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U. S. DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

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Letter Circular

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DETERGENTS AND DETERGENT AIDS

This Letter Circular provides general nontechnical information concerning cleaning and laundering materials and furnishes references for those who wish further information on these subjects.

The National Bureau of Standards has no publication which gives recommended formulas for, or describes in detail the manufacture of, detergents and detergent aids. These materials are manufactured by chemical processes which require careful control and special equipment to insure satisfactory products.

Reports of analyses or tests of detergent products made by the Bureau for the different agencies of the Government are not released to the general public. The Bureau does not issue or maintain an "approved" list of these products.

National Bureau of Standards Circular No. 424, "Washing, Cleaning and Polishing Materials," discusses briefly the chemistry of soap making, describes the various types of soap products in common use, and outlines some of the manufacturing processes. This circular also briefly discusses the use of water in laundering; the theory of cleansing action; dry cleaning methods; and the use of alkaline cleansers, bleaches, laundry sours, bluing, starch, polishes, etc. ~~It may be procured at 15 cents per copy (stamps not accepted) from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.~~

Various reference books on soap manufacture give formulas for making different types of soaps and detergents and describe the operations involved and the equipment required. These books, some of which are listed at the end of this circular, also describe the raw materials used, the various processes of saponifying oils or fats, recovery of glycerin, etc.

SOAPS

Soaps are cleaning agents made by the action of alkali on fats or fatty acids. Strictly speaking, all metallic salts of the higher fatty acids are soaps; but the fatty-acid salts of the alkali metals and of certain organic bases such as triethanolamine are the only ones that are soluble in water, and therefore the only ones commonly used as cleansers in aqueous solutions. A good soap is one that is completely saponified and gives an abundant lather.

Home-made soap.- Soap that is satisfactory for some household cleaning operations can be made from kitchen or garbage grease. However, the quality of the soap depends not only upon the character of the grease used, but also to a considerable extent on the other materials and the process employed. Soap made from kitchen grease is generally softer and darker in color than commercial soaps. A simple formula for the manufacture of soap in the home is given on page 25 of Circular No. 424. Similar formulas are frequently found on commercial packages of lye. In general, it probably will be found more satisfactory to buy ready-made soap than to attempt to manufacture it on a small scale. It should be noted that soap making is a chemical process requiring careful control and special equipment for the production of a high grade, completely saponified product containing no free alkali. Such control is not possible with the usual household equipment.

Toilet soap.- Toilet soaps must be neutral, that is, neither acid nor alkaline, and should lather freely. This result is achieved by using coconut oil as a substantial part of the fat content and omitting all builders.

Salt water soap.- Many types of soap will not form a good lather in salt water. To overcome this inhibiting action, most soap intended for use in salt water is made from pure coconut or palm-kernel oil. Synthetic detergents are also used in some salt water soaps.

Laundry soap.- Ordinary laundry soap is made of caustic soda and tallow, with or without the addition of some rosin. Grease, cottonseed oil, coconut oil and hydrogenated fish and vegetable oils may replace the tallow. Various alkaline salts are usually added as "builders."

Chip and powdered soap.- Chip and powdered soaps for general laundry use are made from the same materials as ordinary laundry soap without excess of alkaline salts. For fine laundry use they normally contain a considerable amount of coconut oil and no excess alkali. They are made by running the liquid soap over cooling rolls to form thin ribbons, which are then dried and reduced to chips or powder.

Soap powder (washing powder).- Soap powder is a mixture of sodium carbonate (Na_2CO_3) and soap in powdered form. It also may contain other alkaline salts, such as silicates, phosphates, and borates.

Scouring powder and scouring cake soap.- Scouring soap, either powdered or cake, is a mixture of soap and an insoluble abrasive, such as pumice, volcanic ash, quartz, or feldspar. The coarseness of the abrasive, which is incorporated into the soap, varies with the intended use of the product.

ALKALINE CLEANSERS

Alkaline salts in themselves are cleaners and water softening agents. They include ammonia, borax, soda ash, washing soda, caustic soda (lye), phosphates, silicates, etc. Most of them are also frequently used as "builders" in soaps.

Ammonia is used in cleaning glassware and as a water softener in washing clothes. Borax, soda ash, washing soda, phosphates, and silicates are used to increase the detergency of soaps and as water softeners. Caustic soda is used in making soaps and also is used, either alone or mixed with aluminum turnings, as a drain-pipe cleaner. It must be handled with caution because it has a very corrosive action and is poisonous.

Detergents for use in mechanical dishwashing machines usually contain one or more of the following alkaline cleansers: sodium hydroxide, sodium carbonate, sodium metasilicate and other silicates, trisodium phosphate, borax, sodium bicarbonate, and sodium sesquicarbonate. In addition, certain polyphosphates such as tetrasodium pyrophosphates, sodium tetraphosphate, and sodium hexametaphosphate are frequently present.

Inasmuch as alkaline salts are generally less costly than soap, their use as "builders" should result in a product of lower cost. The presence of builders is objectionable in a soap to be used in washing woolens and silks, because of the high alkalinity of most builders.

SYNTHETIC DETERGENTS

Synthetic detergents are cleaning agents produced by organic synthesis. A large number of these synthetic compounds have appeared on the market in the last few years and their respective merits have not yet been well established. Considerable work has been done on the relative detergent powers of soaps and synthetic detergents for various purposes, but the lack of adequate standards of comparison makes conclusions difficult. At the present time, most tests seem to indicate that a good soap in "soft" or "softened" water is the most satisfactory for general home laundry of cottons. However, some of the synthetic detergents are superior to soaps for certain uses due to their acid stability and the solubility of their calcium and magnesium salts. The acid stability of the synthetic detergents is useful in washing woolens, in certain phases of textile work, leather tanning and electroplating; and the solubility of the calcium and magnesium salts is very helpful in dyeing operations. Soaps are less costly than synthetic detergents, but must be used in higher concentrations.

WATER SOFTENERS

"Hard" water contains mineral salts such as calcium sulfate, which combine with soap to form insoluble gummy compounds, thus impairing the washing properties of the fluid. These insoluble compounds waste the soap and are extremely difficult to remove by rinsing.

There are two types of water hardness: (1) Temporary hardness (calcium and magnesium bicarbonates) which can be removed by boiling or by the addition of lime water or slaked lime; and (2) permanent hardness (calcium and magnesium chlorides and sulfates) which is not affected by boiling, but can be removed by distillation, by the zeolite process, or by the addition of chemicals. The zeolite process consists of passing "hard" water through certain clay-like substances (hydrated sodium aluminum silicates), known as zeolites, where a chemical change takes place which causes the calcium and magnesium to remain in the zeolite while the sodium compounds pass into the water. The most convenient household method is the addition of chemicals. These softeners fall into two main categories: (1) Those which form a precipitate, such as sodium carbonate and trisodium phosphate; and (2) those which do not form a precipitate, such as the sodium metaphosphates. Because of this non-precipitating characteristic and because they do not increase the alkalinity of the wash water, the metaphosphates are generally the most satisfactory chemical water softeners. It is important to keep in mind that all chemical water softeners should be dissolved in the hot water before the soap is added.

The recommended amount of softener for water of various "grains hardness" is sometimes printed on commercial packages. If water is obtained from a public water system, the degree of hardness can be ascertained from the water department. Or, the hardness can be determined by the method described in Farmers' Bulletin No. 1497, U. S. Department of Agriculture, which can be obtained for 5 cents (stamps not accepted) from the Superintendent of Documents, Washington 25, D. C. The degree of hardness should be checked periodically because it is not constant.

BLEACHES

The process of whitening by treatment with chemicals or exposure to the sun is called bleaching. Often a discoloration can be removed merely by moistening and spreading the cloth in the sun. The chemicals most commonly used are sodium hypochlorite (Javelle water), hydrogen peroxide, and oxalic acid (poison). These must all be removed by thorough rinsing with water after the bleaching has been accomplished.

Information on bleaches and their uses may be found in Thorpe's "Dictionary of Applied Chemistry" and on pages 30 and 31 of the U. S. Department of Agriculture Farmers' Bulletin No. 1497, referred to previously.

STARCHES

Selection of the proper dressing material must depend primarily on the type of fabric to be treated. Some fabrics absorb the dressing more readily than others and, therefore, require less of the stiffening material to achieve the desired finish. Various starches have practically the same composition, but differ greatly in the size and character of their grains, which directly affects their ability to penetrate fabrics. Because of its very small swollen granules, rice starch will penetrate most fabrics thoroughly. Common practice in this country, however, is to use a "thin boiling" mixture of corn and wheat starch for ordinary cotton materials. Gum arabic or wax (usually paraffin) is sometimes added to starch to improve the gloss of the finished product. Gelatin, gum arabic, gum tragacanth, and glue are used as dressings for silks, woolens, and finer cotton materials. Because the latter are transparent, they are desirable for the dressing of colored fabrics.

BLUING

Bluing is an insoluble blue pigment or an aniline dye used to neutralize the natural yellowness of "white" materials. Bluing water should be made just before using and the clothes should not be permitted to stand in it. If an excess of blue color results, it may be removed by boiling the material in fresh water.

REFERENCES

Brannt, Wm. T.: The Soap Makers' Hand Book. Henry Carey Baird and Company, New York, N. Y.

Hiscox, G. D.; Henley's Twentieth Century Book of Recipes, Formulas, and Processes. Norman W. Henley Publishing Company, New York, N. Y.

Hurst, G. H. and Simmons, W. H.: Textile Soaps and Oils. Scott, Greenwood and Son, London, England.

Meerbott, P. B., and Stanislaus, I. V.: American Soap Makers' Guide. Henry Carey Baird & Co., New York, N. Y.

Thomssen E. G. and Kemp, E. R.: Modern Soap Making. MacNair-Dorland Co., Inc., New York, N. Y.

Wigner, J. H.: Soap Manufacture. The Chemical Publishing Co., Inc., Brooklyn, N. Y.

The Chemical Formulary. The Chemical Publishing Company, Inc., Brooklyn, New York.

Technical Journals.-

Chemical Abstracts. American Chemical Society, 1155 Sixteenth Street, N. W., Washington, D. C.

Oil and Soap. American Oil Chemists' Society, 35 E. Wacker Drive, Chicago, Ill.

Soap and Sanitary Chemicals. MacNair-Dorland Company, Inc., 254 W. 31st Street, New York, N. Y.

Government Publications.-

National Bureau of Standards:

Letter Circular LC825, Detergents and Related Subjects. National Bureau of Standards publications on detergents and a list of Federal specifications for detergents and related materials. Free upon request to the National Bureau of Standards, Washington 25, D. C.

Circular C424, Washing, Cleaning and Polishing Materials. Obtainable at 15 cents per copy from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

U. S. Department of Agriculture:

Farmers' Bulletin No. 1474, Stain Removal from Fabrics. Five cents per copy from the Superintendent of Documents.

Farmers' Bulletin No. 1497, Methods and Equipment for Home Laundering. Five cents per copy from the Superintendent of Documents.

Stamps are not accepted in payment for Government publications.

Montana State College Agricultural Experiment Station:

Bulletin 432, Home Laundering, Jessie E. Richardson, Montana State College Agricultural Experiment Station, Bozeman, Montana.