

failure of similar constructions, when these are apparently exactly the same, but in a locality with a totally different mineral deposit.

**Biological and Aesthetic Considerations.**—In common with the changes caused chemically and bacterially, there are many other biological changes desirable for the securing of the more aesthetic qualities of a water supply, such as color, taste, and odor. The mechanical filter is highly successful in treating waters which have to be dealt with in regard to these qualities. The slow sand filter rarely removes more than 20% of the color, while with the mechanical filter total elimination is possible. Odors which are caused by decomposition of vegetable matter are rarely disagreeable, but living organisms, or vegetation may also cause them. Many forms of bacterial or organic growth give off matters of an oily nature, which have a smell peculiar to the species from which they are exuded, in a way analogous to the poisons given off in the body by pathogenic bacteria.

Agitation may break up these bubbles of oil and spread them through the water until the odor is accentuated. In the same way heat, when applied, scatters the oily products and exaggerates the odor until it can be definitely compared with others known to the physical sense. The number of such organisms present in the raw water determine the intensity of the odor, and the various intensities may make the smells appear different, while they are really produced by the same organism.

It is possible that the substances producing the aforementioned qualities may have a poisonous effect on the human system, but unfortunately science has not yet been successful in demonstrating this.

Odors of decomposition are usually set up in the water pipes of a system, by the action of the filaments of plant life attaching themselves to the inside of the walls, propagating there, then becoming detached when in a state of partial decomposition. This is the frequent cause of pitted pipes, as the preservative coating is detached along with the organism, allowing rust to set in. Every system should be flushed out completely and thoroughly, periodically, as a safeguard to the preserving of the pipes against such action, and the maintaining of the physical qualities of the water at the highest standard.

Color is entirely the result of dissolved vegetable matter, and is, therefore, generally associated with taste or odor produced by the same substances. The oxygen used in the oxidizing of the vegetation in solution sometimes gives an insipid taste to the water, which is simply removed by aeration, to replace the occluded oxygen.

In the removal of odors due to organisms, filtration is effective, while the absorptive tendencies of coagulants collect the globules of oil, together with the organisms producing them. Products of decomposition are retained in the same manner, and those growths which attach themselves to the piping in the water system are prevented from passing into the supply. They cannot then become nauseating by detachment.

Nature has been copied as closely as possible in the filtration of public water supplies, and the results of slow sand and mechanical filters are practically the same as those performed naturally.

**Auxiliary Chemical Treatment.**—When water is too soft, it frequently sets up an acid reaction, particularly in the case of peat discolored supplies, which has the effect of dissolving the piping through which it is conveyed. This brings about lead poisoning to the consumer. The absence of mineral salts is a plausible cause of rickets and bone weakness.

Waters which are very hard may also be productive of plumbo solvency when they give an acid reaction, and are frequent causes of constipation and troubles of the digestive organs.

Extreme hardness leads to a stunted and ossified growth in individuals, as is well instanced in the Cretins, a race of dwarfed people who live near the Swiss borders, and use very hard waters.

The commercial side is also important, as the extra cost of fuel with hard waters, and the high cost of soap to a community is very burdensome.

With such waters hardening should take place prior to filtration, or softening where necessary, by the addition of lime water to increase hardness, or an excess to reduce the same trouble.

**Danger in Extreme Purification.**—A note of warning might well be sounded before attempting to exceed the results produced by natural means, as in the tendency in Canada at the present time.

The exigencies of modern civilization demand the collection of human beings in congested sites for the pursuit of industry. The consequent polluting of water supplies, with the subsequent necessity for treating them follows.

In the old tribal times there were no large communities gathered together for a long period of time. The people were constantly moving from one camping ground to another, and oxidation had time to effect purification after a site had been deserted. The spread of disease was to a great extent safeguarded by the absence of a means of conveyance in the shape of water systems, public vehicles, etc., and the water supply was carefully guarded from pollution by those in the camp using them. The dread intestinal diseases of bacterial origin were not much heard of until the commencement of the industrial era, and most of the scourges which attacked communities were of a zymotic nature rather than an intestinal.

*Is there not a possibility that attempts to purify our drinking supplies are being carried too far? Would it not be wise to determine what is the maximum extent to which it is safe to go?*

The healthiest communities are those with natural water supplies, often carrying a large bacteria count of harmless germs, with a small proportion of mineral salts. Yet, modern demands cry out for sterilized drinking water. Even distilled water, devoid of all natural salts, is being largely consumed, while recent investigations into the large number of tubercular patients in navies using distilled water exclusively, point to the demineralization of the human system as conducive to the inroads of the tubercular germ. Much interest will be shown in the experiments now being conducted by French scientists to prove that the absence of mineral salts in drinking waters is a forerunner of the wasting disease.

An attempt has been made to show the vast importance of bacteria in the great scheme of existence. Are we not eliminating some of the bacteria which an all-seeing Providence has provided for the performance of vital functions in the body?

Professor Metchinkoff, in one of the most interesting and masterly treatises of modern times, in summing up the results of his investigations into the longevity of a certain European race, demonstrates clearly that the scouring action of bacteria present in their national beverage of sour milk is probably the reason for the felicity obtained by that people.

In our food and drinking supplies, water conveys bacteria directly from the soil, other bacteria are deposit-