DAVID B. SMITH

105

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Special Articles

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Moisture Per Cent.	Avg. Temp. F. Air	Max. Temp. Air	Min. Temp. Air	No. of Days
Summer 43	73	77	46	16
50	72	75	52	14
53	68	80	46	20
Winter 50	34	43	14	29
52	27	40	17	52

The following are some of the advantages of glass-covered beds:

Sludge can be withdrawn at any time from the digestion tanks. We believe that this is advantageous, because

a. Large amounts of sand and grit are present.
b. Digestion of the sludge is aided, in our opinion.
c. A more uniform production of gas may be maintained.

Interruption of the drying process is prevented.
Odors and flies are controlled.

The glass covers were supplied by Lord and Burnham. The total cost was as follows:

Glass covers	$15,057
Concrete foundations, division walls, trough, underdrains, excavations, sand, stone, etc.	9,455
Total	$24,512

Estimated Costs:

Population	22,500
Cost per capita	$1.09
Estimated cost of open beds	.84
Difference	$0.25

Editorial

ARE INDUSTRIAL WASTES LIABILITIES?

Conservation is the slogan of the day, whether it be of natural or industrial resources. Wanton waste is abhorrent to an enlightened civilization. If we have the ability to solve the intricate problems of production and improvement of industrial products, we should also have the ability to solve the problem of satisfactory disposal of wastes produced by such processes. It is frequently said by manufacturers that no methods of treatment are known for their wastes. As a matter of fact, there are probably technical means for treating all industrial wastes, and the only thing that stands in the way of the Utopia of wasteless industry is the question of cost. Every problem involves a balance of cost of disposal against the benefits obtained, and there is no sense or justice in demands for elimination of wastes from our streams and sewage treatment works, regardless of cost.

Fortunately, there are a few outstanding examples of industries which have profited by recovery of materials, once considered wastes, which now have commercial value. These few industries should be an incentive to the others, which still discharge residues of manufactured products to the sewers, to consider carefully the possibilities of recovering more of their raw materials. This consideration should not stop with a mere perfunctory analysis of costs and values, but research programs should be outlined, consistent and continuous studies should be undertaken in properly equipped chemical laboratories, and small-scale testing stations should be operated. Only in this way can industry convince the sanitary authorities that it appreciates the seriousness of the pollution of streams and lakes by industrial wastes.

When one considers the magnitude and complexity of the industrial waste problem, the few demonstrations of profitable recoveries of waste materials do not in truth give promise of widespread or prompt alleviation of the problem by profitable recovery of materials, but at least they prove that a careful study of the problem, as well as the expenditure of substantial sums of money has been well worthwhile for some plants. The three outstanding examples of successful recoveries of industrial wastes are the Corn Products Refining Company, located in the Sanitary District of Chicago, the Hiram Walker Distillery at Peoria, Illinois, and the U. S. Industrial Alcohol Company at Baltimore. It is significant that all three industries use similar raw materials, primarily carbohydrates such as molasses, starch, corn, rye and other cereals. Recovered products are stock feeds which always find a ready, although fluctuating, market. It seems logical to assume that in other types of industries, if the products are salable, the solids recovered or kept out of the wastes should also be salable, even though at a reduced value. However, in many processes the materials in the wastes are different from the salable products, because of chemical decompositions or syntheses used in the process.

A brief consideration of the progress in other industries of waste recovery indicates that recovery of more or less of the wasted materials may be possible, but finally some process of treatment allied to sewage treatment, or evaporation, may be required.

In the brewing industry, spent grains are generally recovered by dewatering in expellers, and steam drying. The expeller discharges a highly concentrated and putrescible liquor which adds considerably to the population equivalent of the wastes. Likewise, waste yeast and wort residues add to the organic load. A concerted study of improved methods of recovery would show results.

Yeast, vinegar and distillery wastes are a tremendous problem. The question of concentration of solids in the wastes now seems to be the dividing line between profitable and unprofitable recovery—but this question is the crux of all industrial waste problems. The fermentation industry is making a commendable effort to find out how much can be recovered within the factory. Jensen, in Denmark, has developed processes of treatment of these wastes, and the Standard Brands Corporation in this country has been carrying on intensive research for several years on the treatment of yeast wastes. Commercial Solvents Corporation has also studied the problem, and the Hiram Walker plant has installed and is operating equipment which is claimed to recover practically all of the organic solids. Other distilleries are making some effort toward a study of the problem.

The great meat packing industry produces probably the largest volume of the most putrescible waste in American industry, and for decades this waste has defiled streams and overloaded sewage treatment works, yet there has been no concerted effort to study the problem. Individual packers have made laboratory studies, but the industry's research center, the American Institute of Meat Packers, has done nothing. The once-vaunted boast that everything was recovered but the squeal never was true; the sewers carried away the evidence of other losses. However, some effort has been made by individual packers to alleviate this problem, notably at the Hormel plant in Austin, Minnesota. Unfortunately, the sludge proved to be toxic as a stock feed, and too greasy for a fertilizer, to confirm the earlier hopes of a valuable by-product, but this was the best effort that has been made by a packer to recover more of his waste materials.

Tanneries recover hair, but little effort has been made to recover lime, chrome salts or fertilizer. The Tanners' Council started out bravely to attack the problem years ago, but not much has been heard from them recently. Treatment of tannery wastes has been studied at length, but little effort has been made to conserve waste substances within the tannery.

Paper mills have made great progress in recovery of fiber, but the basic sulfite and sulfate processes still discharge a large proportion of the weight of the wood as wastes. These wastes have probably been studied more than any other industrial waste, and hundreds of patents for recovery of materials have been granted, but as yet no satisfactory process has been developed. Sulfite waste is still a challenge to the most skilful efforts of research chemists. However, the Howard process has shown some promise. For fiber losses, the Adka process seems to be exciting the attention of technologists. After all has been done that can be done within the paper factory, there will still remain waste waters that may require further treatment.

Other organic wastes, from canneries, wineries, and beet sugar works, are widespread and the losses are staggering, but in this field there are so many small plants that attention should first be directed to the larger ones. For isolated seasonal plants, Warrick has reported progress in treatment, but the brief season in most canning operations makes for inefficiency in recovery of solids in the factory. The tremendous losses of tomato solids from the large tomato canneries are astounding. Surely this is a fertile field for the best efforts of research chemists.

Dairy wastes are ubiquitous, and consequently have been subject to widespread study. Agar, in this issue, reviews the work that has been done on these wastes. Recovery of salable byproducts is encouraging; treatment of residual wastes is feasible and practical.

The steel and chemical industries are of less importance as producers of industrial wastes, if we except the by-products coke plants. In the steel works, pickling liquor is practically the only waste of importance. This has long been a subject of concern and research, and everyone agrees that the ferrous sulfate should be recovered, but it has been hoped that better technique might be developed in the recovery process, to cut down costs and improve the product. A great advance has been reported in Germany in methods of recovery, and a comprehensive symposium held at the meeting of the Association of German Steel Workers in Düsseldorf in February, 1937, indicated that several improved processes for recovery of copperas and ferrous sulfate (monohydrate) are being used in Germany.

Phenol wastes from by-products coke plants are probably most widely publicized and condemned of any industrial wastes because of their effect on the taste of public water supplies. The progress that has been made in the extraction of phenols from these wastes is well-known, and processes are available that will remove 90 per cent of the phenols from such wastes. It is not generally realized, however, that only about 70 per cent of the B.O.D. is removed by such processes, leaving a substantial residual waste that will affect the oxygen balance of streams and the loading of sewage treatment plants.

Chemical wastes are of infinite variety, but on the whole they are of less serious significance than those just discussed. Large tonnages of acids can be discharged into sewers or streams, if care be taken to balance the acidity against the available alkalinity of the sewage or water, and uniform discharge of acid be provided. Precipitation, aeration or evaporation within the plant may result in substantial reduction of wastes.

In this brief review of the status of some industrial waste problems, it is apparent that such wastes are almost universally liabilities to the sewer authority, but they may not be liabilities to the manufacturer. After entrance into the sewer, hope of profitable recovery practically vanishes. Therefore, industry should exhaust every possibility of recovery within the factory by establishment of research groups of chemists and engineers charged with the responsibility of determining what improvements of processes and recoveries of materials may be accomplished. The time is short before pressure for alleviation of pollution by industrial wastes becomes urgent. National legislation may not condone local complacence; therefore, if industry has to spend money for waste treatment, it would be wise to start now to study how such wastes may be diminished in volume and strength.

F. W. M.

Reviews and Abstracts

H. W. Streeter

THE OCCURRENCE OF DILUTE SEWAGE AND ITS RATIONAL TREATMENT

By H. C. Shenton

The Surveyor, 92, 629–630 (1937)

It is pointed out that in many cases the volume of sewage treated is much greater than is usually assumed, because in the smaller treatment plants, such as are found in conjunction with hospitals, factories and small towns, there is no attempt to make a careful gauging of the sewage flow.

The dilution of the normal flow of sewage may be caused by rainfall or the infiltration of ground water. The flow that is ordinarily spoken of as the "dry weather flow" is not the "normal" flow but the minimum flow. For example, gaugings of the dry weather flow of sewage from a town of several thousand were taken and found to be 212 gal. per capita per day. As there were no trade wastes present, and taking the daily normal flow per capita or 30 gal., it is seen that the dilution was approximately seven times. This sewage, according to McGowan's formula, had a strength of 27.5 which classifies it as a dilute sewage, and by removing the settleable solids from such a sewage very little additional treatment is necessary.

It is suggested that in the treatment of a dilute sewage the settleable solids be removed as soon as possible to prevent their further solution and also to prevent occurrence of septic conditions.

The degree of dilution affects very markedly the volume of sewage that may be treated per cubic yard of filter per day. According to the Royal Commission, a strong sewage from which only the detritus has been removed requires 1 cubic yard of filtering medium per 15 gallons treated per day. Twenty-five gallons of a sewage of average strength or 40 gallons of dilute sewage can be treated per cubic yard per day. It is common practice to discharge a sewage without treatment after a dilution of six volumes has taken place. It is pointed out that by dilution a sewage may be treated at an increased rate.

The removal of the settleable solids is generally accepted as being a prerequisite to the further purification of a sewage, yet the use of the old-fashioned settling tank in which the sludge may be removed only once a week is shown to be ideal for increasing the strength of the sewage passing through it. In the treatment of a dilute sewage the frequent removal of sludge as an aid to purification is emphasized.

In conjunction with the removal of settleable solids, mechanical or chemical flocculation, together with clarification, may be resorted to during those periods when further treatment is advisable. This should be more economical than designing a works suitable to handle a sewage during the dry weather flow and ignoring the fact that during the greater part of the year only a dilute sewage is being received.

W. Allan Moore

EFFICIENCY OF HUMUS SETTLING TANKS

By P. G. Lloyd

The Surveyor, 92, 621 (1937). (Discussion) *The Surveyor*, 92, 621–23 (1937)

An attempt was made to measure the efficiency of two humus settling tanks connected in series (each tank being 66 ft. by 35 ft. by 6 ft. average depth) by determining