they were obtained. They were instituted especially for the purpose of ascertaining the precise action of certain chemicals upon the flax plant, and although much of this work will have already been performed by others, some portion may be new, and the whole will possibly have an interest and a value, from the care and exactness with which it has been endeavoured to conduct the inquiry.

Mechanical Preparation.—It was found absolutely necessary to commence the process by bruising the leaves. The leaves chosen were about seven feet long, from old plants, and the whole of the leaf was taken except about one foot of the base. The double leaf was placed upon a smooth block of hard wood and smartly struck over every part with a hammer, the iron head of which had its flat striking part rounded off at the edges to prevent the cutting of the fibre. By this process the bundles of fibres in the thick part of the leaf are easily separated from each other, but the top part of the blade, from its thinness, is much more difficult to break up.

The nature of those two constituents of the plant which are supposed to interfere most with its preparation was first examined into.

Bitter Principle of Plant.—This was found to be a non-nitrogenous, non-crystallizable body, of a pale yellow colour, feebly soluble in water, more soluble in alcohol, and capable of being absorbed by charcoal, and from which it can be dissolved away by alcohol. It refuses to form salts with acids or bases—it has all the character of a neutral substance. It is entirely removed by the repeated washing of the bruised leaf in water. In its concentrated form it is a very pure and intense bitter, and might be used, perhaps, to communicate a bitter taste to beer, in the absence of hops. It would at least be less objectionable than drugs that are said to be used for this purpose.

Nature of Gummy Part.—Soluble in water, but very slightly so when cold, and unless the solution is very much diluted, it thickens, on cooling, to an opalescent jelly. It is insoluble in alcohol; also in aqueous solution of caustic or carbonated alkali, or solution of soap; indeed, a clear solution of gum is rendered turbid and thick by either of these. On the other hand, it is readily soluble in sulphuric acid, strong or dilute, a thick opalescent mixture of it with this acid quickly changing to a limpid and nearly transparent solution, the whole of the gum being dissolved with the exception of a few flakes of some gelatinous substance, which floats freely about in the liquid, and which are probably nitrogenous matters. In its chemical character and physical properties it much resembles gum arabic. When once dried or merely desiccated in a natural way, it is only partially soluble in water, at least it is soluble only with great difficulty, and when in this dry state it is very hard and brittle; probably it is this circumstance that tends greatly to injure badly prepared flax, the delicate fibres of which must be cut as with a knife by such a substance when they are twisted about in the process of manufacture.

Action of Various Chemical Agents upon the Leaves of the Plant.

Action of Sulphuric Acid.—Three ounces of the bruised leaf were warmed up with twenty ounces of water, and two grains of concentrated sulphuric acid, previously diluted with water, were added. But this quantity was found insufficient to produce any result, even on long boiling, and the quantity of acid had to be increased to eight grains before any decided effect took place. With this quantity the green colour of the leaf was turned brown, and the solution also was coloured. Other three ounces of the leaf were therefore taken and treated with eight grains of sulphuric acid as before, and after boiling the whole for two hours, it was found that every part of the leaf was easily scraped clean by the nail, and the fibre did not appear to be damaged; it was, however, very harsh and inflexible.

Further experiments proved that if the boiling process was kept up much longer, or if the amount of acid added to it was largely increased, the fibre was greatly damaged.

Action of Hydrochloric Acid.—Hydrochloric acid was then substituted for sulphuric, with precisely the same results.

The effect of an organic acid was next studied.

Action of Oxalic Acid.—Oxalic acid was selected, as, from its being in a solid form, more exact quantities could be employed. 1,516 grains of the leaf were placed in 20 ounces of water, and boiled with 20 grains of crystallized oxalic acid, and digested for three hours, when the leaf was so much affected that it was easy to scrape it clean with a blunt instrument. This treatment did not impair the strength of the fibre at the time, though afterwards its strength seemed to decrease. The fibre obtained was bright and lustrous, and of a gray colour, but still harsh and inflexible, and, as was the case with the mineral acids, an increased quantity injured its strength. It was therefore evident that the use of organic acids possesses no special advantages over that of the cheap mineral acids.

Action of Alkalies.—1,120 grains of flax were put into 30 ounces of water, and one per cent. of caustic potash added, and the whole warmed for four hours, or until the leaf would scrape clean with the nail. In this case, though the fibre was clean it was very tender, and no matter how the quantities were varied, no useful result was obtained, for simultaneously with the cleansing of the fibre, there was a weakening which could not be avoided. The same results were obtained when carbonate of soda was substituted for the potash.

These results are difficult to reconcile with what is said about the non-detrimental effect of stronger solutions of the alkalies, than those employed as above, upon linen goods in the process of cleansing them for the bleacher, but probably the fresh fibre of plants is more easily affected by the action of alkalies, than the same fibre after passing through the various operations used in preparing it for the manufacturer.

Action of Oil.—The dry leaf was heated with it for some hours, but no advantage was gained, the leaf remaining unaltered.

Action of Alcohol.—The high price of this re-agent would of course prevent its use, even if the re-distillation of it from waste solution for further use was resorted to.

An unbruised leaf was found to be merely discolourised by the loss of its chlorophyll, the external varnish being first removed, nor was the bruised leaf more favourably affected, the gum, as before stated, being quite insoluble in alcohol.

Action of Soap.—The last chemical experimented with was soap, its solvent powers upon many