

## SALTS OF TRIETHANOLAMINE. II. DETERGENCY.\*

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Fatty acid salts of triethanolamine have been suggested as substitutes for soap in both commercial and cosmetic use because of their low alkalinity as compared with ordinary soaps. The various salts of triethanolamine with pure fatty acids (1) were subjected to washing tests to determine their relative efficiency.

*Apparatus.*—In order to determine the relative soil of the cloth employed in the washing tests, a photoelectric photometer was devised. This consisted of, as illustrated in Fig. 1, a photo-

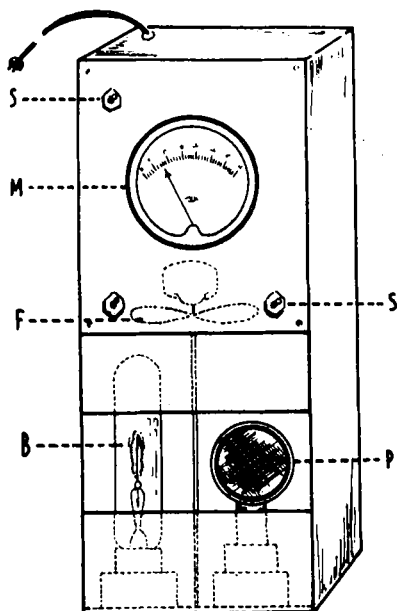


Fig. 1.—PHOTOELECTRIC PHOTOMETER  
B—projection bulb, P—photoelectric cell,  
M—microammeter, F—fan, S—switch.

electric cell (Weston Photronic Cell No. 594) mounted in a box opposite a tubular 100 watt projection bulb. The two were separated by a partition of insulating material extending to within 1 cm. of the top of the container. This partition was movable so that optimum reflection could be obtained and then firmly fixed in this position. In order that the illumination from the bulb be identical in the tests, the voltage of the current was measured at each experiment and adjusted uniformly. The temperature was kept uniform by means of a fan near the top of the bulb which removed the warm air from both the bulb and the cell. The cell was connected in series with a microammeter so that the amount of current produced could be measured.

In order to test the extent of soil of a sample of cloth, it was folded longitudinally and held firmly above the opening above the bulb and the cell so that light would be reflected to the cell and the extent of reflected light measured as microamperes. The extent of soil would be indicated by the relative amount of light absorbed. A clean cloth was taken as standard for 0% soil and a photographic plate cover was used as a standard for 100% soil. The difference in microamperes between the two

readings was divided by 100 to give data in per cent. While this is not exactly correct, for practical purposes it gave a readily obtainable measure of relative extent of soil. This apparatus has certain advantages over optical photometers in that it is less expensive and that a larger surface of soiled cloth is measured with each determination.

The apparatus for washing the cloth consisted of four wide mouth ("Mason") jars held in an aluminum frame within the agitator of a *Whirldry* miniature washing machine. The temperature was maintained by means of warm water filling the tank and covering the jars. The bottles moved over an arc of 90° and completed oscillation 80 times per minute.

## EXPERIMENTAL.

Recently ironed white cotton cloth (thread count 80 x 80 per inch), 6 x 9 inches, was soiled with artificial soil mixture, dried at 80° C. for one hour, aged over night, ironed with a low-heat iron and the extent of soil determined. Eight readings were taken with each cloth so as to cover

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a large area of both sides. Two samples were placed in 200 cc. of a one per cent solution of the triethanolamine salt and washed for 10 minutes at 45° C. The cloth was removed, rinsed in distilled water three times, partially dried on bibulous paper, placed in oven at 80° for one hour and finally dried in air for 30 minutes. The cloth was then ironed and the extent of soil determined. The soil mixture (2) consisted of:

|                               |          |
|-------------------------------|----------|
| Lamp Black.....               | 2 Gm.    |
| Liquid Petrolatum, heavy..... | 5 Gm.    |
| Tallow.....                   | 3 Gm.    |
| Carbon Tetrachloride.....     | 2000 cc. |

Four cloths were washed with each salt; the average readings of the four samples is shown in the table below:

| Salt of Triethanolamine. | Original Soil. | First Wash. | Soil Removed. | Second Wash. | Soil Removed. |
|--------------------------|----------------|-------------|---------------|--------------|---------------|
| Caproate                 | 36.7%          | 23.2%       | 13.5%         | 18.8%        | 17.9%         |
| Isocaproate              | 36.4%          | 22.7%       | 13.7%         | 18.4%        | 18.0%         |
| Caprylate                | 35.7%          | 19.0%       | 16.7%         | 16.4%        | 19.3%         |
| Caprate                  | 37.0%          | 18.4%       | 18.6%         | 14.4%        | 22.6%         |
| Laurate                  | 36.7%          | 8.3%        | 28.4%         | 5.9%         | 30.8%         |
| Myristate                | 36.7%          | 9.5%        | 27.2%         | 7.4%         | 29.3%         |
| Palmitate                | 36.7%          | 11.3%       | 25.4%         | 6.9%         | 27.8%         |
| Stearate                 | 36.6%          | 17.7%       | 18.9%         | 15.8%        | 20.8%         |
| Oleate                   | 36.8%          | 8.9%        | 27.7%         | 6.4%         | 30.4%         |

*Commercial Fatty Acids.*—The preceding tests were made with soaps prepared from pure (Eastman) fatty acids. Salts were also prepared from commercial mixed fatty acids used in the manufacture of soap. These were prepared by heating equivalent molecular quantities (based upon the acid value of the mixed fatty acids) of triethanolamine and fatty acid. Salts were prepared from the mixed fatty acids of tallow, coconut oil and red oil; the latter is equivalent to the mixed fatty acids of olive oil.<sup>1</sup>

Four cloths were washed in the same manner as above with each of the soaps; the average readings of the four samples is shown in the table below:

| Salt of Fatty Acid. | Acid Value. <sup>1</sup> | Original Soil. | First Wash. | Soil Removed. | Second Wash. | Soil Removed. |
|---------------------|--------------------------|----------------|-------------|---------------|--------------|---------------|
| Coconut Oil         | 265.5                    | 30.0%          | 14.3%       | 15.7%         | 8.3%         | 21.7%         |
| Tallow              | 198.5                    | 29.5%          | 13.9%       | 15.6%         | 6.1%         | 23.4%         |
| Red Oil             | 195.0                    | 30.2%          | 16.4%       | 13.8%         | 9.2%         | 21.0%         |

#### SUMMARY.

An apparatus is described utilizing a photoelectric cell to determine the extent of soil of cloth. Pure salts of triethanolamine were subjected to washing tests. The following salts had definite detergent action: laurate, oleate, myristate, palmitate (in order named). None of these salts possessed as great a detergent action as ordinary soap. Triethanolamine salts of commercial mixed fatty acids possessed detergent action in the order named: tallow fatty acids, coconut oil fatty acids, red oil.

#### REFERENCES.

- (1) Fiero, G. W., *Jour. A. Ph. A.*, 27, 658 (1938).
- (2) Rhodes, F. H., and Brainard, S. W., *Ind. Eng. Chem.*, 21, 61 (1929).

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