

LETTERS TO THE EDITOR

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GROUND TRIPLET IN BROMINE II

SOME of the main features in the first spark spectrum of Bromine were reported by Bloch and Lacroute¹ previously; but the most important deepest terms of the spectrum have not yet been identified correctly. Following the work² in our laboratory on the successive spectra of Bromine, it has been possible to establish the fundamental inverted triplet term $4p\ ^3P$ of Br. II, involving the classification of about thirty lines in the vacuum grating region. The intervals are found to be $4p\ ^3P_2 - 4p\ ^3P_1 = 3147$ and $4p\ ^3P_1 - 4p\ ^3P_0 = 695$ units. Bloch's identification of $5s\ ^1D$, had to be changed from 65657.1 to 61179.5. Full details of the analysis will be published elsewhere.

Andhra University,
Guntur,
January 11, 1944.

K. R. RAO.

1. *Compt. Rend.*, 1934, 199, 41 and *Ann. de Physique*, 1935, 3, 5. 2. Rao and Krishnamurty, *Proc. Roy. Soc., A*, 1937, 161, 38 and *Proc. Phy. Soc.* (Lond.), 1934, 46, 531.

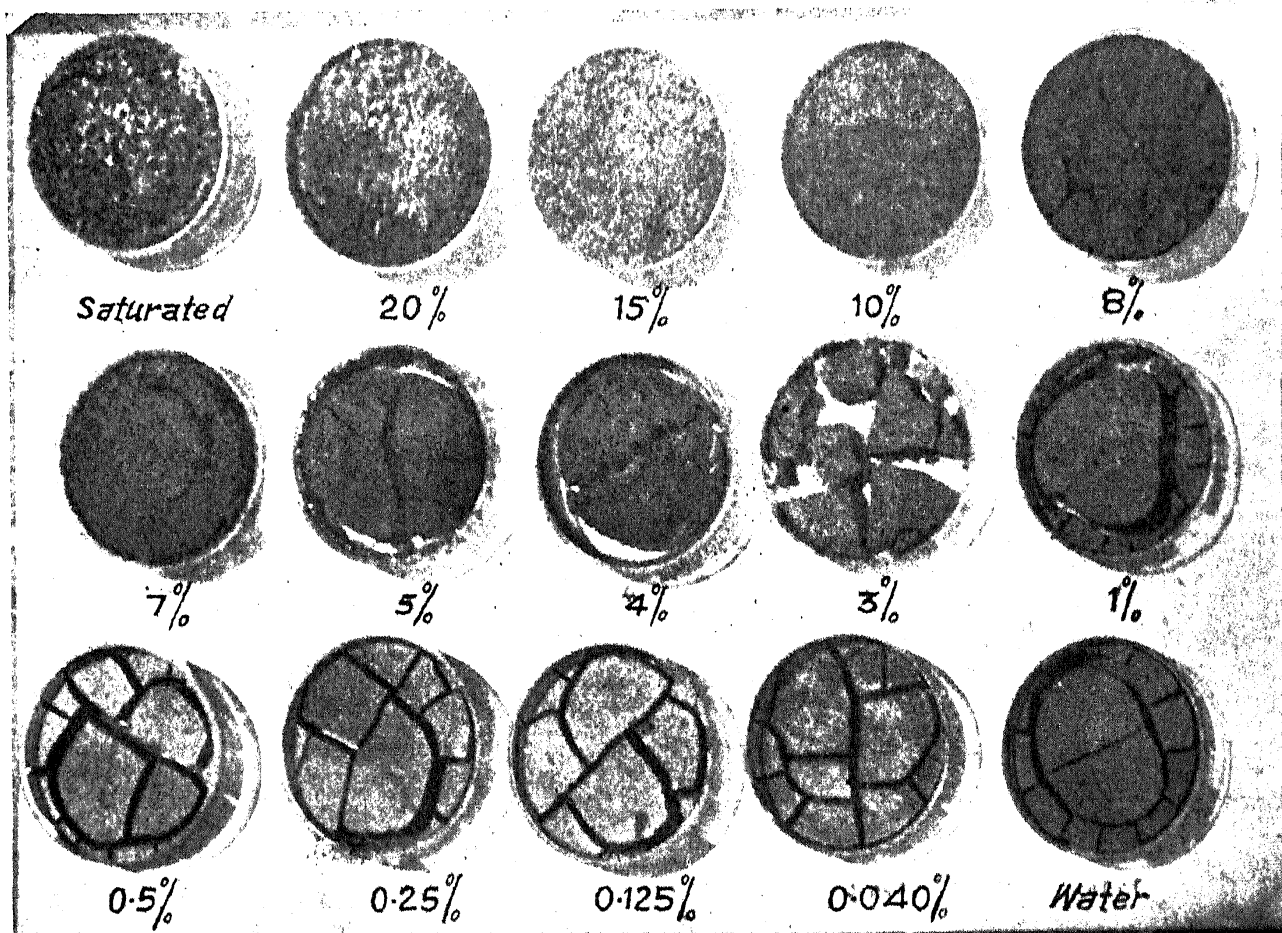
ON THE EFFECT OF CONCENTRATION OF SODIUM CARBONATE IN AQUEOUS SOLUTIONS ON (A) THE FORMATION OF CRACKS, (B) SWELLING AND DISPERSION AND (C) CAPILLARY ASCENT IN THE BLACK COTTON SOIL

IN a series of papers published recently^{1,2,3} the present writers discussed the capillary rise of sodium carbonate solution in black cotton soil packed in glass tubes and the swelling of the soil particles when immersed in solutions of lithium and sodium carbonates and of some

other salts. While a trace of sodium carbonate in water (0.03 per cent.) actually increases capillary rise, as the concentration is increased from 0.03 to about 1 per cent. there is a rapid deterioration in the permeability of the soil due to swelling of particles. Similar results obtained with solutions of other salts will be discussed in a separate paper.

In the present note we report some interesting results obtained with sodium carbonate. In this case, experiments could be made on (a) the development of cracks in soils mixed with sodium carbonate solutions, (b) swelling or dispersion of the soil in the solutions, and (c) capillary ascent, over a wide range of concentration (owing to the high solubility of the salt).

When samples of black cotton soil weighing 100 gr. are mixed with 60 c.c. of sodium carbonate solutions of different concentration and the pastes so formed are allowed to dry in a steam oven, the soil layers develop the well-known cracks only in the range of concentration from 0 to 5 per cent. The width of the cracks formed increases to a maximum at a concentration of 3 per cent. No deep cracks appear above 5 per cent. Between 4 per cent. and 8 per cent. the soil mass contracts *en masse* on drying and a black layer appears at the surface. This contraction also decreases with increase of concentration in the above range. Finally, at concentrations higher than 8 per cent. the precipitation of the salt prevents visible contraction, and the soil particles have no tendency to form lumps but remain powdery and porous like sand. The maximum cracking should occur at a concentration where the swelling on wetting and contraction on drying are both large. The cracked layers are hard as brick. Between 4 per cent. and 8 per cent. the dried mass is very friable. Fig. 1 shows



the appearance of the soil layers mixed with different concentrations of sodium carbonate solution when dried.

In the next experiment 15 gr. samples of black cotton soil were shaken for a minute with 100 c.c. of different concentrations of sodium carbonate solution, and allowed to settle in measuring jars. After settling was complete (i.e., after two days), the volumes of the sediments in the different concentrations were recorded. The values are given in Table I.

TABLE I

Concentration % of Na_2CO_3 —0 (Water), 0.2, 0.4, 0.7, 1.0, 1.5, 2.0, 3.0, 4.0, 10.0, 20.0.
Volume of soil sediment c.c.—24, 29, 36, 41, 45, 41, 36, 32, 26, 22, 19.

The volume of the soil sediment increases with concentration up to 1 per cent. As the concentration is increased further the volume of the sediment decreases rapidly. The supernatant liquid in solutions of concentration greater than 1 per cent. is coloured deep brown; the cause of this colour is being investigated.

The capillary rise of different concentrations of sodium carbonate solution through columns of black cotton soil during a period of 24 hours is indicated in Table II.

From Table II it will be seen that the capillary ascent decreases rapidly from 0.03 per cent. to 2 per cent.; but it is very remarkable that as the concentration of the sodium carbonate solution is increased further there is rapid restoration of the permeability of the soil. Thus, a concentrated solution of sodium carbonate is found to rise through the soil at even a

TABLE II

Concentration of sodium carbonate solution	Capillary rise during 24 hrs. in cm.	Concentration of sodium carbonate solution	Capillary rise during 24 hrs. in cm.
% (Water)			
0	28.8	0.25	5.4
0.010	29.9	0.50	3.9
0.020	31.7	1.00	3.1
0.030	32.3	2.00	1.9
0.040	31.7	3.00	3.0
0.050	28.0	6.25	6.8
0.125	12.0	12.50	19.5
		25.00	26.1

faster rate than pure water initially (as through sand) although pure water scores ultimately over the solution. The soil wetted by the highly concentrated solutions turns black after some time. This effect begins at the lower layers of the wetted soil and slowly moves upward along the wet column. It is to be noted in particular that although the soil becomes nearly impermeable to a 2 per cent. solution, the permeability increases rapidly with concentration above 2 per cent.

The importance of the above results in dealing with problems connected with lands affected by sodium carbonate is obvious. For a given quantity of black cotton soil there is an optimum concentration at which its auto-dis-

person in sodium carbonate solution (e.g., for mechanical analysis) will be most effective. Similarity in the influence of concentration on different phenomena like crack formation, swelling and capillary ascent is also noteworthy. A more detailed discussion of our results will appear elsewhere.

Our thanks are due to Mr. A. U. Momin for help in performing some of the experiments described above.

Meteorological Office,
Poona,
January 24, 1944.

L. A. RAMDAS.
A. K. MALLIK.

I. Ramdas, L. A., and Mallik, A. K., *Proc. Ind. Acad. Sci., A*, 1942, **16**, 1-9. 2. —, —, *Ibid.*, 1942, **16**, 16-22. 3. —, —, and Pandit, U. P., *Curr. Sci.*, 1942, **11**, No. 7, 288.

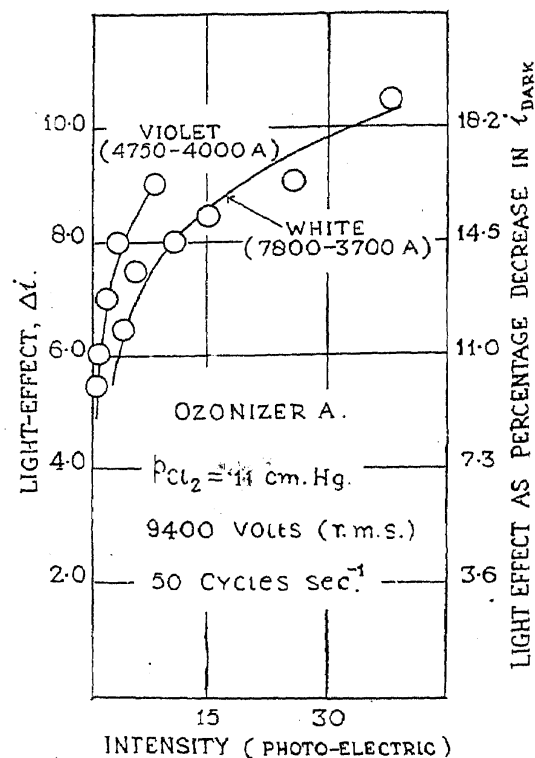
NEW LIGHT EFFECT—INTENSITY VARIATION BY DIRECT PHOTO- ELECTRIC MEASUREMENTS

EARLIER results^{2,4,5} for the dependence of the new light-effect defined as Δi the instantaneous diminution on irradiation of i the conductivity in chlorine^{2,4,6,9} and other gases^{2,3,4,7} subjected to electrical discharge, upon I the corresponding light-intensity, have shown that Δi is not a linear function of I . This has been used by Joshi to discriminate this phenomenon from the well-known photo-electric effect^{2,4,5} in which the linearity of the above relationship has been found to hold over a millionfold variation of I .⁸ Due to limitations of means then at our disposal, the *inverse square law* was assumed for the large size, light-source employed, viz., an incandescent filament bulb. Results now to be reported are independent of the approximations involved in the above assumption, since I varied by varying the distance of the light-source was observed directly by a G.E.C. Osram photo-electric cell.

The chlorine-filled ozoniser A, the light-source—a 200 watt 180 volt bulb, the light filters and the general experimental procedure were the same as before.^{5,9,11} The intensity of the filtered green (5775-5070 Å) and the sensitivity of the available cell to the filtered red (7070-6070 Å) were too low for a study of Δi as a function of I for these light-bands. With about 9400 volts (r.m.s.) and 50 cycles frequency, i the current in the dark, was 55 on a Cambridge A.C. microammeter. The light-effect, expressed as Δi and also as a percentage of the original i in the dark, is shown graphically in Fig. 1, at various I_{white} and I_{violet} .

It is seen from Fig. 1 that the Δi - I curve for the violet lies above that for the white; for a given I , Δi under violet exceeds that due to white. Evidently, therefore, the nature of irradiation is an additional factor involved in the production of this effect, and that, at same I for both, this factor in white is less effective than in violet. This mode of observation may be referred to by (i) for shortness. Now (ii) when, at a given distance, the chlorine tube is irradiated directly by the bulb and then with the violet filter interposed, Δi due to the white exceeds that under (filtered) violet. The discrepancy between (i) and (ii) is only apparent. In (ii), I_{violet} is less than

I_{white} being only a fraction of same. The light-effect, which is found to be produced by all the components of the white light,^{2,3,4,9,10,11} should be, therefore, and is, found to be greater under white than under violet.^{5,9,10,11} Since $I_{\text{violet}} = I_{\text{white}}$ in (i), irradiation by violet is comparatively stronger in the short-wave components; it is besides more, within the absorption spectrum of chlorine, than the former.^{12,13} On either or perhaps both these grounds, Δi under violet should be greater than under an equally intense white light, which is actually the case (Fig. 1).



These results afford a more quantitative support to Joshi's view^{2,4,5} based on the observed non-linearity of the Δi - I relation, that this phenomenon cannot in the first instance be identified with negative photo-electric effect. The curves in Fig. 1 also show that the initially pronounced rise of Δi slows down at larger I due presumably to a saturation effect.^{5,9,11}

Grateful thanks are due to Prof. Shrinivasan, Indian Institute of Science, Bangalore, for the loan of an A.C. microammeter and to Dr. S. S. Joshi for kind interest and guidance.

Benares Hindu University,
January 15, 1944.

P. G. DEO.

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