride dissolved in ether to the theoretical quantity of aniline mixed with an equivalent amount of pyridine also dissolved in ether. After mixing, the ether is distilled off, and the action completed by heating for a short time on a water-bath. After cooling and thoroughly washing with dilute hydrochloric acid, and finally with

OF THE *p*-HALOGEN-SUBSTITUTED BENZENESULPHONAMIDES. 1819

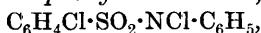
water, the anilide is recrystallised from alcohol, the solution being decolorised when necessary with animal charcoal.

These compounds all yield stable *N*-chloro-derivatives when suspended in chloroform and shaken with a solution of hypochlorous acid. In preparing those which do not readily undergo intramolecular rearrangement, a solution of sodium hypochlorite acidified with acetic acid may be used, whilst if intramolecular rearrangement readily occurs, potassium hydrogen carbonate is best employed to liberate the hypochlorous acid.

The following *p*-chloro-, *p*-bromo-, and *p*-iodo-sulphonanilides have been prepared. They are all readily soluble in boiling alcohol or acetic acid, and separate in well-shaped crystals on slowly cooling the saturated solutions. They have all been analysed by conversion into the corresponding chloroamides, and estimation of the amount of chlorine attached to nitrogen in the latter compound. To save space, the details of the analyses are not given.

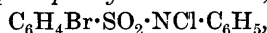
The chloroamides derived from the sulphonanilides are all very readily soluble in chloroform, and sparingly so in light petroleum. Unless otherwise stated, they were crystallised from a mixture of chloroform and light petroleum.

p-Chlorobenzenesulphonphenylchloroamide,



six-sided, rhombic prisms, melting at 100°.

p-Bromobenzenesulphonphenylchloroamide,



colourless, elongated, rhombic prisms, melting at 104°.

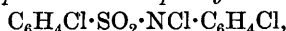
p-Iodobenzenesulphonphenylchloroamide, $\text{C}_6\text{H}_4\text{I}\cdot\text{SO}_2\cdot\text{NCl}\cdot\text{C}_6\text{H}_5,$

colourless rhombs, melting at 139—140°.

p-Chlorobenzenesulphon-*m*-chloroanilide, $\text{C}_6\text{H}_4\text{Cl}\cdot\text{SO}_2\cdot\text{NH}\cdot\text{C}_6\text{H}_4\text{Cl},$

colourless, transparent rhombs, melting at 106°.

p-Chlorobenzenesulphon-*m*-chlorophenylchloroamide,

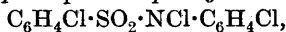


colourless, transparent, six-sided, rhombic prisms, melting at 90°.

p-Chlorobenzenesulphon-*p*-chloroanilide, $\text{C}_6\text{H}_4\text{Cl}\cdot\text{SO}_2\cdot\text{NH}\cdot\text{C}_6\text{H}_4\text{Cl},$

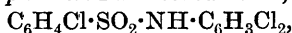
colourless needles, melting at 148°.

p-Chlorobenzenesulphon-*p*-chlorophenylchloroamide,



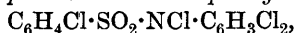
colourless, transparent, rhombic prisms, melting at 127°.

p-Chlorobenzenesulphon-2 : 4-dichloroanilide,



colourless plates, melting at 108°.

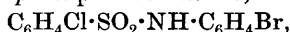
p-Chlorobenzenesulphon-2 : 4-dichlorophenylchloroamide,



colourless prisms, melting at 100°.

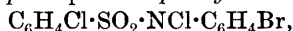
1820 BAXTER AND CHATTAWAY: N-HALOGEN DERIVATIVES

p-Chlorobenzenesulphon-p-bromoanilide,



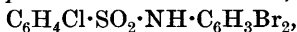
colourless, rhombic prisms, melting at 163°.

p-Chlorobenzenesulphon-p-bromophenylchloroamide,



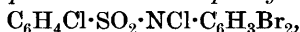
colourless, rhombic prisms, melting at 127°.

p-Chlorobenzenesulphon-2:4-dibromoanilide,



colourless, rhombic prisms, melting at 116°.

p-Chlorobenzenesulphon-2:4-dibromophenylchloroamide,

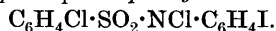


colourless, transparent, rhombic prisms, melting and decomposing at 110°.

p-Chlorobenzenesulphon-p-iodoanilide, $\text{C}_6\text{H}_4\text{Cl}\cdot\text{SO}_2\cdot\text{NH}\cdot\text{C}_6\text{H}_4\text{I},$

colourless, rhombic prisms, melting at 173°.

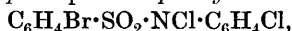
p-Chlorobenzenesulphon-p-iodophenylchloroamide,



—This compound is very unstable; it is precipitated as a colourless, crystalline solid on adding light petroleum to a freshly prepared solution in chloroform. If kept for a few minutes, even when dry, it decomposes, with the liberation of iodine. It melts and decomposes at 70°.

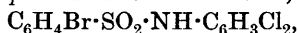
p-Bromobenzenesulphon-p-chloroanilide, $\text{C}_6\text{H}_4\text{Br}\cdot\text{SO}_2\cdot\text{NH}\cdot\text{C}_6\text{H}_4\text{Cl},$
colourless, rhombic prisms, melting at 138°.

p-Bromobenzenesulphon-p-chlorophenylchloroamide,



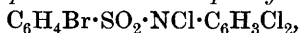
colourless, transparent, elongated rhombic prisms, melting at 142°.

p-Bromobenzenesulphon-2:4-dichloroanilide,



colourless, rhombic prisms, melting at 134°.

p-Bromobenzenesulphon-2:4-dichlorophenylchloroamide,

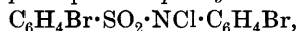


colourless, transparent, rhombic prisms, melting at 97°.

p-Bromobenzenesulphon-p-bromoanilide, $\text{C}_6\text{H}_4\text{Br}\cdot\text{SO}_2\cdot\text{NH}\cdot\text{C}_6\text{H}_4\text{Br},$

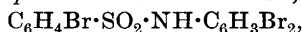
colourless, rhombic prisms, melting at 141°.

p-Bromobenzenesulphon-p-bromophenylchloroamide,



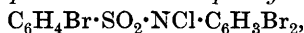
transparent, rhombic prisms, melting at 141°.

p-Bromobenzenesulphon-2:4-dibromoanilide,



colourless, rhombic prisms, melting at 147°.

p-Bromobenzenesulphon-2:4-dibromophenylchloroamide,



colourless, transparent, rhombic prisms, melting at 117°.

OF THE *p*-HALOGEN-SUBSTITUTED BENZENESULPHONAMIDES. 1821

p-Bromobenzenesulphon-*p*-iodoanilide, $C_6H_4Br \cdot SO_2 \cdot NH \cdot C_6H_4I$,
colourless, elongated rhombic prisms, which melt and decompose at
160°.

p-Bromobenzenesulphon-*p*-iodophenylchloroamide,
 $C_6H_4Br \cdot SO_2 \cdot NCl \cdot C_6H_4I$.

—This compound is deposited, on adding petroleum to a freshly prepared solution in chloroform, as a colourless, crystalline solid which is extremely unstable and shows signs of decomposition after remaining a few minutes at the ordinary temperature. When rapidly heated, it decomposes completely below 100°, without previous fusion.

p-Iodobenzenesulphon-*p*-bromoanilide, $C_6H_4I \cdot SO_2 \cdot NH \cdot C_6H_4Br$,
colourless, rhombic plates, melting at 174°.

p-Iodobenzenesulphon-*p*-bromophenylchloroamide,
 $C_6H_4I \cdot SO_2 \cdot NCl \cdot C_6H_4Br$,

colourless, transparent, rhombic prisms, which melt and decompose at 137°.

p-Iodobenzenesulphon-*p*-iodoanilide, $C_6H_4I \cdot SO_2 \cdot NH \cdot C_6H_4I$,
glistening, colourless plates, which melt and decompose at 167°.

p-Iodobenzenesulphon-*p*-iodophenylchloroamide,
 $C_6H_4I \cdot SO_2 \cdot NCl \cdot C_6H_4I$,

separates in small, colourless prisms on adding light petroleum to a freshly-prepared chloroform solution. It is very unstable, and shows signs of decomposition if kept for a few minutes at the ordinary temperature. If rapidly heated, it melts and decomposes at 142°.

p-Chlorobenzenesulphon-*o*-nitroanilide, $C_6H_4Cl \cdot SO_2 \cdot NH \cdot C_6H_4 \cdot NO_2$,
pale yellow, elongated, rhombic prisms, melting and decomposing at 114°.

p-Chlorobenzenesulphon-*o*-nitrophenylchloroamide,
 $C_6H_4Cl \cdot SO_2 \cdot NCl \cdot C_6H_4 \cdot NO_2$,

very pale yellow, transparent, rhombic prisms, which melt and decompose at 148°. When the melted compound is heated rapidly to 5--10° above this temperature, the decomposition becomes violent.

p-Chlorobenzenesulphon-*m*-nitroanilide,
 $C_6H_5Cl \cdot SO_2 \cdot NH \cdot C_6H_4 \cdot NO_2$,

pale yellow needles, which melt at 124°.

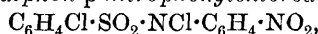
p-Chlorobenzenesulphon-*m*-nitrophenylchloroamide,
 $C_6H_5Cl \cdot SO_2 \cdot NCl \cdot C_6H_4 \cdot NO_2$,

very faintly yellow, almost colourless, elongated rhombic prisms, melting and decomposing at 131°.

p-Chlorobenzenesulphon-*p*-nitroanilide, $C_6H_4Cl \cdot SO_2 \cdot NH \cdot C_6H_4 \cdot NO_2$,
yellow needles, which melt and decompose at 159°.

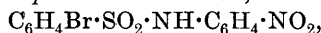
1822 BAXTER AND CHATTAWAY: N-HALOGEN DERIVATIVES

p-Chlorobenzenesulphon-*p*-nitrophenylchloroamide,



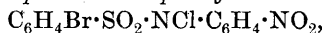
very faintly yellow, rhombic prisms, which melt and decompose at 143°.

p-Bromobenzenesulphon-*o*-nitroanilide,



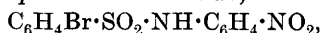
yellow needles, which melt at 130°.

p-Bromobenzenesulphon-*o*-nitrophenylchloroamide,



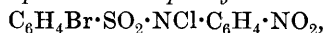
very pale yellow, rhombic prisms, which melt and decompose at 160°.

p-Bromobenzenesulphon-*m*-nitroanilide,



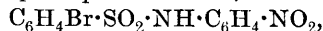
yellow needles, melting at 140°.

p-Bromobenzenesulphon-*m*-nitrophenylchloroamide,



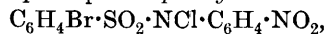
long, yellow, rhombic prisms, which melt and decompose at 140°.

p-Bromobenzenesulphon-*p*-nitroanilide,



yellow needles, melting at 183°.

p-Bromobenzenesulphon-*p*-nitrophenylchloroamide,



pale yellow, rhombic prisms, melting at 164°.

p-Iodobenzenesulphon-*o*-nitroanilide,



very pale yellow plates, melting at 137°.

p-Iodobenzenesulphon-*o*-nitrophenylchloroamide,



very faintly yellow-coloured, transparent, rhombic prisms, melting at 167°.

p-Iodobenzenesulphon-*m*-nitroanilide,



long, yellow, rhombic prisms, melting at 157°.

p-Iodobenzenesulphon-*m*-nitrophenylchloroamide,



very faintly yellow-coloured, transparent, rhombic prisms, melting at 164°.

p-Iodobenzenesulphon-*p*-nitroanilide,



very pale yellow, glistening plates, melting at 154°.

p-Chlorobenzenesulphon-*o*-toluidide, $\text{C}_6\text{H}_4\text{Cl}\cdot\text{SO}_2\cdot\text{NH}\cdot\text{C}_6\text{H}_4\cdot\text{CH}_3$,

colourless needles, melting at 111°.

p-Chlorobenzenesulphon-*o*-tolylchloroamide,



OF THE *p*-HALOGEN-SUBSTITUTED BENZENESULPHONAMIDES. 1823

colourless, six-sided, rhombic prisms, which melt and decompose at 127°.

p-Chlorobenzenesulphon-*p*-toluidide, $C_6H_4Cl \cdot SO_2 \cdot NH \cdot C_6H_4 \cdot CH_3$,
colourless, rhombic prisms, melting at 88°.

p-Chlorobenzenesulphon-*p*-tolylchloroamide,
 $C_6H_4Cl \cdot SO_2 \cdot NCl \cdot C_6H_4 \cdot CH_3$,
crystallises in colourless, rhombic prisms, which melt and decompose at 110°.

p-Chlorobenzenesulphon-*p*-tolylbromoamide,
 $C_6H_4Cl \cdot SO_2 \cdot NBr \cdot C_6H_4 \cdot CH_3$,
pale yellow, six-sided, rhombic prisms, melting at 91°.

p-Bromobenzenesulphon-*o*-toluidide, $C_6H_4Br \cdot SO_2 \cdot NH \cdot C_6H_4 \cdot CH_3$,
colourless, rhombic prisms, melting at 119°.

p-Bromobenzenesulphon-*o*-tolylchloroamide,
 $C_6H_4Br \cdot SO_2 \cdot NCl \cdot C_6H_4 \cdot CH_3$,
colourless, transparent, rhombic prisms, which melt and decompose at 129°.

p-Bromobenzenesulphon-*p*-toluidide, $C_6H_4Br \cdot SO_2 \cdot NH \cdot C_6H_4 \cdot CH_3$,
colourless, rhombic prisms, melting at 99°.

p-Bromobenzenesulphon-*p*-tolylchloroamide,
 $C_6H_4Br \cdot SO_2 \cdot NCl \cdot C_6H_4 \cdot CH_3$,
colourless, rhombic prisms, melting at 131°.

p-Iodobenzenesulphon-*o*-toluidide, $C_6H_4I \cdot SO_2 \cdot NH \cdot C_6H_4 \cdot CH_3$,
colourless, elongated, rhombic plates, melting at 161°.

p-Iodobenzenesulphon-*o*-tolylchloroamide,
 $C_6H_4I \cdot SO_2 \cdot NCl \cdot C_6H_4 \cdot CH_3$,
colourless, transparent, rhombic prisms, melting at 110°.

p-Iodobenzenesulphon-*p*-toluidide, $C_6H_4I \cdot SO_2 \cdot NH \cdot C_6H_4 \cdot CH_3$,
colourless, rhombic prisms, melting at 135°.

p-Iodobenzenesulphon-*p*-tolylchloroamide,
 $C_6H_4I \cdot SO_2 \cdot NCl \cdot C_6H_4 \cdot CH_3$,
colourless, transparent, rhombic prisms, which melt and decompose at 137°.

UNIVERSITY CHEMICAL LABORATORY,
OXFORD.

[Received, November 1st, 1915.]