insufficient amount of alkali to completely saponify the fatty acid on the enhancement or inhibition of the soap's irritant properties have not been thoroughly studied. Since the potassium soaps are more irritant than the sodium soaps and there was no irritation produced by either alkaline buffer control of these cations, it appears that the greater irritant action of the potassium soaps is due to the augmentation of the solubility of the irritant component of the soap by the potassium. The difference in the irritant action of potassium and sodium soaps becomes more marked with the laurates and increases with an increase in chain length. This observation would be expected, as above twelve carbon atom acids the solubility difference is great enough to mean that an appreciable amount of the potassium soap would be in solution but little of the sodium soap would be in solution. Studies of the actions of simple mixtures of these same soaps on human skin are now in progress.

CONCLUSIONS

1. An improved patch test method for the determination of the irritant properties of soap solutions on human skin has been described.
2. The irritant effects of the potassium and sodium soap solutions of nine pure fatty acids common in soaps have been determined on human skin.
3. Lauric and myristic acids produce the most irritant soaps of the nine acids studied.
4. Potassium soaps of the saturated acids have been found to be more irritant than the corresponding sodium soaps.
5. Females are more subject to irritation from soap solutions than males.
6. Soap irritation is not due to hydrolytic alkalinity alone.

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The Pharmacology of Soaps

III. The Irritant Action of Sodium Alkyl Sulfates on Human Skin

*By Byron E. Emery and Leroy D. Edwards**

The sodium alkyl sulfates have recently been introduced on the market in forms of shampoos, washing powders, cosmetics, dentrifices, etc., as substitutes for ordinary soaps. Little can be found in the literature pertaining to the irritant action of these substances on human skin. Carpentar (1) reports irritation of the skin in the case of a hairdresser from daily contact with a "hymolal salt shampoo." Ammonium lauryl sulfate has been claimed to produce skin irritation by Biederman (2). Because of this lack of any definite information concerning the irritant actions of the alkyl sulfates, it was considered advisable to run skin tests similar to those outlined in the preceding paper for true soaps (3).

EXPERIMENTAL

The sodium alkyl sulfates from C-8 to C-18, inclusive were supplied by the Procter & Gamble Company, Ivorydale, Ohio. The concentration of these sulfates employed in the tests was the same as that used in the tests of the pure soaps (0.0225*N*). Since in the commercial production of the alkyl sulfates it is common to add inorganic salts to enhance the detergent properties of these soap substitutes, additional tests were conducted after the addition of 0.002*N* NaCl, 0.002*N* Na_2CO_3, or 0.002*N* Na_2SO_4 to the 0.0225*N* solutions of the alkyl sulfates. The results presented here in Table I were obtained on the same 24 males and 14 females as were the results for the true soaps mentioned above. The per cent positive values for the sodium and potassium salts of the individual fatty acids are included for the

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Table I.—Per Cent Positive Reactions of Alkyl Sulfates and True Soaps on Human Skin

(24 Males and 14 Females; Soap or Alkyl Sulfate Concentration, 0.0225*N*; NaCl, Na_2CO_3 and Na_2SO_4 Concentration, 0.002*N*)

	C-8, Per Cent	C-10, Per Cent	C-12, Per Cent	C-14, Per Cent	C-16, Per Cent	C-18, Per Cent
Sodium alkyl sulfates	5	5	43	24	5	0
Sodium soap	2	19	70	41	4	0
Potassium soap	13	15	89	54	13	10
Sodium alkyl sulfates plus sodium chloride	14	25	57	72	5	0
Sodium alkyl sulfate plus sodium sulfate	14	25	58	67	5	0
Sodium alkyl sulfate plus sodium carbonate	31	47	85	39	8	8

purpose of comparison. While the number of tests should be greater, the results should offer some idea as to the relative power of the different alkyl sulfates to cause skin irritation.

The values for the sodium alkyl sulfates are striking in that they show that the alkyl sulfates are much less irritant to the human skin than the sodium or potassium salts of the pure fatty acids. The results of the sulfates, however, are similar to the results of the others in that lauryl and myristyl derivatives possess the greatest irritant properties. With the addition of minute quantities of the salts of strong acids and strong bases, NaCl and Na_2SO_4, the power to produce irritation in every case except palmityl and stearyl sulfates is decidedly augmented. This increase in activity is pronounced with lower members of the series and reaches its maximum with sodium myristyl sulfate. Since there is the presence of a common ion in sodium which should give a diminution of the dissociation of the alkyl sulfates, the results suggest that the increased amount of the undissociated alkyl sulfate is responsible for the augmentation of the irritant action. Palmityl and stearyl sulfates do not respond because of their low solubility. In the case of the addition of an alkaline salt, Na_2CO_3, the results are somewhat different. Here the augmentation reaches its maximum with lauryl sulfate, and in the case of the lower members, it is much greater than the increase noted with NaCl or Na_2SO_4. Sodium myristyl sulfate in the presence of the carbonate was a jel while in the presence of the other salts it was not—this should explain the shift in the results. The high values for caprylyl, capryl and lauryl sulfates would be expected since there is not only the presence of a common ion but an increase in the alkalinity as well. Controls of the inorganic salts were negative.

CONCLUSIONS

1. Pure sodium alkyl sulfates are less irritant to human skin than the pure sodium or potassium salts of the saturated fatty acids from C-8 to C-18.

2. Sodium lauryl sulfate is the most frequent cause of skin irritation of the series studied, but it is closely followed by myristyl sulfate.

3. Sodium chloride and sodium sulfate enhance the irritant action of these soap substitutes markedly. This enhancement is greater with sodium carbonate.

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Iodocholeate*

Its Efficiency as a Germicide and Its Clinical Performance

By H. R. Scherzer and Paul Goedrich.†

In the field of disinfection and bacterial control, inorganic iodine, despite its obvious disadvantages, has been used in alcoholic or aqueous solutions practically unchanged for more than a century. However, the extensive use of iodine is limited by its irritation, corrosiveness and other disturbing properties.

As to iodine's effectiveness as a germicide in comparison with modern antiseptics, Gershenfeld and Miller (1) stated in 1931: "From the standpoint of bactericidal action, 3% solutions of iodine were found to be superior to any of the other commonly used bactericidal agents in the dilutions most frequently employed." Nye (2) several years later confirmed in effect their findings.

In 1936 Goedrich brought forth a new iodine compound which was named Iodocholeate. This new compound, the result

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