Photosensitisation by Stannic Oxide.

PHOTOSENSITISATION by zinc oxide and titanium dioxide has been studied by numerous workers. These oxides absorb in the near ultraviolet and photosensitise various chemical reactions. A. Eibner[1] studied the decolorisation of various dyes in the presence of zinc oxide and light. Winther[2] observed the formation of hydrogen peroxide when water was exposed in a glass vessel in the presence of zinc oxide. E. Baur and co-workers[3] studied the decomposition of aqueous solutions of silver nitrate in sunlight photosensitised by zinc oxide. C. Renz[4] observed that titanium dioxide becomes markedly photosensitive in the presence of certain organic liquids and reducing solutions, particularly glycerol. Gopala Rao[5] studied the photosensitised oxidation of aqueous ammonia in sunlight with titanium dioxide and zinc oxide as photo-sensitisers. He has also observed that the oxidative de-amination of various amino-acids in sunlight is markedly accelerated by these photo-sensitisers. Goodeve and Kitchener[6] studied the photosensitised decolorisation of wool violet by titanium dioxide. Photosensitisation by solids is of great practical and theoretical interest. We have now observed that stannic oxide exhibits marked photosensitive action in the oxidation of aqueous ammonia and the reduction of potassium nitrate, in sunlight. Colloidal hydrous stannic oxide as well as the ignited oxide act as photo-sensitisers, though the latter is somewhat more active. Ammonia is oxidized to nitrate and potassium nitrate is reduced to nitrite.

Some of the results are given below :—

A. 200 c.c. of N/2 solution of ammonia + 0·25 gm. of SnO_2 + 50 c.c. water.

B. 200 c.c. of N/2 solution of ammonia + 50 c.c. of 0·5 per cent. SnO_2 solution.

Hours of exposure to sunlight in pyrex-glass flasks	Nitrite nitrogen mg. per litre	
	A	B
3		
8	1·076	0·677
16	2·333	1·458
25	2·918	1·945
35	3·676	2·363
53	4·568	3·061

It is evident from the above table that ammonia in aqueous solution is oxidised to nitrite in the light transmitted by glass. In the absence of stannic oxide or other photo-sensitisers the oxidation occurs only in the extreme ultraviolet.

It is well known from the work of Warburg that potassium nitrite decomposes to nitrite in ultraviolet light of wavelength shorter than 3000 Å. Now we have found that nitrate reduction can occur in light transmitted by glass in the presence of stannic oxide.

A. 200 c.c. of M/10 KNO_3 solution + 0·25 gm. of SnO_2 + 50 c.c. water.

B. 200 c.c. of M/10 KNO_3 solution + 50 c.c. of 0·5 per cent. SnO_2 sol.

Hours of exposure to sunlight	Nitrite nitrogen mg. per litre	
	A	B
10	1·199	1·090
27	2·567	2·333

We have also observed that the decolorisation of various dyes, *e.g.*, methyl violet, methylene blue, brilliant green, is also photosensitised by stannic oxide.

Further work is in progress.

CH. I. VARADANAM.
G. GOPALA RAO.

Department of Chemistry,
Andhra University,
Waltair,
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[1] *Chemiker Zeitung*, 1911, 755, 774, 786.
[2] *Z. Wiss. Phot.*, 1921, **21**, 141, 168, 175.
[3] E. Baur, *Helv. Chim. Acta*, 1918, **1**, 186; E. Baur and C. Neyweiler, *ibid.*, 1927, **10**, 901.
[4] *Ibid.*, 1921, **4**, 961.
[5] *Soil Science*, 1934, **38**, 143; *J. Ind. Chem. Soc.*, 1934, **11**, 617, 623.
[6] *Trans. Farad. Society*, 1938, **34**, 570.