XXX.—*Note on the Absorption Spectra yielded by certain Organic Substances.*

By Dr. T. L. PHIPSON, F.C.S.

SINCE I published my little paper entitled "*Sur l'Application de certaines propriétés optiques des Corps à l'Analyse Chimique, &c.*," to which the Royal Society of Medical and Natural Sciences of Brussels, did me the honour to award a gold medal in the competition of 1867, and in which I called attention to the advantages that may be derived by the pharmaceutical, as well as by the analytical chemist, from the use of the prism for the examination of various organic solutions, I have become more convinced every day of the truth of Professor Stokes' observations on this subject previously brought before the Chemical

* Journ. Chem. Soc., vol. xxi (New Series, vol. vi), p. 310.

Society of London; and I believe that the recent observations made by Professor Hoppe, Dr. Gladstone, Professor Stokes, Mr. Sorby, Mr. Crookes, Dr. Reynolds, and others, who have devoted some time to the study of various absorption spectra, will become more valuable as the number of known spectra increases.

In the present short note, I wish to allude only to the principal features presented by solutions of certain organic substances when examined by a prism, perhaps more for their practical than for their scientific interest.

I was rather surprised to find recently that the beautiful chinoline blue, called cyanine, which Mr. Greville Williams, obtained a few years ago as a derivative of the alkaloid cinchonine, gave an absorption spectrum very much resembling that

of mauve—the original aniline dye discovered by Mr. Perkin. When the solutions are somewhat concentrated, they cut out a considerable portion of the spectrum, from beyond the line D to F, or even to G (Fig. 1), but when examined in very dilute solutions they both give a spectrum similar to Fig. 2, namely, a wide dark band just above D, and reaching to this line, and then another band, less dark, below D; these bands often blend one into the other, but with solutions which are not too strong, a faint streak of yellow light finds its way between them. Several substances in commerce, known as Hofmann's violet, mauveine, mauve, aniline pink, or purpurine, and some aniline

greens (but not all the greens sold under that name) show a similar kind of spectrum.

The colours of certain flowers offer absorption bands placed somewhat similarly in the spectrum; for instance, Fig. 3 is that I found presented by *Clarkia pulchella*, which is common in our London gardens; it yields its beautiful violet colour to water and its spectrum is not unlike that of the colouring matter of the flowers of *Lobelia speciosa* (Fig. 4), previously described by Mr. Sorby, which is also soluble in water.

Fig. 5 represents the spectrum of a weak solution of "magenta." It will be seen to differ from the mauve spectrum by the dark band commencing some distance below D, instead of above it; it also presents some similarity to that of the beautiful red colour derived from the flowers of a "Brompton stock," to which a drop of hydrochloric acid is added (Fig. 6).

Fig. 7 is the spectrum yielded by solutions of picric acid, picrate of soda, chrysaniline (or the aniline yellow of certain manufacturers), and certain dyes sold under the name of aniline green.

Fig. 8 is the spectrum of a magnificent green solution obtained by mixing picric acid and cyanine. This forms a bright-emerald-green solution, and yields a vivid spectrum composed exclusively of red and green.

Many years ago, the celebrated astronomer, William Herschel, spent some time in endeavouring to discover the medium through which the disc of the sun could be studied with the least fear of injury to the eye. After a great number of experiments, he finally arrived at the conclusion that a solution of black writing ink was the substance which should be preferred to all others, and the spectrum of this solution (Fig. 9) shows, indeed, that it must answer the purpose exceedingly well. It is characterized by a general absorption, similar to that which is observed with the colouring matter of the petals of wall-flowers, stocks, and other *crucifera*, the darkening being more pronounced towards the violet and red extremities of the spectrum.

I have seen it stated that the colouring matter of the purple holyoak, which grows abundantly in Greece, has been used for imitating the colour of wines. Dr. Landerer, professor of chemistry at Athens, was the first, I believe, to call attention to this fact. I imagined that the prism might detect this colour,

and therefore examined the spectrum of the colouring matter in question dissolved in water containing a trace of alum, and that of the grape as seen in a sample of pure Bordeaux wine. The two spectra are seen side by side (Figs. 10 and 11), and it is easy to distinguish them. The pure colouring matter of the

grape gives no absorption bands, but a general absorption, like that of the *cheiranthus* (wall-flower) before mentioned, but gradually darkening towards the violet. With this I compared also the orceine red derived from English lichens (*ramilina*), by the fermentation process, which might be used for a similar purpose. Its spectrum is shown (Fig. 12).

Lastly, I may mention that I have observed the peculiar spectrum recently described by Dr. Thudichum, consisting of three absorption bands between F and H, and ascribed by him to a yellow substance called *luteine*, that would appear to exist in the yolk of eggs and in the petals of many flowers.

I find that the flowers of *Cytisus racemosus*, the colouring matter of which is soluble in water, give this luteine spectrum very distinctly.