viously been prepared for the purpose, by being dried and rendered pliant by beating; and thus arranged, it is carried from the field to be submitted to what may be regarded as the commencement of the special operations for the separation of the textile fibre.

Before entering upon the description of the process employed for the separation of the fibre, it will be useful to give a short account of the minute structure and chemical composition of the stem of the flax plant.

If you take a piece of flax straw and examine it, you will find that it can readily be split up into three parts, which are placed one round the other. The exterior of these is a thin membrane of a green colour in the unripe plant, which is replaced by a fine yellow as the plant approaches maturity. The second portion you will observe to consist of extremely fine hair-like filaments, while inclosed by these filaments, and occupying the centre of the straw, and usually perforated by a hollow canal, there is a comparatively thick layer composed of a brittle material which cannot be split into threads.

A transverse section of the straw with a penknife will show these three portions presenting the appearance of rings or circles of different diameters placed one within the other. So far it is possible by the naked eye, and especially when the stem has been softened by maceration in water, to recognize its division into three portions; and the flax grower is well aware that the thin investing skin and central brittle woody matter are of no value to him, but must be broken up and removed, to enable him to obtain the fine filaments which are inclosed between them. It is these delicate, but at the same time tenacious fibres, which give the flax plant its chief commercial value; and the separation of them in the most perfect form, and with the least expenditure of time and labour, has for several years occupied the attention of men of science and of manufacturers in all parts of Europe.

If we take a horizontal slice of flax straw, and examine it by the assistance of the microscope, we obtain some additional information respecting its structure. It shows us that the external layer or zone, the "skin" of the plant, is composed of extremely delicate membrane, formed by the union of minute cells or vesicles closely pressed together, while the middle layer or ring consists of a number of tubes with very minute cavities, their walls or sides being apparently formed of numerous layers of lining material, by which the cavity has been almost obliterated. These tubes or elongated cells have been termed *bast cells*, and constitute in flax, hemp, and other plants, the material employed for textile purposes. Proceeding inwards from the circle of bast cells, we find the third layer composed of short cells, hardened by deposits which render them brittle and inelastic.

The chemist, whose science enables him to resolve the various structures of plants into their elements, discovers that all the parts of which the flax straw is made up consist chiefly of a substance possessing, in every case and in every plant, from the apparently green slime-like covering of the stagnant pool to the stately tree, with its complicated arrangement of wood and bark and leaves, the same elementary composition, being formed by the union of the elementary body, carbon, and the elements of water, oxygen and hydrogen. Such is the composition of the simple rudimentary substance which forms, as it were, the skeleton of flax, and of every other plant. But associated with this universal building material of the vegetable world, to which the name of *cellulose* has been given, are discovered, lining and strengthening these cells, and contained either in a solid form within their cavities or dissolved in water, other substances, as starch, gum, sugar, a peculiar gum-like substance named dextrine, oils, colouring matters, and resins. The greater number of these substances are analogous to cellulose in composition, and consist merely of carbon and the elements of water; but accompanying them we find other substances, which contain, in addition to carbon, oxygen, and hydrogen, the element nitrogen, of which the gluten, or sticky matter of wheat, affords an example, and respecting which chemistry has made known to us the singular fact that they closely resemble in their composition the casein or cheesy matter of milk, the albumen of the white of egg, and the substance which forms the chief constituent of animal flesh. We also find invariably united with these compounds certain saline and earthy matters, derived from the soil, and indispensable to vegetable development.

From the results of numerous examinations of flax straw which have been made in the laboratory of the Chemico-agricultural Society, both of Irish and foreign flax, the following statement may be regarded as correctly representing the proportion in which these constituents of plants are usually associated in the mature flax straw immediately after its removal from the field of the farmer. One hundred parts consist of:—

Wax	0·270
Resinous matters, volatile oil, and lino-tannic acid	1·090
Sugar and colouring matter	5·630
Inorganic matters	2.910
Pectine	0·360
Nitrogenized compounds, soluble in water	0·885
" " insoluble in water.	4·269
Insoluble inorganic matters united with the fibre	2·500
Fibre	82·137
	100.00

One hundred parts of the ash of flax straw consist of the following ingredients:—

Potash	13 88
Soda	5·33
Chloride of sodium	6·47
Lime	18·86
Magnesia	4·10
Oxide of iron	5·40
Sulphuric acid	11·16
Phosphoric acid	9·63
Carbonic acid	10·37
Silica	10.37
	100·43
Ash per cent. in the straw	3·89

Several of the substances which analysis shows to be contained in the straw of the plant dissolve readily in water, and may be removed from it by simple maceration. But the cellulose itself, which