Circular No. 42 **1953**

STATE OF ILLINOIS

Municipal and Home Water Softening

by

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Issued by

Department of Registration and Education

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State Water Survey Division

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Urbana, Illinois

(77650—500—9-53)

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JOURNAL AMERICAN WATER WORKS ASSOCIATION
Vol. 45, No. 6, June 1953
Printed in U. S. A.

Municipal and Home Water Softening

By T. E. Larson

A paper presented on Mar. 19, 1953, at the Illinois Section Meeting, Chicago, by T. E. Larson, Head, Chemistry Subdiv., Illinois State Water Survey, Urbana, Ill.

THERE is no need to describe in detail the types of treatment which have been designed to soften waters containing various amounts of hardness. Not only are there specific treatments for specific purposes but also different satisfactory treatments for the same purpose. Sometimes economics is the principal element in the choice of treatment, but very often the governing factor is the demand of many housewives whose standards are high.

Aside ' from highly specific treatments, there are three or four general methods vised more or less profitably by the American people: municipal softening (hardness reduction), treatment with home-owned softeners, home-serviced softening, and the use of soap or synthetic detergents.

All of these methods have advantages and disadvantages, and will continue to be employed for many years. It is the purpose of this discussion to provide factual data for evaluation of these treatments.

Comparative Costs

A reasonable basis for comparing softening expenses incurred by household consumers is the cost per unit volume of water (say, 1,000 gal). The cost of municipal softening to the consumer may be 10 to 15 or, possibly, 20 cents per 1,000 gal, and the consumer receives a water of 85-100-ppm hardness. Such water is not completely soft and should never be so characterized.

If it is conceded that 50 per cent of household consumption is "wasted" in flushing and sprinkling, "effective" cost to the householder becomes: 40 cents per 1,000 gal for water which has been reduced in hardness by 50-80 per cent. This cost estimate, though almost always higher than the actual expense, will serve for purposes of comparison.

Assuming the cost of salt for 20,000-grain regeneration to be 30-40 cents (at $1.50 per 100 lb of salt), the cost of softening 1,000 gal of water with home-owned equipment is 30 cents, if the hardness is 250 ppm; 40 cents, if 340 ppm; and 57 cents, if 510 ppm. These costs are exclusive of softener amortization and personal labor involved in the regeneration or handling of the salt. The treated water has a hardness approaching zero.

Commercially serviced softening costs may be estimated at approximately $2.30 per regeneration of a 20,000-grain unit at 4-week intervals. The cost per 1,000 gal would be $1.75 for a hardness of 250 ppm; $2.30, for 340 ppm; and $3.40, for 510 ppm. The treated water has a hardness approaching zero. If municipally softened water (effluent hardness 85 ppm) is treated

by the home-service method, the cost of the service-softened product would be approximately $1.00 per 1,000 gal.

At an average cost of 30 cents per pound for soap, the loss due to necessary softening of water with 250-ppm hardness for household use may be $3.70 per capita per year *(1),* amounting to an effective cost of .58 cents per 1,000 gal if 27 gpcd is used for purposes other than flushing or sprinkling *(1, 2).* When considering soap savings, it is essential to recognize the fact that approximately 25 lb per capita per year is necessary for washing even in completely soft water. Soap (or synthetic-detergent) consumption is not eliminated by the use of completely soft water, as is often implied. If synhetic detergents are used, the cost per pound is greater than for soap but there is no loss due to hard water. These detergents, however, are not a panacea.

The estimated effective costs of the various methods of softening are compared in Table 1. It is evident that water of 85-ppm hardness can most effectively and most economically be made available to the greatest number of users through softening the municipal supply.

TABLE 1

. Comparative Costs of Softening Methods

Softening Method	Effective Cost—$/1,000 gal			
	Initial Hardness—*ppm*			
	85	250	340	510
Municipal (to 85 ppm)		0.20	0.27	0.40
Home owned (salt cost)*	0.10	0.30	0.40	0.57
Home serviced	1.00	1.75	2.30	3.40
Soap	0.26	0.58	0.76	1.08

* Not including amortization of softener, which would be $0.88 for 1,000 gal for an 8-year life (or $0.47 for a 20-year life), assuming $200 softener, a family of four, and a water use of 27 gpcd for all purposes except flushing and sprinkling.

Comparative Effectiveness

The figure 85 ppm is dictated by the limitations of lime softening and by the usual necessity to avoid deterioration of municipal water mains through corrosion. A properly operated municipal plant should provide a water which has a minimum tendency to scale or corrode either the utility-owned or the home-owned facilities. Although hardness reduction is thus limited, it remains an established fact that municipally softened Water is wholeheartedly approved by its consumers. This does not mean that its quality cannot be further improved. Even rain water or completely softened water can be improved for particular purposes.

TABLE 2

*. Maximum Hardness for Various Service Intervals**

No. in Family	Max. Hardness—*ppm*		
	Service Interval—*weeks*		
	2	4	8
2	500	250	125
3	330	165	
4	250	125	
5	200		

* Assuming softening unit of 20,000-grain capacity and water use (hot and cold) of 27 gpcd for all purposes except flushing and sprinkling.

As a result of the 85-ppm hardness remaining, municipally softened water still exhibits a minimal tendency to form the well-known bathtub ring; to produce some scale or sludge in hot-water tanks; to form a sticky rather than soft lather for shaving; to detract from natural luster when used in wash-

ing hair; and to leave some lime deposit in laundry.

Although synthetic detergents have not been found to improve on soap with zero hard water for washing cottons and linens, they are superior in hard or soft water for washing woolens, nylons, silks, and even dishes. Their acceptance by the public is indicated by the fact that 42 per cent of the household detergents sold in the United States in 1952 were synthetic.

The home-serviced softener likewise has disadvantages, aside from the cost, which, in the author's opinion, is not a decisive factor, as it is largely a personal-service cost, like that for car washing. This type of softener is often of 20,000-grain capacity—that is, it can remove only 20,000 grains of hardness, regardless of the quantity or quality of water passed through. The efficient operation of a servicing plant (almost dictates that the exchange for a freshly charged unit take place at regular intervals (usually 2, 4, or 8 weeks). Assuming a 20,000-grain capacity unit and a use of 27 gpcd (2) of hot and cold water for all purposes except flushing and sprinkling, a family of two cannot obtain satisfactory hot and cold soft-water service for 4 weeks if the water has a hardness greater than 250 ppm. A family of four cannot be provided with 4 weeks' service if the hardness of the water is greater than 125 ppm (Table 2).

In many communities, the softening only of hot water is popular, as the hardness is so great that the usual 4 weeks' service cannot meet the requirements of both hot and cold water. In such instances, it is obvious that completely softened water' is not obtained when cold water is used to temper the hot. The hardness of the mixture may | be equivalent to that of municipally softened water. Unmixed softened hot water can, however, be used to full advantage in automatic dishwashers and washing machines.

On the other hand, when home softeners are applied to municipally softened water (85-ppm hardness), a family of two or three can obtain completely soft water with 8-week intervals between regenerations; and a family of four or five, with 4-week intervals.

A survey by one of the soft-water service companies has indicated that 27 per cent of the services were being provided to high-income families (6 per cent of all spending units, with an annual buying income greater than $7,000); 57 per cent of the services, to the middle-income families (64 per cent of all spending units, annual buying income $2,000-$7,000); and 16 per cent of the services, to the low-income families (30 per cent of all spending units, annual buying income less than $2,000). Although 90 per cent of those in the high-income bracket received serviced softening, only 18 per cent in the medium- and 11 per cent in the low-income brackets obtained such service. Municipally softened water, therefore, benefits those with low and medium incomes more than those with high incomes.

The soft-water service companies, as well as their customers, also benefit from municipal softening. The quality of the water is less likely to deteriorate toward the end of the service interval. There is a virtual elimination of complaints and costly special service calls. It is possible to operate the regeneration facilities more uniformly. Furthermore, municipal softening not only removes the major proportion of the hardness but also iron and manganese, and color and odor treatment is usually

provided, too. All of these extra items are of great value to the soft-water service operators in satisfying their customers.

Conclusion

Municipal softening unquestionably improves hard water. Home softening is a further improvement, as is home-serviced softening. Either of the latter is made more economical and convenient by municipal softening.

Municipal hardness reduction, complete home softening, and the use of soap or synthetic detergents are all compatible. For those who prefer a, polished, completely soft water, municipal softening economically and effectively supplements home-owned and home-serviced softening, thus benefiting not only the consumer but also the soft-water service industry.

References

1. LARSON, T. E. Interpretation of Soap Savings Data. *Jour. AWWA*, 40:296 (Mar. 1948).
2. LARSON, B. O & HUDSON, H. E., JR. Residential Water Use and Family Income. *Jour. AWWA*, 43:603 (Aug. 1951).

Discussion

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Until a few years ago there was conflict between many soft-water service operators and the water works officials in their respective communities. This was especially true if the municipal body was planning to incorporate softening in its plant expansion program. In those days service operators looked upon the areas with extremely hard water as their ideal franchise. It was in those sections that sales came most easily and the public was unusually conscious of the hardness factors in the water. The hot soft water usually provided had to be tempered with hard cold water, resulting in water quality probably equaled by municipally softened water.

So much for history. Today, whenever possible, soft-water service operators provide hot and cold soft water to most of the outlets in the home. A common practice is to bypass toilets and sill cocks for lawn watering. The advent of polystyrene resins with increased capacity is also a factor in rendering better service. Soft-water service dealers operating with relatively low-hardness waters continue to grow and prosper. Their "takeout" and "exhausted-softener" problems are less frequent than in harder-water areas. Furthermore, they have learned that customers desire completely softened water, which is not supplied by municipal hardness reduction plants. As the author has pointed out, municipal and home softening are compatible and complementary.

Need for Education

There is, however, a' serious problem that municipal officials and soft-water service operators have in common: the need for consumer education on the subject. The public relations programs of both groups can and should be made a joint effort. The objectives are identical insofar as both are determined to furnish the public with the best water possible. Municipal hardness reduction plants are often desirable for the proper development of the soft-water service business.

In order to find out what the public expects from a municipal softening plant and from soft-water service, the National Assn. of Soft Water Service Operators requested the Marketing Div., College of Commerce, University of Illinois, to study the situation in Champaign-Urbana, 111., where a controversy over water rates and municipal softening had been well publicized in the local press. Cooperation was obtained from both the Illinois Water Survey and the local water works manager.

The final report brought out some significant facts. Seventy-five per cent of the consumers did not realize that they would be getting only partially softened water from a municipal plant, but the overwhelming majority thought it would either cost the same as or less than commercial softening. The report also noted that: "[1] Woefully large groups of people answered 'don't know' to almost all questions, indicating a failure of the newspaper articles to date; and [2] even those who are properly aware of the problem get confused. Therefore, it would seem that more publicity using different terms is needed to correct both problems" (*1*).

To attain its objective of informing the public so that there can be no opportunity for misunderstanding, the service operators association has adopted a program:

1. To educate its own members on the need for a close relationship with the municipal plant.

2. To furnish literature and data to be used in direct mail to customers.

3. To provide operators with a "press book" that points out the difficulties encountered in poorly written news articles.

4. To urge its members to work hand in hand with the municipal water works officials at all times in a common effort to educate their mutual public.

The soft-water service operators association agrees with Larson that "For those who prefer a polished, completely soft water, municipal softening economically and effectively supplements home-owned and home-serviced softening, thus benefiting not only the consumer but also the soft-water service industry."

It is evident from market research and practical experience that clearer terminology and better methods of public education are necessary to build proper public relations and understanding of municipal and commercial softening services. The operators association is now using the terms "municipal hardness reduction" and "completely softened water" in an attempt to meet this educational need. A better way may be found if water works management and soft-water service operators continue to apply their minds to the problem.

Reference

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