Admiralty Tests with Phormium Fibre.

A notable advance was made during the year when the results of the tests made with New Zealand phormium fibre by the British Admiralty in association with the Imperial Institute became available. These tests have been in progress since 1925 at the Imperial Institute, where the inaugural trials indicated that small-scale trials under service conditions were warranted. For this purpose, 30 tons of "high fair," "low fair," and "young leaf" grades were made into cordage of various dimensions and issued to the Royal Dockyards and to His Majesty's ships in different stations. The result of these large-scale trials is given concisely in the following extract from a circular letter written by the Director of the Imperial Institute:—

> "The breaking-loads of the cordage of all sizes immediately after manufacture equalled (and in most cases exceeded) the standard of the Government departmental specification for Manila cordage. The reports received from ships and shore services were, in the great majority of cases, definitely favourable, and no noticeable distinction was drawn between the cordage made from the three grades of fibre.
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> "In view of the promising results of this investigation the Admiralty has decided that New Zealand hemp cordage may be used in the Navy for specified purposes so long as supplies can be obtained at satisfactory prices and the yarn and cordage give the breaking-strains demanded by the official specification. Subject to these conditions, and to the continued satisfactory behaviour of cordage made from New Zealand hemp, the question of its more general adoption will receive consideration."

Cellulose Pulp from Phormium (New Zealand Flax).

Cellulose pulp prepared from phormium has been frequently advocated in the past as a material for papermaking, and more recently its use for the manufacture of rayon (artificial silk) has been suggested. Two methods have been proposed for carrying out the pulping, one in which the green untreated flax is subjected direct to the action of chemicals in a digester, the other in which the flax is first treated mechanically to separate the fibre from the waste material of the leaf, and the fibre then subjected to digestion with chemicals. The advantage of the first is that there is practically no mechanical loss of cellulose. With the second, while some cellulose is lost in the mechanical pre-treatment, there is a much reduced bulk of material to be digested, and the pulp obtained is of a better colour and should require less bleaching.

In discussing yields of any product from flax the moisture present in the flax when treated must always be known. Moisture in the flax leaf while growing may be 70 per cent. or more. When cut, the leaf dries out considerably, and after some days may contain only 55 per cent. of moisture, or less. It is evident that a ton of green flax containing 70 per cent. of moisture—*i.e.*, only 30 per cent of dry matter, including fibre—would give a less yield of pulp than a ton of similar flax which had partly dried on standing to 55 per cent., moisture—*i.e.*, contained 45 per cent. of dry matter. It is important, therefore, in comparing yields of any product obtained by different methods or at different times to know the percentage of moisture, or, to put it in another way, the actual dry weight of the flax treated. Similarly, the moisture of the product must be determined. The results can then be brought to the same basis by calculation. A convenient basis is flax with 65 per cent. of moisture, which is probably not far from the average of cut flax delivered at a mill. For pulp it may be assumed that when air-dried it would contain 9 per cent. of moisture.

Laboratory pulping trials were carried out by Dr. J. S. Maclaurin by treating 1 lb. weight of green flax in a small digester for 3½ hours at 172° C. with 4 or 5 per cent. of its weight of caustic soda in solution, and in one case with the addition of 0·5 per cent. of sodium sulphite. The pulp, after washing, was bleached with bleaching-powder. The yields of bleached pulp with 4 per cent. soda, were 14·8 and 13·6 per cent. for two determinations, with 5 per cent. soda, 12·8 per cent.; with 5 per cent. soda and 0·5 per cent. sodium sulphite, 13·5 per cent. The average of these is 13·7 per cent. When only 4 per cent. of caustic soda was used for digestion the consumption of bleaching-powder was very high. A similar laboratory trial by Mr. W. Donovan, using 4·1 per cent., of soda and 0·08 per cent. sodium sulphite, gave a yield of 14·2 per cent. bleached pulp. A semi-commercial trial, using 200 lb. of green flax, with 8¼ lb. of caustic soda and 2½ oz. sodium sulphite (4·15 per cent. and 0·08 per cent. respectively) gave a yield equivalent to 13·3 per cent. bleached pulp. It is therefore evident that green flax of average moisture content, when digested direct, does not yield more than 14 per cent. of bleached pulp. Expressed in other words, at least 7 tons green flax are required to produce 1 ton of pulp.

For the second process, involving mechanical treatment of the flax prior to digestion, there are no direct figures available. Figures obtained at the Bureau of Standards, United States of America, and also by Dr. Maclaurin, indicate that the yield of good-quality pulp from ordinary scutched fibre is not more than 60 per cent. As 6 tons of green flax would, under very good conditions only, give 1 ton of scutched fibre, this is equivalent to 10 per cent. on the green leaf. Comparing with the 14 per cent. obtainable by direct digestion, it is evident that the mechanical pre-treatment may diminish the yield, and the advantages of better conditions of digestion and better appearance of pulp may be to an extent nullified.

The cost of chemicals for the processing is high, and even if flax could be delivered at the works for 10s. per ton, it seems improbable that bleached pulp could be produced for much less than £18 per ton at the works. (By installation of expensive machinery for the recovery of soda, this cost could be somewhat reduced.) The price of wood cellulose pulp landed in Great Britain, is from £11 to £15 per ton. It is essential, therefore, to know whether phormium pulp is superior to wood pulp for any purposes, and