

many years ago in a paper before the Pennsylvania State Board of Health, that unpurified surface-water is always unfit for drinking, and that, as concerning it, analyses—bacteriological and chemical—are academic. The object of science is, of course, the discovery of truth, and from this point of view, any addition to knowledge, whether the discovery of a new marking on Mars or the properties of the circle in non-Euclidian space, must be appreciated, but the sanitarian deals with the purely utilitarian phase of science. I think there is no more important problem before the people of the United States than the conservation of the water supply, and it is the duty of informed persons to insist with all possible energy upon the necessity in economy in the use of water, for maintaining the quality of the original material and for reducing the cost of the subsequent purification of the effluent. For these reasons, I regard the water-meter as a most important sanitary agent.

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ADVANTAGES OF SOFTENED WATER IN LAUNDRY WORK¹

By J. H. RYAN

Received November 8, 1916

My topic to-day is what advantage softened water has over hard water, the saving not only to the laundryman, but also to the customer, and what the possibilities are for the equipment of a modern laundry with an efficient water-softening plant.

The laundries of this country in 1914 transacted business amounting to \$142,503,350, and there was paid for labor \$71,764,059; the amount invested in machinery, equipments, buildings, etc., was \$98,055,000. These figures give some idea of the magnitude of the laundry business, and yet, as a matter of fact, it is still in its infancy. The majority of the laundries in this country are devoting most of their time to the laundering of the provincial stiff collar and shirt, but this portion of the business is by far the smallest part of the work that the average American home has to offer. For example, one man in Michigan decided he would enter the family wash field and in less than one year increased his business over \$1400 per week. When the American laundry is properly equipped and makes the proper effort to obtain this class of work, the field is practically unlimited.

It might be well for us to consider for a moment the class of work, also the difficulties that the laundrymen have to contend with. Laundry is cosmopolitan in its service. There is, of course, a wide range in the quality of the fabrics treated. Not many years ago fabrics manufactured in this and other countries were heavier, very much stronger and would therefore stand more grief in the laundry. This class of goods is seldom ever used now; it has been replaced with thin delicate fabrics which are "loaded," sometimes to the extent of from 10 to 70 per cent in order to make them heavy and apparently more durable. Aside from this, every conceivable color known comes to us from day to day, which, in treatment, must receive the utmost care. Hence, the problem is a very different one from that of twenty years ago. The question that the laundrymen are trying to solve is how to do this class of work for American homes with the least wear and tear and at the lowest possible cost.

For more than a quarter of a century I have been in the laundry business. About half of that time I was connected with a laundry that used hard water exclusively. I can best illustrate the point I am trying to make by giving you a little personal experience I had more than twenty years ago. In those days we heard very little about water analysis, or at least the laundrymen knew very little about it. All they knew about washing

was this: if they used plenty of caustic soda or soda ash in the soap and a plentiful supply of bleach, their clothes would come out of the machine clean, but very often they were in serious difficulties and did not know just why; neither did they know just how to work their way out of their troubles. The story I am about to tell you will demonstrate beyond any question of doubt, the value of water softening in a laundry and the danger of using hard water.

The laundryman I worked for was troubled a great deal with a yellow or brown cast in his work. His collars always had yellow seams. He insisted that it was the iron in the water that was causing this trouble and at a considerable expense he installed a filter, but this did not do away with his difficulty. At that time, and even now, a great many of the laundrymen use chloride of lime and soda for bleaching purposes; soda is used to soften the bleach, in other words to prevent it from destroying the soap. It mattered very little how much of this bleach was used, there would still be yellow seams and edges on the collars. About this time I read somewhere that oxalic acid was a good bleacher, so I made up my mind that I would do a little experimenting on my own account. I took some collars home and prepared a solution of oxalic acid and water; in this solution I placed the collars, rinsed them, and immediately the yellow seams vanished but a green tint remained and I had considerable difficulty in washing out the effects of the acid. After the proprietor had inspected the work, he asked me one day how I did it and I told him I had a new bleach; he thought so favorably of the work I was doing that he offered to form a stock company, if I would turn over the formula to them so they could manufacture it.

About this time I became a little negligent about washing the green tint out of the collars, so one day when I had an extra large amount of collars delivered to my home and did the necessary work, the foreman and the proprietor made up their minds I was using sulfuric acid; they proceeded to experiment, sent out for a bottle of sulfuric acid, filled a wooden pail three-quarters full of water and poured in the acid until they thought the solution was sufficiently strong to do the work. They then rinsed in this solution a nightshirt which had a decided yellow tint; the third time the garment went into the pail the boss found himself hanging onto two sleeves, the rest of the nightshirt resting quietly and unattached in the pail; but it had the green tint the same as I had left in the collars; after this operation was over I told them of my secret bleach and when they used oxalic acid in their rinsing and blueing water in sufficient quantities the yellow edges would disappear.

This particular laundryman never knew just why or how the acid was taking care of the yellow seams, neither did he know just what was making the yellow seams; it was the result of attempting to break hard water in the machine by using an excessive amount of alkali.

It is not necessary for me to go into detail in attempting to bring to your minds the great hazard the laundryman takes when he attempts to break hard water in the machine, especially when it is loaded with clothes. You might ask me if there is any danger in using soft water when the water is treated in a water softener. The facts are that the danger is identical with that of the hard water, so far as the use of acid is concerned; the minute the alkalinity is raised above 7 grains trouble starts and then the acid remedy will have to be applied.

There are three water softener systems that are generally used in the laundries of this country: the intermittent, the continuous and the four-pipe systems. The intermittent system is seldom used, so it leaves the field open, practically speaking, to the continuous and four-pipe systems.

About twelve years ago, we had what was known as the old Tweedale system of water softening. The process of treatment

¹ Read at the 52nd Meeting of the American Chemical Society, Urbana-Champaign, Illinois, April 18 to 21, 1916.

was purely caustic soda; we used this system for about three years and always had trouble whenever we reduced the hardness below 8 grains, because we would always have an excessive amount of alkalinity in the water so that it would take a large amount of acid to neutralize it before we were able to blue or destroy the yellow color that would appear in the goods after they were ironed. The four-pipe system, as I understand it, uses a caustic soda treatment, but they do not attempt to rinse or blue their clothes in softened water; hence the necessity of the four-pipe system. I am very much opposed to the system of washing in soft water and then rinsing in hard, because it destroys all the visible effects of soft-water washing, *i. e.*, that soft velvety feeling that clothes possess when washed and rinsed in soft water. Our water in Kalamazoo is 21 grains and is quite hard—about 3 lbs. of solids to every 1000 gallons of water. It is impossible to wash clothes in our water and reduce the hardness below 3.5 and 4 grains with any degree of safety, for just as soon as the hardness is decreased below that point there is trouble, due to an excess of alkalinity.

We have had splendid results with our water softening system. It has been in operation now for a number of years and we have never had a particle of trouble in our washroom; on the contrary the results have been unusually satisfactory. We use a continuous water softener. The treatment is 280 lbs. of building lime and 40 lbs. of soda ash to every 100,000 gals. of water. Under this treatment our water tests hardness 4, alkalinity 5 and causticity 3.5 grains per U. S. gallon.

We have not used any chloride of lime or oxalic acid since we installed our water softening plant. We use a little acetic for our blue. We have always claimed that the secret of good washing was pure clear soft water and I believe we have demonstrated this beyond any question of doubt. We believe we are doing more family washing than any other city in America twice our size and we attribute this largely to the method of treating our water and our washing methods in general.

SAVINGS MADE BY USE OF SOFT WATER

As an experiment we washed recently 100 shirts in raw hard water with 3 lbs. of neutral soap; we washed this same number of colored shirts in the same machine with the same amount of soft water with 1 lb. and 6 oz. of the same soap. We washed 95 lbs. of family washing in raw hard water with $2\frac{1}{2}$ lbs. of neutral soap; we repeated the same operation and with the same weight of clothes and the same amount of soft water as hard water with $1\frac{1}{4}$ lbs. of soap. All the soft water used tested 4 grains. This is not all the saving, however; the bleach is reduced to a minimum and no acid is required for the purpose of neutralizing alkalinity left in water or getting proper color. If we did not have a water softener, we would use about 1400 lbs. of neutral soap per week. The present market value of neutral soap is about \$0.07, which would make our soap bill \$98 a week. Our saving is thus about \$50 per week.

The laundries using chloride of lime and oxalic acid are finding them a very expensive commodity at present. To my mind the present abnormal condition of the market is one of the best things that has happened to many laundrymen for a number of years, because it has taught them that laundries using the proper kind of water softener can and do get along without the use of those chemicals and do better work. After all, what the laundry business needs more than any other one thing is plenty of pure clean soft water, and when a laundry will install a system of water softening that will produce this kind of water, a large share of its troubles will cease and the customers will be happier for they will receive their clothes clean, clear and soft. White goods will be white, soft, and last longer than when washed under any other process known to the writer.

KALAMAZOO, MICHIGAN

STREAM INSPECTION IN CONNECTION WITH THE OPERATION OF SEWAGE TREATMENT WORKS¹

By C. B. HOOVER

The treatment of the sewage of municipalities is made necessary in order that the natural advantages of our streams may be conserved. These natural advantages consist in the opportunities which our streams furnish as sources of supply for public water works and power purposes, for recreational activities, and as an important factor in adding beauty to the land.

The discharge of sewage into a stream of water may convert it into a foul open sewer, or, it may have no appreciable effect upon the stream, the result in any case being governed largely by the composition of the sewage, the dilution which the stream affords, and the prevailing temperature. There may be found to-day almost any combination of these three factors and in fact in most of our larger inland towns and cities, a wide range of combination of these three factors may be observed within a period of one year, *i. e.*, a given volume of sewage will encounter in the stream a widely varying dilution, and, in turn, the mixture of sewage and stream water will be subjected to widely varying rates of oxidation, due to changes in temperature during the year.

The object of sewage treatment is to prevent harmful stream pollution and broadly speaking, this means the prevention of the discharge of pathogenic bacteria into the stream, or, the prevention of a nuisance in the stream, or both. When the problem is simply one of eliminating pathogenic bacteria, chemical sterilization is practiced and stream inspection will reveal but little that cannot be ascertained through an inspection and analysis of the effluent of the works.

When the problem is one of the prevention of a nuisance, the desirability of stream inspection will increase as the dilution afforded by the stream decreases. The minimum dilution by the stream may be such that stream inspection will be unnecessary because a satisfactory stream condition may be safely assumed from the results of tests and analyses of the effluent of the works; furthermore, the minimum dilution may be such that assumptions of this character cannot be relied upon and the only way to check the adequacy of the treatment of the sewage is to inspect thoroughly the stream into which the treated sewage is discharged. If the stream is polluted from other sources, the results of stream inspection will not be a very reliable index of the adequacy of the treatment of the sewage which is discharged into the stream either above or below the other points of pollution.

It is thus evident that stream inspection, in order to be of value, must be comprehensive and must be made both above and below the point of discharge of the effluent of the treatment works. The absence of definite standards of purity for polluted streams would seem to indicate a difficulty as to what should be looked for in stream inspection. Where the polluted stream passes through a sparsely settled district where land values are low, the standard of purity need not be as high as where the stream passes through a thickly settled agricultural district where land values are high and where a foul-smelling and unsightly stream would seriously reduce the value of riparian properties. The keeping of a stream in a non-offensive condition might be all that would be required in the first case and if the effluent from the works will not develop an offensive odor after a two days' incubation in a closed container at 37° C., it may be safely assumed that such an effluent when discharged into a stream will not produce an offensive odor regardless of the dilution which the stream may afford, and under these circumstances, comprehensive stream inspection would hardly be necessary.

¹ Presented at the 53rd Meeting of the American Chemical Society, September 25 to 30, 1916.