A Photographic Determination of the Relative Intensities of Three Chemiluminescences

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In the present experiments, which were carried out in the laboratories of the Cleveland Clinic Foundation, measurements were made of the relative intensities of the luminescences resulting from the oxidation of urine, lophine (2, 4, 5-triphenylimidazole), and luminol (3-aminophthal hydrazide). The solutions used to produce the luminescence have been described in a previous article.[1] The light was maintained by means of the "lumistat," an automatic feeding device which maintains chemiluminescence at almost constant intensity. This device is to be the subject of a forthcoming article sometime in the near future. The lights were photographed on Eastman's Super XX roll film. A camera shutter was in each instance placed between the film and the light source to control the time of exposure. With this shutter interposed, the light source was about one inch from the film.

An exposure of 30 minutes was allowed for urine luminescence, 2 seconds for the lophine, and 0.08 seconds for the luminol. The densities produced on the film are shown in Table I and in Fig. 1. They were

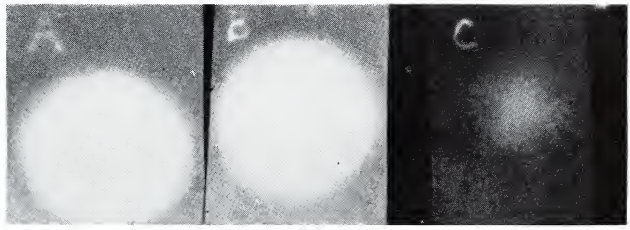

Fig. 1. A. Light from lophine, 2 sec.
B. Light from luminol, 0.08 sec.
C. Light from urine, 30 min.

TABLE I.

Luminescent Material	Density	Log Exposure	Exposure	Time in Seconds	Intensity
Urine.....	0.83	$\bar{2}.43$	0.0269	1800	1.49×10^{-5}
Lophine.....	1.87	$\bar{1}.54$	0.3468	2	0.173
Luminol.....	2.03	$\bar{1}.74$	0.5495	0.08	6.87

[1]Cottman, Journ. Chem. Ed. 16:292-4 (1939).

measured on a densitometer of the Hartman type. The logs of the exposures were read from the proper H & D curves[2], and the exposures were determined. Assuming no reciprocity failure, $E=IT$, and $I=E/T$, in which I is the intensity, E is the exposure, as derived from the H & D curve, and T is the length of the exposure in seconds.

It may be determined from the data in Table I that the intensity of luminol luminescence is about 4.6×10^5 times as great as that of urine and about 40 times as great as that of lophine. Lophine luminescence is about 1.16×10^4 times as intense as that of urine.

Summary

Through the use of photographic methods, determinations were made of the relative intensities of the chemiluminescence produced by the oxidation of luminol, lophine, and urine, respectively. Luminescence from luminol is about 460,000 times as bright as that from urine and about 40 times as bright as that from lophine.

[2]Supplied by the Eastman Kodak Company.