

come within the scope of a chemical report to discuss the possible medicinal value of this bitter principle, but it may be assumed that it possesses active properties, and I am inclined to think that these are tonic rather than poisonous.

E.—Colouring Matters.

The chief colouring matter of the *Phormium* leaf is the usual green colouring matter of plants, namely, chlorophyll. This substance is extracted by alcohol from the dry leaves in abundance, but it is left behind in an altered or decomposed state when the alcoholic extract is evaporated and then boiled out with water. It is not necessary to dwell upon the properties of so universally distributed a substance as chlorophyll, particularly as there seems little or no probability of its being turned to account in the arts. Its interest in connection with the present inquiry appears wholly to lie in the following consideration. In preparing *Phormium* fibre the chlorophyll may give rise to stains or discolourations if it be not rapidly and thoroughly removed in the first processes to which the leaves are submitted; for though chlorophyll may be removed easily from the fresh leaf cells containing it, yet this colouring matter is susceptible of certain changes, the products of which, having a dull green or brown colour, are not very easily dissolved from the stained fibre. They seem to find their way into the central cavities of the fibres, from which it is difficult to remove them. But the chlorophyll is accompanied by another colouring matter, which appears to give rise to certain reddish-brown stains on the *Phormium* leaf and fibre. I am inclined to think that this colouring matter originates in a peculiar principle, of an acid character, which not only exists in the healthy and vigorous leaves of this plant, but which may actually be developed by an alteration of one of the constituents of the fibre itself. I refer to the substance mentioned in my former report under the name "pyrocatechin" (see page 18 of that Report.) A large quantity of this substance, which has the chemical formula $C_6 H_6 O_2$, appears to be found, as I previously concluded, from the mere heating of the *Phormium* fibre with water to a temperature of 150° centigrade, when about one-fifth of the weight of the dressed fibre taken is dissolved and transformed into soluble matter. My conclusions on this point have been lately confirmed by another chemist, F. Hoppe-Seyler, who has made pyrocatechin by heating pure linen filter-paper to a temperature of 210° centigrade, for four to six hours, with water. But the action on the *Phormium* fibre, though requiring a much lower temperature, is far more extensive than is the case with flax, with hemp, or even with Manila. We have therefore, in the natural occurrence of pyrocatechin in the *Phormium* leaf, and in its easy production by the action of heat and moisture upon the very substance of the fibre itself, a mode of accounting for some at all events of the discolourations and alterations to which the *Phormium* fibre is liable under some modes of treatment. For it must be remembered that pyrocatechin gives rise to a variety of colour-reactions under the influence of chemical re-agents, &c. Of this matter I shall however speak in the next heading of the present section.

F.—Organic Acids of the *Phormium* Leaf.

In describing the mode adopted of separating the bitter principle of the *Phormium* leaf, I mentioned the lead subacetate precipitate, formed from the extract of the plant, as containing the lead compounds of the organic acids present. When this lead precipitate has been washed with water and decomposed with hydro-sulphuric acid, it yields a mixture of several acid substances. From the small quantity obtained of these bodies, and the difficulty of separating them, I can give but very slight indications as to the acids of the *Phormium* plant. These appear to be oxalic and citric acids in small proportions, and pyrocatechin in greater amount. This latter substance has been already alluded to under the heading E. It has many of the characters of an acid. Its occurrence in the extractive matters of *Phormium tenax* was recognized by—

1. The formation of a precipitate with neutral lead acetate, and the solubility of this precipitate in acetic acid.
2. The volatility and odour of the substance.
3. The darkening of the solution by the addition of lime-water and exposure to the air.
4. The dark green colour produced by the addition of ferric chloride, and the subsequent change of this colour to a red or purplish red by the addition of an alkali.

§ 2.—MINERAL MATTER OR ASH OF THE LEAF OF "PHORMIUM TENAX."

The amount of ash in the whole leaf of this plant was recorded in my last Report.* The percentage of ash in the fresh plants corresponds to 1.59 per cent.; in the dry plant it is no less than 5.56 per cent. There is, however, according to a recent determination made in my laboratory, rather a higher percentage of ash in the lower part of the leaf than in the whole leaf. A fair sample of the lower part of the leaves—from one-third to one-quarter of their total length—was prepared, and a careful burning gave, of ash, 6.91 per cent. Of this ash the most valuable, but not the most abundant, constituent is probably potash. An estimation of this substance in the ash prepared as above described, showed the presence of 12.45 per cent. of potassium oxide (K_2O), corresponding to 18.28 per cent. of potassium carbonate (K_2CO_3 .) It may be roughly calculated that 100 lbs. of the fresh butts of the *Phormium* leaves would yield, on burning, an amount of ash containing at least one-third of a pound of pearl-ash. This fact may be of some utility in connection with the preparation of the leaf for the after processes by which the fibre is separated; the ash of the rejected parts of the leaves being applicable to the preparation of a lye, by which the valuable parts of the leaf could be partially cleansed.

§ 3.—EXPERIMENTS WITH PREPARED FIBRE.

Most of the experiments now to be detailed are connected with the oiling of the *Phormium* fibre. The samples used were submitted to certain tests so far as regards their hygroscopic condition, ash, and natural grease, with the following results:—

* Appendix to Journals, House of Representatives, 1871, G. No. 4A., p. 12.