## **Recovery of Valuable Constituents of Garbage**

Summary of the Various Methods of Disposal of Municipal Wastes, Including Hog-Feeding, Incineration, Sorting, Reduction, Alcohol Production, Etc.—Paper Read Two Weeks Ago at Annual Convention of American Society for Municipal Improvements

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THE subject-matter of this paper covers a large and important field of municipal activity. It is not within its scope to reach many of the details of the processes required for the economic recovery of valuable materials from municipal refuse; the paper deals very largely with general principles and the limitations attending their application.

The term "valuable" is, furthermore, difficult to use with any degree of certainty under present market conditions. Only the most careful consideration of local conditions, with projects tempered by a measure of flexibility, can justify definite conclusions.

Particular attention is directed to the importance of local conditions in developing methods of garbage disposal. Apparently satisfactory garbage disposal is obtained in one place by incineration, in another by hog feeding, another by reduction, etc. Matters of administration, stage of city development, past experience and training in garbage disposal, location, climate, character of population, topography, soil and many other factors are pertinent.

## **Fundamental Considerations**

Broadly speaking, a method of final disposal of municipal refuse should serve three functions as follows: (a) It should render satisfactory service to householders; (b) it should be measurably clean and sanitary; (c) it should be reasonably economical.

In accomplishing these three ends, there are four parts, or phases, of the problem to be developed, as follows: (1) The house treatment; (2) the collection; (3) the transportation; (4) the final disposal.

The problem of garbage disposal is the proper development and adjustment of these parts of the problem to local conditions. The house treatment more directly affects the people; the collection is generally the more costly part of the work; transportation other than in collection wagons is needed only in the larger communities; while final disposal involves more engineering work and in general stimulates more discussion than the others. In the author's opinion, each of the four phases is equally important, and a limitation of what follows primarily to disposal is not intended to eliminate or discard the influence of "house treatment" and "collection" upon the disposal.

Two other fundamental considerations are important, viz.: (a) The so-called relative values in sanitation; and (b) the fact that a successful handling of the refuse problem revolves primarily about operation.

By relative values is meant such items as, for instance, the stage of other municipal improvements possibly more directly affecting the public health, as well as the question of the proper cost of measures for eliminating odors not constituting a general nuisance. It is also obvious that "operation" looms large in refuse disposal work and must be given first consideration during the development of new works.

## Valuable Constituents

Refuse is the term for the solid waste resulting from community activities as distinguished from sewage. Refuse is made up of garbage, ashes, rubbish, manure and many other materials. The valuable constituents contained in them are as many as the varied activities of the community. These constituents may, however, be roughly classified by the disposal methods used to recover them, thus:—

1. Dumping, or land fill, makes the fullest use of the inert constituents of refuse not otherwise generally useful. Sometimes valuable land can thus be made. 2. Burial, or ploughing into the soil, makes possible the recovery of those constituents of refuse which are valuable for fertilizing the soil. Manure is quite generally disposed of in this way and some cities have developed its collection and transportation to farming districts very advantageously to the public comfort and the municipal pocket book. At Columbus, Ohio, a gross revenue of about \$4,000 per annum is derived from the sale of manure. Street sweepings are also used in this way; sometimes, for instance, to cover dumps of mixed refuse for park purposes.

3. Mixed refuse can be burned at high temperature, producing steam suitable for power development, thus recovering or using the carbon and hydrogen contained in the refuse. With the increased demand for power, the higher price of coal and oil, and the gradual reduction in available closeby dumping areas, the value of refuse for steam productior is increasing.

4. Garbage contains grease and tankage, both valuable constituents which are being economically recovered on a large scale by the reduction process.

5. From rubbish many marketable materials can be recovered, such as paper, rags, leather, old metals and the like. The process is commonly termed "rubbish sorting."

6. An old and universal method of recovering the valuable food constituents from garbage, is by feeding to hogs. This is one of the most interesting and useful methods of garbage disposal which has recently been given much prominence by war shortage of food.

7. There are many other processes for the recovery of valuable constituents from garbage which have been more recently studied, such as the production of alcohol and the preparation of a stock and chicken food.

## Hog Feeding

For garbage alone, feeding to hogs is a method of disposal which undoubtedly has a wide field. By this method the food constituents of garbage are recovered in part. Some tests during an investigation of the refuse disposal problem made by the writer in Louisville, Ky., showed that 32.4 pounds of city garbage were required to add one pound to the weight of the hogs. The tests lasted seven weeks and covered observations on the feeding and growth of 25 to 40 hogs. The garbage was taken from several collection districts, but contained a somewhat smaller amount of other refuse materials than does much city garbage. With pork on the hoof at 15 cents a pound, the garbage would have a gross value of \$9.26 per ton. It was actually sold by the city at that time (September, 1918), at \$3 to \$3.50 per ton for feeding to hogs.

At Worcester, Mass., where the separation of garbage is very good, it takes 37.5 pounds of garbage per pound gained by the hogs.

Hotel garbage has a higher food value. Mr. Gaumnitz, who feeds such hotel garbage in St. Louis, states that it takes only 25 pounds of such garbage to make one pound of gain on a hog; and this data is confirmed by tests at the Iowa Agricultural Experiment Station. At 15 cts. per pound of pork, hotel garbage should thus have a gross value for feeding purposes of \$12 per ton.

From the gross indicated value of garbage for hog feeding, it is, of course, necessary to deduct plant operation, risk, overhead, fixed charges, etc. These vary with the location of the hog farm, the value of the land, the climate, the length of the contract and the care with which the operation of the farm is conducted. In 1916, in connection with a study of