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WATER FILTRATION FOR INDUSTRIAL PURPOSES.

In a paper read before the state meeting of the Franklin Institute, January 18, 1911, by Mr. Churchill Hungerford, the attention of the members was directed to the importance of a standard water for industrial purposes.

Disregarding the hardness of the water, the reduction of which is not properly a function of filtration, there are a number of apparently harmless forms of pollution that are very troublesome in many instances. A case was mentioned where a party engaged in the manufacture of gorgeously printed lap robes, made use of large wooden blocks impregnated with certain colors imported from England. These colors are all mordanted with alum, and finally washed. Trouble developing in the washing bath, led the manufacturer to investigate the source of his water supply. The examination showed that the major part of it was derived from a shallow lake about seven miles back in the country. The elevation of the water in this lake had been raised four or five feet a number of years ago and overflows a peat-bog over a square mile in extent. During winter it is customary to close the outlet of this lake and allow it to fill up. About the latter part of May, when the water in the stream begins to get low the gates are opened and the highly colored water from the lake takes the place of the comparatively clear flow. When this colored water reaches the mill and the alum saturated lap robes are washed in it, the coloring matter derived from the peat is precipitated by the alum upon the fibre, and the more color there is to the water the greater the discoloration of the goods.

Another instance mentioned was in a city of some 60,000 inhabitants supplied from a fairly large stream. The water from this stream possesses considerable color and is filtered by means of a mechanical filter plant. This mechanical filter plant is very well operated indeed, shows a very high bacterial efficiency and is ideal in every particular save one, and that is that for some reason or other a small amount of hydrate of alumina, formed during the chemical treatment of the water with alum, finds its way through the filters. This has no hygienic significance whatever and the inhabitants of the town are enthusiastic over the many virtues of their filter plant insofar as the potability and appearance of the water is concerned. However, there are a number of large silk dye-works in this town and this trace of hydrate of alumina present in the water prohibits its use in silk dyeing. Most of the dye houses are located along the banks of the same stream from which the city supply is drawn but at a point below town. The stream at this point is not only badly contaminated with sewage but the discharge from the silk dye houses themselves enters into it making the general color of the water blue-black. Nevertheless, the silk dyers have solved the problem of water supply by filtering this badly contaminated water with a filter which will not permit hydrate of alumina to pass through it. The filtered water is, of course, crystal clear and entirely free from dye.

Originally filtration for industrial purposes meant the removal of clay, silt, and vegetable stains from the water. The problem at that time was a simple one as it merely meant that enough alum or sulphate of alumina or similar coagulant was employed as a preliminary treatment, after which the water could be passed through the filters and would be suitable for industrial purposes.

The filters of to-day have to remove industrial wastes, consisting very largely of dyestuffs, waste liquors from paper and pulp mills, chemical wastes from wire-drawing plants, gas-house liquors, tannery wastes, etc. Some streams contain only one or two different varieties of contamination while others contain several.

In some instances the ingredients existing in streams may be precipitated by discharged material entering the stream from another source. For instance, the waste dye from a woolen house mingling with the waste soap from the fulling and finishing department, coming in contact with lime dissolved in the water would by this agency be precipitated and dropped to the river bed. If sulphate of iron were being emptied into the stream at another point, it would combine with the coloring matter and form a heavy precipitate, so that it would be possible that much of the solid matter would form a coating of mud on the stream bed, and thus lessen the load on the filters.

The object of filtration is to remove all these substances which attempt to gain entrance into the storage vats of the manufacturer.

The next consideration is to precipitate as cheaply as possible the remaining deleterious substances. The most economical and effective substance for doing the major part of this work is sulphate of alumina. The writer realizes that there will be considerable protest made in favor of sulphate of iron and lime. Nevertheless so far as his own experience goes, and, in fact, the experience of some others, sulphate of alumina is cheaper, safer, more satisfactory and far easier to apply than sulphate of iron and lime.

Having applied the sulphate of alumina with a due regard for the alkalinity of the water as evinced by the chemical analysis, the treated water is allowed to flow slowly through a settling tank. The period of time occupied in sedimentation varies greatly with different waters. In some cases one and one-half hours may be sufficient. In others three hours. Occasionally twelve hours are required. Generally speaking, however, three hours sedimentation with aluminum sulphate for a coagulant is sufficient.

We occasionally find, however, upon operating a plant that complete decoloration of the water is not effected and that there is a very offensive odor. If large masses of sediment rise from the depths, come to the surface, spread out and disappear, and one point in the sedimentation basin shows a fairly good degree of sedimentation while further along where sedimentation ought to be further advanced we find the water far more turbid than when first introduced into the basin. The sewage in the water is simply fermenting and this fermentation is not only interfering with sedimentation by reason of the gases evolved but is producing resolution of the impurities entrapped by the hydrate of alumina.

It is necessary to stop the fermentation of precipitated matter. Copper sulphate (bluestone) applied at a strength of two or three parts per million will, in certain cases, cause