

§ 4.—CELLULOSE IN PHORMIUM FIBRE.

The term “cellulose” is used in chemical and botanical literature without much precision. The whole question of the real nature of the substances named “cellulose,” “bast,” and “fibre,” requires a thorough investigation. In the following experiments I have aimed at comparative rather than absolute results; but, at the same time, I have not rested content with the indications furnished by the usual method of determining the per centage of fibre in vegetable products. A control of the results has been attempted by means of the employment of three different processes. As these methods will be frequently alluded to subsequently it may be as well to describe them briefly here.

I.—The Nitric Acid and Potassium Chlorate process, or F. Schultze's process.

Two grams* of the dry substance are placed in a glass stoppered bottle with 1.6 gram potassium chlorate, and 24 grains nitric acid of spec. grav. 1.10. The mixture is left for fourteen days at a temperature not exceeding 18° centigrade. At the expiration of this time, the contents of the bottle are mixed with some water, brought upon a filter and washed, firstly with cold and secondly with hot water. When this washing is complete, the fibre is emptied into a heater and heated to 74° C for about 45 minutes with weak ammonia solution, (1 volume commercial ammonia to 50 volumes of water). The fibre is then brought upon a weighed filter; and washed, firstly with dilute ammonia, as long as this passes off colored, then with cold and hot water, then with alcohol, and lastly with ether. Carded cotton gave by this method 91.15 per cent of residue. Carded cotton may be regarded as one of our purest forms of normal cellulose, as may be seen by the following analysis:—

	Per cent.
Hygroscopic water	7.56
Cellulose	91.15
Oil	.51
Ash	.11
Albuminoids and undetermined	.67
	100.00

II.—The Acid and Alkali method.

Three grams of the powdered or finely cut sample are placed in a large beaker, 150 cubic centimeters of water added, and the mixture brought to the boiling point, with constant stirring to avoid burning, 50 centimeters of five per cent H2 SO4 are then added, and the boiling continued for half an hour; the normal total volume of 200 cubic centimeters being obtained throughout the operation by the addition of a little boiling water. Collect on a filter the residue from the digestion with acid, after having siphoned off the clear supernatant liquid. The residue is to be thoroughly washed on the filter with hot water, and then syringed off the paper into the beaker with about 100 cubic centimeters of hot water. Fifty cubic centimeters of a five per cent solution of Na HO are next added, and the beaker filled up with hot water to the mark indicating 200 cubic centimeters. The mixture is boiled for half an hour, some cold water added, and the whole allowed to rest. When the supernatant liquid is clear it is siphoned off, and the residue collected on a weighed filter, washed with the dilute ammonia water used in method I. as above; and in the remaining steps of the process treated exactly as described in detailing that method.

III.—The Sulphuric Acid method.

One gram of the substance is placed in a small stoppered bottle with 30 cubic centimeters of sulphuric acid of specific gravity 1.53, and allowed to rest 36 hours. The mixture is then washed into a beaker, diluted with water, filtered, and the residue on the filter washed with warm water. The rest of the process is conducted as in methods I. and II. This method removes from mixed fibres all the normal cellulose they contain, dissolving, for instance, cotton completely, and linen nearly so, but removing smaller quantities of substance from wood tissue.

CELLULOSE.—Determinations of the per centage of Cellulose in various specimens of prepared *Phormium tenax* fibre, and in other fibres, for comparison.

	By Method I. per centage.	By Method II. per centage.	By Method III. per centage.
<i>Phormium</i> fibre No. 1	73.1	...	...
" " No. 5	67.5	...	...
" " No. 9	69.0	...	...
" " No. 11	72.0	49.76	7.1
Manilla Hemp	68.80	...	...
Irish Flax	74.10	...	...
Russian Hemp	72.10	...	...

At a slightly higher temperature Method No. I. gave rather smaller per centage of residual cellulose. In these cases, which are given below, the residues were treated successively by Methods II. and III., and thus the cellulose, and incrusting or deposited matters, were separated into three kinds:—

	Cellulose by Method I. Per centage.	Cellulose by Method II. Per centage.	Cellulose (?) by Method III. Per centage.
<i>Phormium</i> fibre No. 1	64.25	52.22	.48
" " No. 13	63.00	46.45	.70

* The gramme of 15.432 grains is here meant, and also throughout the Report.