LETTERS TO THE EDITOR

PRODUCTION OF THE *EIGAT-EFFECT* UNDER X-RAYS

Previous work[1,2,3,4,5,6] on this phenomenon showed that when chlorine and other gases subjected to an electric discharge, are irradiated in different parts of the visible spectrum, an instantaneous[6] and a reversible current *decrease* Δi, is produced, which increases by increasing the intensity and especially the frequency of light. With essentially the same experimental arrangement as before, the observation of this effect has now been extended to irradiation with X-rays.

A sealed glass ozonizer of the Siemens' type filled with pure chlorine at 26 cm. pressure was kept at a target distance of 2 ft. from a Coolidge tube. The discharge current i was determined with a Cambridge vacuo-junction connected to a reflection galvanometer. At 10·7 kilo-volts (r.m.s.) applied to the ozoniser and 50 cycles frequency, i in the dark was 62 in arbitrary units. This decreased almost immediately[6] to 51, that is, by about 17 per cent. on exposure to X-rays; interception with a lead screen caused the current to increase immediately[6] to its original value. Light from a 200-watt incandescent bulb instead of X-rays, produced a current decrease Δi of 25 per cent. Increase of intensity, as judged from the fluorescence of the test screen, obtained by a variation of the tube current in the range 1 to 4 milliamps did not produce an appreciable increase in Δi. That this may be ascribed, in part, to a saturation effect was suggested by the result that the light-effect Δi was about 25 per cent., when the chlorine tube was irradiated *simultaneously* by the incandescent bulb and X-rays.[7]

It is found that a continuous 30 minute exposure of the chlorine tube to an intense beam of X-rays produced a permanent diminution in the magnitude of the light-effect. The corresponding influence of radiation from the incandescent bulb was much smaller despite 16-hour daily exposure for over fifteen days.[8]

The ionization potentials of all elementary gases are higher than 10 volts. It is to be anticipated therefore, that their photo-electric ionization would occur at wave-lengths shorter than 123·4 Mμ. A number of investigations have, however, detected photo-ionisation at sensibly longer wave-lengths than the above limit. This has been attributed to a 'cumulative effect'. It is that one of the photo-excited atoms and/or molecules ionises on collision with another excited particle or by capturing a second quantum. The occurrence under electric discharge of an appreciable number of particles in energy states higher than the normal, is well established by the spectroscopic and other evidence. From this it follows that *ceteris paribus*, an exposure of a gas to discharge, would favour its cumulative photo-ionisation. The occurrence of as much as a 17 per cent. decrease of the discharge current in chlorine consequent on irradiation with X-rays—a powerful means of ionisation—is remarkable. Such a diminution of the conductivity, as far as I am aware, has not been observed hitherto in the literature of the X-ray phenomena. It is obviously of vital significance to the elucidation of the general mechanism of *the light-effect.*[1,2,3,4,5,6]

Department of Chemistry,
Benares Hindu University, S. S. Joshi.
October 21, 1944.

1. Joshi, *Curr. Sci.*, **1939, 8.** 48. 2. — *Pres. Address Chem. Sec. Indian. Sci. Cong.*, (1943). 3 —, *B.H.U. Journ.*, **1943, 8, 99.** 4. —, *Nature*, **1944. 154, 147.** 5. Joshi and Deo, *ibid.*, **1944, 153, 434.** 6. For a possible time-lag, *cf.*, Joshi, *Curr. Sci.*, **1944, 13, 253.** 7. Lenard and Ramsauer, *cf.* Hughes and DuBridge, "*Photo-Electric Phenomena.*" 1st ed., *p.* 279, 283 (*Mc Graw-Hill Book, Co. Inc.*, **1932**). 8. Deo (unpublished results).