MUNICIPAL DEPARTMENT

THE MUNICIPAL WATER-SOFTENING PLANT AT WINNIPEG.

In the spring of 1899, the city of Winnipeg found itself in possession of a waterworks system purchased from a private corporation for $237,500, and with about $462,500 available toward the construction of an improved plant. It was proposed to obtain a new supply from a series of wells, and work was begun by sinking a pump well 17 feet in diameter and 48 feet deep. The quantity of water encountered in this one well was so great, amounting to more than half again as much as the present consumption, 1,400,000 imperial gallons per day, that work on the chain of proposed supply wells has not been started. While there has thus been no trouble with the quantity of the new supply, its quality has unfortunately left much to be desired in respect to hardness, and a softening plant has been recently built by the Pittsburg Testing Laboratory to remedy this defect. The annual report for 1901 of Col. H. N. Ruttan, city engineer, contains an interesting chapter on this plant, from which the following notes have been prepared.

The character of the water, in parts per million, is given in the following statement of analyses by Prof. E. B. Kenrick, of the University of Manitoba :

	Untreated.	Treated.
Calcium	91.5	21.1
Magnesium	67.6	42.8
Sodium	167 2	167 8
Iron and aluminum	Trace	Trace
Silicic acid	7 3	4.2
Sulphuric acid	172.9	172.4
Chlorine	242.0	242.0
Hardness as $CaCO_3$	510.4	231.1

The temperature of the water in the ground is about 42 degrees Fahr., but the supply as it comes from the well runs through a surface condenser of a 75-horse power engine, which raises its temperature considerably.

The carbonates of lime and magnesium and the sulphate of magnesium cause the hardness of the water. The softening process removes only the first two, as it would be necessary to add soda ash to the water to remove the magnesium sulphate, and thus incur an expense out of proportion to the benefits derived. The extraction of the carbonates eliminates rather more than two-thirds of the hardening substances in the supply.

It is not generally understood how lime can remove lime from water. The confusion arises from the free use of the word "lime" to cover all the compounds of the element calcium. The lime in the water is in the form of carbonate of calcium, while the lime used for water softening is calcium oxide, two wholly different substances. Lime is made into lime water before it is used for softening water. Lime water is made by agitating water with an excess of slaked lime until it has become saturated. After that, even if filtered perfectly clear, it is of full strength still. One thousand imperial gallons of water will dissolve 13 pounds of calcium oxide.

Hard water at Winnipeg contains carbonates of lime and magnesium besides other substances already mentioned, but of no importance in this connection. These carbonates are held in solution by carbonic acid gas which the water dissolved from the air or soil before it was able to dissolve the carbonates of lime or magnesium from the rock. Any means which will abstract this carbonic acid from the water will soften it because the carbonates of lime and magnesium will at once separate from the water. Boiling softens the water for this reason, but it would be impracticable and undesirable to soften a public water supply in this manner. It is possible, however, to accomplish the same thing without the use of heat. If any substance having a strong affinity for carbonic acid is added to hard water, it combines with the acid and sets free the carbonates of lime and magnesium which thereupon separate and settle out as a white powder, leaving the water soft. Such a substance is found in the builders' line of the trade, the best grade being the cheapest to use. For convenience it is slaked and converted into lime water. When the lime water is mixed with hard water, flakes and crystalline matter are observed to separate at once. These consist of carbonate of lime, formed by the union of the lime which was used with the carbonic acid in the water, also the carbonate of lime which was in the hard water, also the carbonate of lime which was in the hard water, and lastly, hydrate of magnesium produced by the action of the lime on the magnesium carbonate in the hard water.

It is thus apparent that all of the lime which is used for softening is converted in the process into carbonate of lime which separates immediately from the water, bringing with it the carbonates which were in the hard water.

(To be continued.)