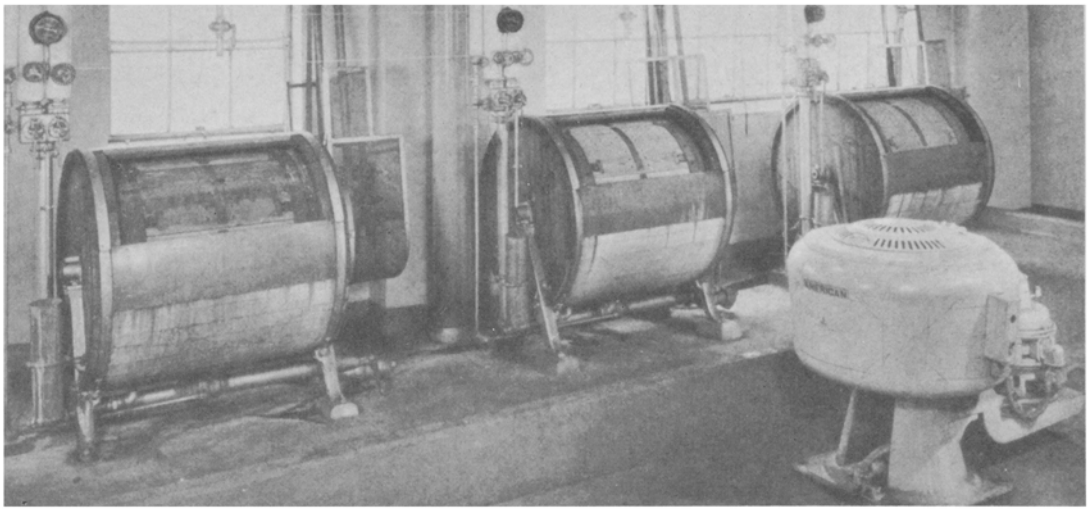


Experimental laundry for testing detergents

Notes on Power Laundry Practice

By C. E. LENNOX

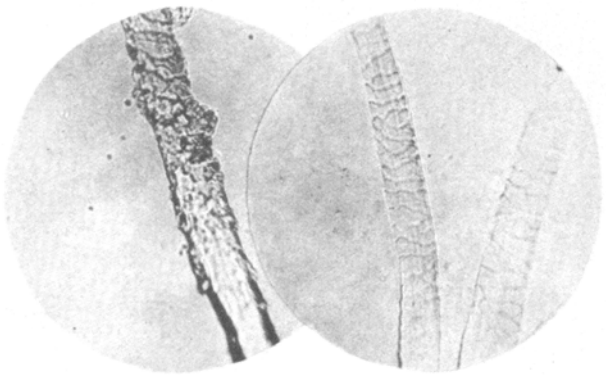
Swift and Company, Chicago

Scientific Study and Evaluation of Soaps and Other Detergents Under True Laundry Conditions of Inestimable Value to Industry

THE power laundry industry is one of the largest consumers of industrial soap products and although the use of soap in this industry is closely allied to cleaning operations in general, the methods and equipment employed present problems that are not found elsewhere.

It is important to differentiate between a power laundry and other laundries. Although the distinction is not sharp, the line of demarcation has been set largely by the size of the plant and the volume of business handled. This in turn determines the kind of equipment used and the methods employed. Power laundries, as the name implies, use power-driven machines for practically all washing and finishing operations, while hand laundries, unable to finance the investment in power equipment, must be content to do much of the work manually. The power laundry, because of its volume of business, is in a position to invest in water softening equipment, adequate boiler capacity, and other necessary auxiliaries to the actual laundry equipment, all of which are essential for the proper handling of commercial laundry work. It is usually adequately financed, has good credit and is run by a business man with abilities commensurate with the investment. These power laundries represent a stable business, akin to a utility but without the monopolistic privileges granted utilities. They are, therefore, constantly finding new competitors in the form of poorly operated hand laundries, outgrowths of the work of laundresses, that are started on the proverbial shoe-string and run until the initial capital is exhausted. It is seldom that the owner of this type of hand laundry has the slightest conception of laundering methods or business principles. The equipment used is inadequate and the quality of work produced is usually inferior. These statements are not intended as a general indictment of hand laundries, since they have their place in our business structure, in many cases producing good work and ultimately growing to the proportions and methods of a power laundry. These statements, however, do explain the fundamental reasons why the washing practices of the power laundries differ from those of other laundries.

The power laundry industry of today is highly developed. There are a number of individual plants in this country each representing investment of over a million dollars and having an annual business in excess of the same figure. Estimates from the Federal Census indicate annual business for the industry in excess of five hundred million dollars. The annual

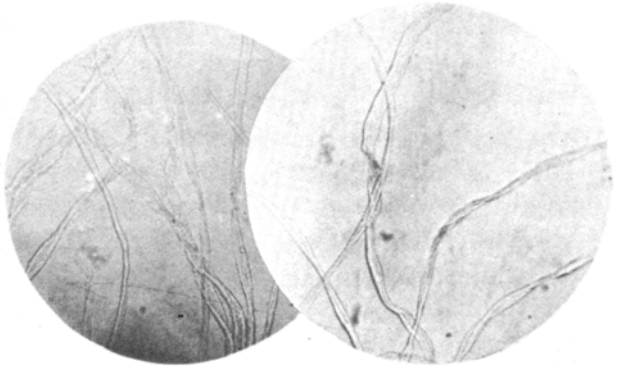


Photomicrographs of wool fibres scoured in hard water (left) and in Zeolite softened water (right). Photos on this page through courtesy of Permutit Co.)

bill for detergent materials for this industry is probably in excess of ten million dollars, even in this period of demoralized soap prices.

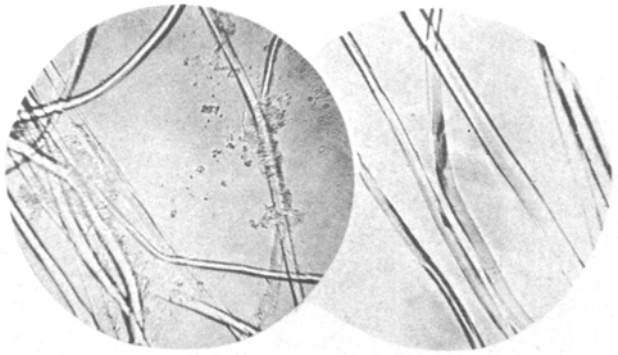
Although the machinery used in washing operations retains its fundamental design of the last century, many refinements are added annually. For a number of years rapid growth has necessitated the use of larger and larger equipment so that now a plant may handle a load of 1,000 pounds of clothes in a single machine if desired, while loads of 200 to 300 pounds are considered standard. These increased loads have introduced problems in washing that were not even considered ten years ago.

Perhaps the greatest boon to the power laundry industry was the introduction of adequate water softening equipment. In the early days—the good old days—no attempt was made to soften water prior to its use. If a plant was located in Boston it had a very good water to work with, practically soft. A city using the water from the Great Lakes was a fair place to operate, having moderately hard water. The great plains region, with high hardnesses and limited supplies, was a nightmare. Practically no adequate method of pre-softening was available. During this period many of the plants made their own soap from local tallow supplies. This soap contained liberal quantities of excess alkali to complete the saponification and was bolstered up with additional quantities of caustic soda and soda ash, in an attempt to soften the water in the washing machine. Unfortunately, the soap was a better water softener than the alkali so that attempts to prevent the formation of lime soaps were all in vain. The result was very gray looking work that even enormous quantities of hypochlorite bleaches and long boiling could not change. This experience did not aid in public acceptance of the power laundry.



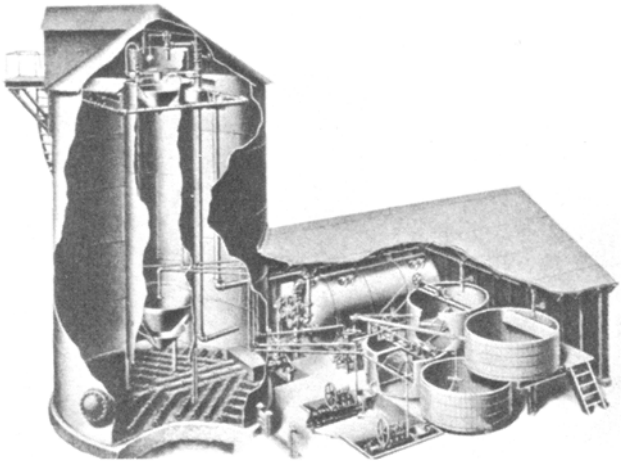
Photomicrographs of silk degummed in hard water (left) and Zeolite softened water (left). Note insoluble lime and magnesia cords on silk fibres to left, and absence to right

Later, in hard water regions, lime-soda softeners were introduced. Many were improperly designed, many were home-made, practically all were operated without any appreciation of control. The hardness of the resulting water was sometimes low, sometimes medium, and sometimes higher than the original hardness of the raw water due to excesses of lime used. Experience with attempting to soften water in the washer indicated that great excesses of alkaline materials did some good and this same practice was sometimes applied to pretreatment with distressing results. With a properly operated lime softener, the laundry could turn out superior work and save enormously on the soap costs. Large excesses of caustic alkalinity in over-treated water pre-



Photomicrographs of cotton fibres washed in hard water (left) and fibre washed in Zeolite softened water (right)

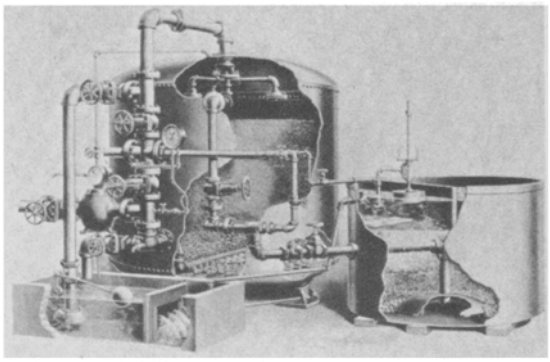
sented new problems in laundering. No longer were great quantities of caustic and carbonate alkalines necessary and no longer were there available large bicarbonate hardnesses in the water to aid in removing the excess already present in home-made soap or introduced by the treated water. This seems to be one of the logical reasons for the great spread in the use of modified sodas. The bicarbonate contents of these sodas corrected the new evil, excess causticity, which with improper rinsing was causing some discoloration. The modified soda was also useful to the plant not equipped with a lime softener since it could be shoveled on in great quantities without obtaining high alkalinities. This excess did but little good but did no harm, hence the safety plea in the use of



Cold Continuous Lime Soda Softener
(Courtesy Permutit Co.)

modified soda. It might be interesting to know that the "sodas" were actually shoveled, dry, into the washer in those days of small washers, small loads, hard water, and inadequate knowledge.

Then came the new era of the modern laundry industry. Zeolite water softeners supplied what nothing else could; zero soft water from nearly any water supply all the time—if properly operated. Gone were the days of shoveling on alkalies. With an absence of hardness and an absence of excess causticity it was thought that soap alone would now do the washing. This idea was short-lived, however, as soap alone was not sufficient. Mild alkalies were employed. Since soap was not being consumed in softening the water the savings in soap costs paid for the new water softener in a short time. With soft water came a possibility for real quality work at all times with reduced supply costs. The bug-bear of grey work was gone. The attempts to bleach to whiteness fabrics that were hopelessly grayed with lime soaps, were in the past. Clothes lasted longer and looked better; better even than the most particular home manager ever hope to do them herself. Public confidence in the laundry industry was being restored by better work.



Vertical Zeolite Water Softener
(Courtesy Permutit Co.)

This equalization of conditions in all parts of the country due to soft water has done much to standardize methods employed at the present time. Generally speaking, the power laundry industry is doing a good job. Reasonably careful operation will produce a good quality of work with but little loss in the strength of the garment.

The foregoing sketchy history, if I may call it such, brings us to a point of considering present day practice and present day needs. Many of the fundamental principles and ideas used in the power laundry are the result of practical application rather than true scientific study. The combined efforts of the industry itself and of the manufacturers of detergent supplies have brought about more or less universal standard washing procedures called washing formulas.

True scientific studies in laundering date back about 15 years. Prior to this, the reports of technical discussions at annual conventions present amusing reading matter. In all fairness to those discussions, however, we must consider the development of chemistry as a science during the same period. Since the application of scientific information to the laundry indus-

try, a better understanding of washing problems has been created. Pseudo-scientific selling attempts have soured many laundry operators on the possibility of laboratory aid, but honest, unprejudiced sources of information have largely offset this. University graduates are finding places in the larger laundries, and many sons of present owners have included chemistry in their college curricula in their preparation to take their place in the management. In addition, there are two trade schools offering practical courses that include a liberal discussion of chemistry. In spite of any opinion to the contrary, the laundry industry is eager for information and training. Highly technical articles dealing in strange mathematical formulae and expressing results in unfamiliar terms can hardly be accepted by the industry and properly digested. Neither can the mysticism of the past be continued indefinitely. The laundry industry wants definite facts, backed by adequate scientific information.

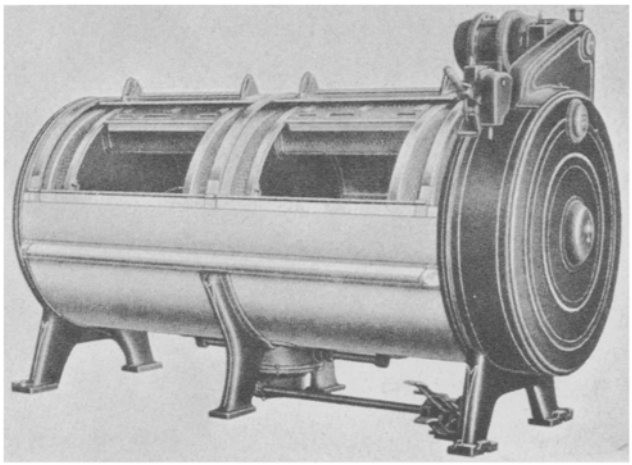
These developments can come from only two sources: the industry itself and those industries furnishing washing supplies. The industry as represented by the Laundryowners' National Association and the American Institute of Laundering maintains a laboratory at Joliet, Illinois, and another at Mellon Institute. By necessity, the work in these laboratories is very broad and generalized. Individual laundries with trained men at hand are also constantly making practical and, in many cases, technical studies. These, however, are hampered by widely divergent opinions that filter in from sources that should be in greater accord for the best good.

A review of the available information supplied directly or indirectly by the manufacturers and distributors of laundry supplies presents a picture of many studies on detergency but few definite results. The indefinite results can be well understood when the complexities of detergency are appreciated. Efforts in studying the problem have not been centered entirely on one definite principle but have been generalized to include the subject of detergency in its entire scope or on the other hand to limit the study to certain intangible and artificial laboratory standards. Individual efforts of investigators are too often directed toward the proof of the result desired rather than the report of the results as found. Power laundry requirements, home-washing needs, bottle washing, metal cleaning, shaving soaps,—endless uses of soaps are considered individually and collectively and then reported according to predetermined standards. These results trickling out through the technical and trade journals present an endless and wide difference of opinion, leaving the reader in a state of confusion.

Consideration of the power laundry washing problem should be confined only to the needs of this problem, since it is fundamentally different from many other uses of soap. The literature is filled with results applied to power laundry practice that were not even based upon the methods now employed. To define the conditions for power laundry operation there follow several important points that should be considered as a basis for experimental work on this subject:

1. Water conditions—

(a) Hardness. For all practical purposes all water supplies for the modern power laundry



Latest Type Laundry Equipment
(Courtesy American Laundry Mach. Co.)

can be considered as soft. The occasional plant without softened water can be regarded as an exception to the rule and does not deserve consideration since the poor quality of work it is probably producing can be so much improved by a water softener that until that plant utilizes a softener, there is little constructive work that can be done for it. To date, all attempts to soften water in the washer have failed miserably and have been economically unsound.

(*Continued on page* 24)

NOTES ON POWER LAUNDRY PRACTICE

(*Continued from page* 17)

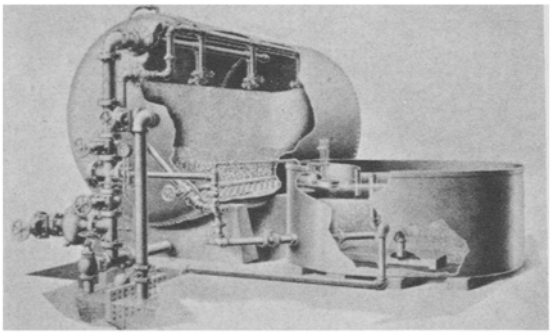
Future studies in this direction are apart from present consideration.

(b) Alkalinity. The fact that all waters used can be considered soft does not mean that they are all identical. If lime-treated, they will probably contain small amounts of carbonate alkalinity and even very small quantities of caustic alkalinity. If Zeolite treated, they will contain varying quantities of bicarbonate alkalinity. As will be noted later the low concentration of laundry supplies can be greatly affected by the alkalinity of the water used. To grossly condemn soda ash for any reason whatsoever and advocate, for example, the general use of modified soda is amusing when one considers that the use of soda ash in a water high in bicarbonates produces the equivalents of modified soda in the solution. The reverse condition is equally evident. When one speaks of water he must qualify his remarks with the specifications. Detergency studies must include consideration of these waters.

2. Concentration of Supplies—

(a) Soap. Generally speaking, the concentration of soap in actual use in a washer is in the vicinity of 0.1 per cent. In washing cleaner work or in the later sudsing operations this concentration is considerably lower. Occasionally in very dirty work it is higher. The use of soap at much higher concentrations is virtually impossible with the present type of laundry equipment, as the suds formed will inundate the washroom. Therefore, conclusions drawn on laboratory work at higher concentrations are not acceptable unless they can be scientifically correlated to prove that results at lower concentrations follow the same rule or that it is physically possible to use the laboratory concentration in the plant.

(b) Alkalies. Under this term we group the various bases and salts showing alkaline reaction. These are also called fillers in soap, builders, and detergents. Present practice causes the bulk of these materials to be used in an admixture with the soap at various proportions depending upon the type of alkali, the type of soiled work, the water, and the whim of the operator. The concentration, in actual use, seldom exceeds that of the soap—0.1 per cent—and in the case of very strong caustic alkalies, about 0.03 per cent. Translated in terms of normalities, the maximum concentrations are in the magnitude of 0.01N. When these extremely low alkaline concentrations are fully appreciated, it becomes obvious that attempts to refer to results obtained at high concentration really lack sound technical judgment. Reference to the damaging effects on cotton fabrics of a 1



Horizontal Zeolite Softener
(Courtesy Permutit Co.)

per cent solution of sodium hydroxide at a pH of 13 can hardly be considered seriously when the conditions in practice probably call for the use of a 0.02 per cent solution of sodium hydroxide in a softened water carrying sufficient bicarbonate alkalinity to not only fully neutralize the hydroxide to carbonate but also to buffer the alkalinity of the carbonate formed, resulting in a solution of a pH of about 10. The use of alkalies in aiding soap revolves largely around the detergent properties of the admixtures. Unprejudiced study in this direction would be of real benefit to the power laundry industry inasmuch as it might lift the veil of mysticism and dispel the confusion now existing. After all, soap is still the primary detergent.

3. Soil—

What is it? The correct answer would go far toward simplifying the whole problem of washing. The very fact that soil cannot be defined in simple terms has been the stumbling block of all technical experimentation. Although arbitrary standards are admittedly necessary for the study to proceed, the artificial nature of the soil chosen always leaves the conclusions open to criticism. Every standard for comparison chosen may allow a different con-

clusion to be reached, either by design or accident. Several of the most recent articles in the technical journals almost directly contradict each other because the standards of comparison chosen were quite different. Perhaps the practical laundry operator is right in his assumption that laboratory studies are of little value to him.

Perhaps the best approach is by way of practical studies aided by scientific instruments. The maintenance of the highest grade of whiteness during actual operation has frequently been the basis of constructive work. Unless all operating conditions are carefully noted, however, erroneous conclusions can be drawn because of the difficulty in controlling all possible variables entering into the washing formula. The final judgment of this procedure is the whiteness of the washed fabric. Here, again, the variables enter. Bluing, sizing, finishing, and personal taste enter into the conclusions. Some of these can be eliminated by the employment of complicated photometers. Finally, as the differences in results become small, as we approach the perfect process, the par in laundering, the method of measurement breaks down and leaves us still groping for the ideal procedure. As we approach more perfect work we must be increasingly careful in the method of measurement.

In conclusion, I would like to stress the necessity of studying this problem with the practical limits in view. Elimination of irrelevant factors will do much toward avoiding the present state of confusion regarding basic principles of detergency. Unprejudiced cooperative work should arrive at more definite statements of fact for the ultimate consumers of soap products, who in this discussion are the laundry operators. Perhaps I am leaning too heavily toward their viewpoint. If so, it is because I have spent a number of years in intimate association with them trying to fully appreciate their problems in their way.

Agash Refining Company, Brooklyn, New York, have recently installed a new winterizing plant for cottonseed oil, giving them over double their former capacity for salad oil production.

PHASE PHENOMENA IN COMMERCIAL SOAP SYSTEMS

(*Continued from page* 8)

tion, a separation of neat soap and nigre is obtained. Hence it appears that this particular soap solution can be "salted out," i. e., separated into layers, by addition of salt, water or soap.

Area N delimits those concentrations which give rise to two phases, nigre and lye. Equilibria in this part of the system are not nearly so definite and precise as in the more concentrated portions. The area, however, lies completely outside the range of soap boiling practice and is of theoretical interest only.

Summary

TO sum up, it has been found that the phase theory is applicable to commercial soap systems. Tallow soap in particular behaves as a single component in most of its equilibrium relations.

A general discussion of the system tallow soap—NaCl—H_2O has been given, with a description of the various phases which occur. The fields of stability of these phases at 100° C. have been outlined.

[THE END]

The Peruvian customs regulations provide for a special import duty of 10 per cent ad valorem on a list of commodities as follows, when imported in quantities of more than 500 gross kilos for use in industries of Peru: Coconut oil, fish oil, and coloring matter which is soluble in fats but insoluble in water, ordinarily dutiable as follows: Coconut oil 0.04 and 0.06 sol per gross kilo according to capacity of container; fish oil, 0.10 sol per gross kilo; harmless coloring matter for foods and beverages, 6 soles per gross kilo except when derived from coal tar of sulphur coloring, in which case the duty is 1 sol per gross kilo.

Sol equals $0.3999 U. S. currency.

The modern whale oil industry is based upon a dual foundation of geographic exploration and laboratory research.