Original and Selected Papers.

ON SPECTRAL ANALYSIS APPLIED TO PHARMACY.

BY E. B. SHUTTLEWORTH.

A perusal of the interesting paper on this subject, read by W. W. Stoddart, F. G.S., F.C.S., at the recent meeting of the British Pharmaceutical Conference, induced me to repeat the experiments therein detailed, with a view of ascertaining whether the constancy of the spectra was such as could be relied upon; and whether the spectroscope could be applied with advantage to the detection of adulteration, and substitution, as suggested by the author.

The instrument used was constructed by D. K. Winder, of Toronto, and contained four flint glass prisms, having a refracting angle of seventy degrees. An ordinary coal oil lamp was employed as a source of light, with a small condensing lens for increasing the intensity when required. The liquids examined were, in all cases, contained in white glass bottles of 0·5 inch diameter, of the kind commonly known as one drachm homœopathic vials.

Two sets of experiments were made; one with the preparations diluted, as nearly as possible, to the same extent as recommended by Mr. Stoddart; the other, with the tinctures in an undiluted state, the condensing lens being employed to increase the light.

In comparing the results of the first set of experiments with those obtained by the author of the paper referred to, considerable differences were observed. Some of these were apparently traceable to a difference in the powers of the instruments employed; as in the cases of Tincts. Stramonii, Sennæ, and Lobeliæ, which exhibited well marked lines, though none were mentioned by Mr. Stoddart. The principal variation was found, however, in those instances where a partial absorption, or darkening were described, or where one color was stated to overlie another. An inquiry into the cause of this want of coincidence revealed the fact that the amount of absorption varies with the state of dilution of the substance under examination, and that the result is further modified by the intensity of the light. This was rendered particularly evident in the case of Tinct. Iodi. Mr. Stoddard describes the spectrum thus:—"Impervious to light, except in a thin stratum. When diluted, the blue and violet are absorbed, and part of the green much darkened." My observations were as follows:—

Undiluted:—All absorbed but part of the red, which appears as a bright band.

Moderately diluted:—Violet and blue absorbed; green partially so.

Dilute:—Violet absorbed, blue partially absorbed.

Very dilute:—Violet and blue partially absorbed.

Here we have four distinct spectra of the same preparation, each of which might be taken as characteristic, if the precise degree of dilution or intensity of light were given; but without which the indications, as a practical test for the recognition of the substance under examination, are of no value whatever. Many other instances of disagreement might be adduced, but, as it is probable that they all arise from the causes mentioned, it will not be necessary to allude to them.

The question to be settled is, What is the proper degree of dilution? Mr. Stoddart says the ratio should vary from two to ten times or more; Tinct. Hyos. Bienn. requiring three or four times its volume of proof spirit, to be seen to the best advantage. This is not my experience, as the spectrum of Tinct. Hyos. Bienn. appeared to the best advantage when undiluted. The chlorophyll lines in Tincts. Sennæ, Stramonii, and Lobeliæ, which were not noticed by Mr. Stoddart, were observed in the undiluted preparations. Instead of dilution, I should recommend an increase of the light by means of a condensing lens. In this way the greater number of the liquids can be examined in their ordinary state. The same intensity of light might be employed by different operators by selecting a standard of comparison. For instance, a degree of light which just rendered visible the red band in Tinct. Iodi. might be taken; this tincture is one of the best that could be chosen, as its color is constant, not being dependant on variable vegetable constituents.

From the experiments made (and the results were in all cases verified by Mr. Winder), I do not think the application of spectral analysis will result in much practical advantage to pharmacy. As a means of distinguishing between various preparations it is not of particular value, as the experienced eye can as readily recognize a tincture by its color in the bottle, as its spectrum in an instrument, although, perhaps, not with the same nicety. After a little experience, the spectrum of a liquid may be foretold by judging of its color. Greenish tinctures, as those from leaves, invariably show a dark line, or lines; yellowish or reddish tinctures always absorb more or less of the violet or blue. It is purely and solely a matter of color. The addition or subtraction of colorless substances does not affect, in any way, the spectrum, except a change of color is produced; and, as the activity of a preparation seldom depends on coloring matter, very little is to be expected from the spectroscope in detecting adulteration or substitution.

As a source of pleasure and interest to the pharmacist, however, this new application of spectral analysis promises much, scarcely less than the brilliant appearances of incandescent bodies. Indeed, the spectra of some liquids even rival in beauty some of the finest lines of the metals. A solution, in alcohol, of the coloring matter of ordinary grass, is particularly to be noticed as exhibiting chlorophyll lines of great distinctness. Some of the aniline colors, dissolved in alcohol, are also remarkably pretty. A somewhat uncommon appearance is given by the color known as "Bleu de Lyon." The middle of the spectrum is entirely absorbed, leaving the red and violet as bright bands; when very dilute, a line appears in the yellow, which is then visible.

A handy substitute for the side prism may be noted. When a comparison of two spectra is desired, it may be effected by bringing the bottoms of the vials containing the liquids together, before the slit. Of course, it is necessary for the bottles to be quite full, and corked.

On the Process for Preparing James's Powder.*

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More than two centuries ago a medicine was in repute made by burning shavings of hartshorn or of bones along with sulphuret of antimony, and continually raking or stirring them together until the sulphur was burnt off, and the powder had become light grey or ash-coloured. It was known as Lile's and Schawanberg's fever powder, and was much used about the middle of the seventeenth century.

In 1746, Dr. Robert James, a physician of talent and eminent learning, finding the powder to be an excellent medicine, and having made a trifling alteration in the process of preparing it, secured a right to the exclusive manufacture by a patent. The conditions of obtaining a patent were that the petitioner shall make oath that he is the sole inventor, and that he has deposited in Chancery a true and precise specification of the mode of producing the article for which he seeks the monopoly. But Dr. James was not the sole inventor, nor did his specification disclose his process; nor could the powder, thenceforward called "James's Powder," be prepared by the means which he pretended were sufficient: he conceived that his best security was secrecy. Dr. James, therefore, virtually had no patent right.

For a long series of years nothing was certainly known of the composition of the powder until the investigation was undertaken by Dr. George Pearson, who in 1791 gave an account of it to the Royal Society, and a communication which was published in the 'Philosophical Transactions.'

A medicine founded on the experiments of Pearson, and intended as a substitute for James's Powder, was introduced into the

* From the Pharmaceutical Journal, London.