Detergent Wastes and their Disposal Problem

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MANUFACTURE of a new product or introduction of a new process poses many times the question of air pollution and consequent hazard to health. Similarly waste liquors and effluents from factories have to be treated appropriately lest they pollute the rivers or lakes into which they are discharged. The problem raised by the detergent wastes is of a slightly different nature because the wastes are obtained not so much at the place of their manufacture but at places where the detergents are consumed.

At the present time almost every individual and many an industry require some kind of detergents for their cleansing property or for some other specific purpose.

The types of users may be roughly classed as follows[2] :—

USERS	PURPOSE
1. Domestic users	Laundering, and general home cleaning.
2. Hotels, restaurants and eating places ...	For dish washing and germicidal rinse.
3. Hospitals and Sanatoriums	General cleaning, floor washing, etc.
4. Metal works	Vat type cleaners, electro cleaning.
5. Garages and mechanical workshops	Removal of grease and oil. Cleaning of vehicles.
6. Dairy industry	Washing of bottles and containers.
7. Food industry	Removal of undesirable material from processing equipment ; washing of cans, bottles, etc. ; washing of eggs, fruits, vegetables, etc.
8. Fur and leather industry	Soaking of dry hides, fat liquoring, drumming, degreasing, dyeing and finishing.
9. Textile industry	Cotton scouring, cotton mercerizing, wool scouring and many finishing operations.

Up to the beginning of the last decade there was little demand for synthetic detergents. The synthetic detergents or surfactants or Syndets (trade name) as they are often called have come into great demand on account of their several advantages over soap.

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These advantages are, in short:

1. The stability of the compounds in acidic and hard waters, thus avoiding wastage of detergents.
2. Their effectiveness in low ranges of concentration.
3. Their quick action, resulting in saving of water and time.
4. Their quick rinsing property which economises time and water.

These and various other advantages have been attracting more and more people to a change-over from soap to synthetic detergents. The increased use of these detergents has naturally cut into the soap sales. The competetion is indeed acute as can be seen from the following figures of consumption in the U.S.A.[3] computed from the U.S. Tariff Commission figures.

Year	*Surfactants in million lbs.*
1947	218.7
1948	297.0
1949	349.5
1950	543.8
1951	566.2
1952	over 800.0

Consumption, however, may not continue to increase at this rate, but extrapolations indicate a sale of 2 billion lbs. in 1955 and 2½ billion lbs. by 1960. Although total detergent consumption *per capita* in the U.S.A. has not changed from about 27 lbs. a year, it is clear that Syndets will have over half the household market this year and over half the total market within the next ten years. In U.K. and European countries, however, there is more demand for industrial Syndets than household Syndets.

The properties of Syndets, viz., emulsification, solubilization, foaming and dispersion of dirt, which are excellent from the point of their utilization, are great hurdles in the way of satisfactory disposal of the waste waters containing these detergents. As long as the quantities of the detergents used were small, their ill effects after their discharge were either not apparent or not heeded and no effort was made to treat the waste waters. It will however, be obvious that the insecticidal property of a detergent will cause harm to water life and may make the water unfit for drinking and for agricultural purposes if the detergent wastes are thrown into rivers or streams. If they are let into the sewage system they may hinder the biologial process of sewage purification. It has been found that traces of detergents especially of cationic type tend to destroy anærobic bacteria. Slime growth also varies with the detergent compound and amount, and at concentrations as found in sewage. Anionic and non-ionic detergents significantly stimulate slime growth. Also presence of phosphorous in the synthetic detergents fertilises the growth of slime.

Huge masses of foam as high as 15'-20' have been noticed at some places in certain rivers clearly indicating the inability of some sewage farm to deal with effluents containing synthetic detergents.

On a certain Friday in 1947 every house in Reading, Pa., U.S.A., was given a free one ounce sample of a household non-ionic detergent. The next day the sewage plant separaters at Mt. Penn sewage treatment plant were flooded with large volumes of foam. Within 2 or 3 days the foam, 2-5 ft. in depth, completely enveloped most of the treatment plant.

Soon reports came in from other sewage plants all over the country. A newly opened plant in Los Angeles, California, reported copious foaming due to large amounts of Syndets in the effluent. In August 1949, thick foam developed in the sewage plant at Batavia, Ill. The foam was sticky, smelt similar

to sour milk and carried a high concentration of grease which deposited all over the plant.

In Great Britain also, similar problems[1] are arising. A special one concerns the recovery of wool grease from the effluents from wool scouring. In Bradford, England, wool grease is recovered by a sewage disposal filter and the sale of these greases brings in funds for the operation of the plant. Now, due to the use of Syndets, the recovery of the grease is no longer satisfactory.

The synthetic detergents are now known to be responsible for such and other problems. The Division of Water, Sewage and Sanitation Chemistry held a symposium at the meeting of the American Chemical Society held in Cleveland on April 10 and 11, 1951, in which chemists of both the U.S.A. and the U.K. participated and discussed the then available information.

The Mt. Penn Sewage Plant has adapted as temporary measures sprinklers for spraying of water containing antifoaming agents. Although this method facilitates the smooth running of the plant, it does not remove the cause of the trouble. Also the use of antifoaming agents is quite an expensive item.

Experiments have been carried out in various U.S. laboratories to determine the influence of the detergents on slime growth using concentrations of 10-100 p.p.m. of representative types of detergents. All concentrations of a cationic detergent inhibited slime growth. Tween 80, a non-ionic, had little or no effect whilst Nacconol N.R. stimulated the growth, though the amount of stimulation decreased with increase in concentrations.

U.K. has announced the appointment of a committee to examine the effects of the increasing use of Syndets with particular reference to the operation of the Public Health Services. This has come just after the completion of a three-year experiment on the effect of synthetic detergents on sewage treatment carried out by Wolverhampton Sewage Department. Various concentrations of Teepol (likely to appear in sewage) had little or no effect in the purification process. Other detergents like Santomerse, Tide and Lissapol N are under experiment.

A London firm, Leda Chemicals, Ltd., claim to have developed chemicals which will eliminate foam from effluent before it is discharged to the rivers. Chemicals are still being tested for the performance of the defoaming effect, the possible toxicity, etc. Very little is known about these chemicals except that they contain active compounds capable of neutralising anionic detergents.

In India, the present consumption of synthetic detergents may not be significant. However, over a few years to come with the establishment of petroleum refineries and fatty acid industries, both locally made and imported synthetic detergents will be consumed in large quantities, especially in textile manufacturing centres. Sewage Disposal Plants at Bombay, Ahmedabad and Kanpur may then have to meet with problems similar to those mentioned earlier. However, by that time, we hope to be prepared fully for any such emergencies.

REFERENCES

1. *Mfg. Chemist*, 1953, 24, 229.

2. *Chem. Eng. News*, 1953, 31, 1072.

3. *J. Am. Oil Chemists' Soc.*, 1952, 29, 552.