quantity to liberate the sulphurous acid. The material is simply steeped or worked in this solution for several hours.

Whether "gas bleaching" or "liquid bleaching" is employed, the subsequent washing should be very thorough, since both the sulphurous acid used and the sulphuric acid formed during the operation are retained very tenaciously by the wool. The presence of any trace of sulphurous acid is especially objectionable when the bleached yarn is to be woven along with dyed threads, since many colors are considerably modified, and others entirely destroyed, by treatment with this reagent. Sulphurous acid is, moreover, much more difficult to remove than sulphuric acid, and, therefore, it is the custom with some bleachers to pass the material after washing through a dilute solution of bleaching powder, or (better) hydrogen peroxide, which at once oxidizes the sulphurous to sulphuric acid. This is then removed by further washing with water.

Theory of the Process.—Several theories have been put forward to explain the decolorizing effect produced by sulphur dioxide upon the natural coloring matter of wool. It has already been mentioned that wool bleached by this process gradually re-acquires a yellow color, and this fact gives support to the idea that the bleaching action consists in a reduction of the coloring matter to a colorless state, the original color being restored by a slow oxidation of the same by the atmosphere. Another theory supposes that the sulphur dioxide forms a colorless compound with the coloring matter; but that the first-named supposition is correct is rendered additionally probable by the fact that other reducing agents —such as stannous chloride in acid solution—will also decolorize the fiber.

(To be continued.)

THE LINEN OR FLAX FIBRE.*

Linen is the fibre of the flax plant (Linum usitatissimum), which is largely grown in France, Belgium and Holland, in Great Britain, Ireland, and certain districts of India, and in Russia, America, Canada, etc. There are a few other species of flax plants, but they are of insignificant value from an industrial point of view The fibre is a bast fibre, and is found between the bark and the woody tissue of the stem. It is separated from both by the process of retting in water and scutching. The fibre as met with in commerce is very variable in length—from two or three inches to several feet. It is made up of a number of distinct filaments, which can be readily separated from one another. The whole fibre is notable for its length, color, fineness and strength. The filaments are also comparatively long, ranging from 0.157 inch to 2.598 inches, while the diameter ranges from 0.0006 inch to 0.00148 inch. When examined under the microscope the flax fibre is seen to be of a tapering form and pointed at each end, of a polygonal section, and with a central canal. It is somewhat variable in diameter through its length. The walls are comparatively thick, which adds to its tenacity, while its suppleness and the length and the nature of the surface are of considerable importance from a spinning point of view.

The flax fibre as met with does not consist entirely of the fibre proper, but is accompanied by some other substances of a woody, waxy, etc., nature, the quantity of which varies with the nature and extent of the retting and scutching processes to which the fibre has been subjected. Of these impurities brief mention may be made.

By treatment with boiling alcohol, from 3.4 to 3.6 per cent. of extractive matter may be obtained from flax. A portion (about half) is deposited on cooling. This substance has the properties of a wax alcohol, and investigation shows it to be ceryl alcohol, $C_{27}H_{55}OH$. There are also present small quantities of other bodies of a ketonic character. It is the presence of this wax alcohol that causes the bleaching of flax to be so difficult, as it very strongly resists the action of alkalies.

Cold alcohol extracts from flax a quantity of matter (about 1.5 per cent.), which appears to have a complex composition, containing chlorophyl and products derived therefrom, a little ceryl alcohol, and a large quantity of an oil having an orange green fluorescence, which is a ketone of some kind and to which body the peculiar odor of raw flax is probably due. Accompanying the cellulose there are also about 25 per cent. of pectose-like bodies, which are easily soluble in boiling weak (1 to 2 per cent.) solutions of alkali, to which solutions they impart a yellow color. Nitric acid converts these pectose substances into mucic acid.

The oil wax is of very considerable importance in the spinning of linen thread, serving probably as a lubricant. Many attempts have been made to supersede the retting processes now in use, but some if not all of these have been failures on account of the fact that the fibre prepared by their means has not spun well. This may probably be ascribed to the fact that they have removed the oil wax from the fibre, which becomes, therefore, deficient in lubrication, and the fibres have not that freedom of motion necessary to spin well. On the other hand, to eliminate these waxy and oily matters from the cloth after being woven, necessitates a most elaborate bleaching process.

The flax fibre is classified as a pecto-cellulose, that is, a fibre which is accompanied by a quantity of non-cellulose bodies of a pectic or pectose character, whose main characteristics have already been pointed out. Another feature is that they give gelatinous hydrates.

It has been stated above that boiling with weak alkalies removes the pectose constituents from the flax fibre, leaving the cellulose constituent intact. It is considered by some authorities that we must view the flax fibre as being a distinct compound of these two constituents, hence the term "pecto cellulose", but this view does not seem to be altogether correct. Probably the pectose constituents are present as products of decomposition of the wool and bark surrounding the fibre

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