PHOTOVOLTAIC EFFECTS IN DYE SOLUTIONS

CONTINUING former work[1] on aqueous solutions of Erythrosin and Chrysoidine, three new dyes, whose absorption extends well into the red have been investigated—Methylene blue, Methyl green and Malachite green. These dye solutions give rise to two absorption maxima and it should be interesting to note if the photo-potential also exhibits similar maxima. With reference to their photo-sensitising action it may be mentioned that when dyed on the phototropic substance, HS.Hg.CNS, a second maximum of darkening is noticed in the orange-red, the first in all cases practically coinciding with, or extending on either side by a short region of that due to the substance itself. These investigations yielded results similar in every way to those recorded before and confirmed the conclusions then arrived at, as will be shown presently. Further a far-reaching parallelism between the development of photo-potential and optical sensitisation may be traced which forms the subject of another communication.

A description of the apparatus will appear elsewhere in a fuller account of the work. It is however necessary to add that a vacuum type of mercury arc served as the source of illumination and potentials were measured with a vacuum tube volt-meter, in which the lighted electrode was connected directly to the grid and the dark electrode was biassed from the negative end of the filament to the potential of the free (floating) grid. Under these conditions the grid current being actually zero at the start and negligibly small at the end of a run, polarisation of the cell does not occur and the zero of the instrument does not drift.

The rise and fall of potential on insolation and cutting off the light, its variation with the concentration of the dye and intensity of illumination, do exhibit complete similarity to the dyes already examined. In the composite light of the mercury arc, Methylene blue develops a potential of 12 m.v. at a concentration of 0·0009 mg. per ml., Methyl green 10 m.v. at 0·0024 mg., and Malachite green 11 m.v. at 0·0015 mg. per ml. Of interest however is the variation of the photo-potential with the wave-length of the exciting radiation. The accompanying table gives these values corrected for the transmission factors of the spectral filters employed and the energy distribution of the mercury arc. It is particularly noteworthy that all the dyes develop maxima of photo-potential corresponding to their absorption maxima in the different regions of the spectrum and shifted therefrom by a few wave-lengths to the red.

Calculated photo-potential and wave-length

	Methyl green	Malachite green	Methylene blue
	m.v.	m.v.	m.v.
Composite light ..	10,0	11,0	12,0
436 $\mu\mu$ ..	7,0	4,0	7,5
546 ..	2,0	6,0	6,0
577–9 ..	8,0	7,0	14,0
615 ..	11,0	12,5	10,0
690 ..	9,0	7,0	8,0
700 ..	3,5	4,0	5,0

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[1] *J. Phys. Chem.*, 1934, **38**, 693.

VERIFICATION OF KAUFMANN CONDITION, FOR ARC DISCHARGE IN MERCURY

KAUFMANN[1] derived the condition for the stability in glow discharge. He showed that the *limiting point* on the falling characteristic of voltage against current in a glow discharge which will give the *smallest current* under which the glow could be maintained depends on the external resistance W in the circuit. His condition can be expressed as $W = -\tan \beta$