

# REPORT OF THE SLUDGE COMMITTEE

Presented to the Sanitary Engineering Section of the American Public Health Association at the Fifty-second Annual Meeting at Boston, October 10, 1923.

THE Committee on Sludge this year brings in a progress report to outline what has been done toward solving the sewage sludge problem in the United States. As the work divides, particularly by the organizations handling the investigations, the report is so outlined.

## MILWAUKEE SEWERAGE COMMISSION

Mr. T. Chalkley Hatton gives the following notes on the Milwaukee work:

The Milwaukee Sewerage Commission appointed a Fellow to the Agricultural College of the University of Wisconsin who has devoted his entire time to the use of sludge in agriculture. Intensive studies have been made of the values of activated sludge in comparison with commercial fertilizers of different mixtures. Plantings were made of corn, soy beans, Sudan grass, tobacco and other crops at the experimental farms of the University of Wisconsin, at Marshfield, Hancock, Codington, Madison, and Wauwatosa. To determine the value for grass in golf greens, tests are being made at the Blue Mound, Ozaukee, Lynx, and Tripoli Golf Clubs, and the Milwaukee Country Club and the Pine Bluff Country Club. A large number of pot cultures have also been made at the greenhouses of the University of Wisconsin.

The National Fertilizer Association has also been advised of the possible value of activated sludge. Samples have been sent various fertilizer distributors for investigation. The cooperation of the Executive Committee of the Association has been assured in handling and marketing the prepared sludge should it prove as satisfactory as appearances indicate.

## SANITARY DISTRICT OF CHICAGO

The Sanitary District of Chicago has interested a number of agricultural experiment stations in growing tests. Work is under way on cotton in Mississippi, and on garden plants at the University of Illinois. In the Chicago territory sludge has been distributed to peony and rose growers, truck farmers, cabbage growers and to various individuals. The Lincoln Park, West Side, and South Park or-

ganizations are trying sludge on lawns and grass plots.

The District has operated a test plot during the growing season, planting corn, beets and beans, with various combinations of fertilizer. Some 45 plots, each 1,100 square feet in area, were planted. The land, while formerly used for truck gardening, had lain idle for over four years. The results in general have been encouraging. A record of weights is being kept, as the vegetables are picked, which will furnish a criterion of the real relative production.

In addition, the District has used sludge in seeding grass, in comparison with sheep manure.

The best price obtained during the year on the sale of carload lots was \$9.00 per ton f.o.b. cars for sludge, dried and bagged.

## BALTIMORE

Mr. Milton J. Ruark, Division Engineer of Sewers, gives the following notes of interest with reference to the sludge handling problem of Baltimore: During the year 1922 the total production of sludge was about 5,400 tons on a dry basis. This is the greatest rate of production in any year since 1918, when the output was somewhat greater. During the year 1922 about 5,500 tons on a dry basis was handled, a portion of this being heat dried sludge from the drying plant and the remainder air dried sludge taken by local farmers. For more than a year no charge has been made for air dried sludge. This season farmers have taken the sludge as often as it is produced by the sand beds, so that the drying plant has not been operated for several months.

At the present time, no income is being realized from the sale of sludge. The city has provided means to load the farmers' trucks from a trestle by dump cars direct from the sand beds, or by a derrick from the storage pile. As a rule the farmer arranges to handle sludge only when the city is operating one of the loading devices. Occasionally a farmer loads his own truck. The sludge is all used within a radius of about four miles, whenever possible, the farmers hauling it directly to the field, where it is spread and plowed under.

Sometimes it is placed in piles or composted with manure for spreading on the fields at a later date. The farming community served is almost entirely composed of truck farmers. The sludge is therefore used to a large extent for such plants as cabbage, spinach, potatoes, string beans, and tomatoes. It is used to some extent on corn, and to a very limited extent on grass. The amount of horse and cow manure available has decreased markedly in the last few years with the result that its cost has reached a point where farmers are seeking other materials for fertilizer. While it is evident that the farmers in the vicinity of the Baltimore plant believe the sludge is worth the handling, the city officials have desired to satisfy themselves of the real value of the sludge in agriculture. In cooperation with the Agriculture Experiment Station of Baltimore, a series of experiments have been outlined to extend over some 4 or 5 years. Nine acres have been laid out in 6 sections of  $1\frac{1}{2}$  acres each, each section being divided into 6 plots of  $\frac{1}{4}$  acre each. The whole of each section has been treated with one of the following fertilizers: Liquid digested sludge, air dried sand bed sludge, commercial fertilizer, commercial fertilizer and dry sludge and manure. As a control, one plot has been given no treatment. One-half of each section then was treated with lime in a manner to cover half of each plot. In one plot of each section will then be planted some crop, and likewise with each of the other plots, so that in any year some crop will be growing on ground treated with all of the six fertilizers, both with and without lime. Rotation of crops will probably be introduced, but the ground will receive the same fertilizer year after year. A special experiment with alum treated sludge will also be started on other ground.

At the date of September 15, the farm was already growing late potatoes, beans, and fall cabbage. It is proposed to plant spinach and grass seed in the fall and next spring to add another crop, probably tomatoes, making a total of six different crops.

The preparation of air dried sludge for the year 1922 cost \$0.666 per ton.

#### ROCHESTER

Mr. John F. Skinner reports that at the Irondequoit plant of the city of Rochester, N. Y., about 10,600 cubic yards were prepared for market in 1922 by air drying. This sludge

was sold at an average price of \$0.75 per load of 2 cubic yards to farmers, delivery being made by a tipple to the teams and auto trucks. When shoveled from storage only \$0.50 was received by the city. The sludge is largely used in the top dressings of the orchards for a distance of seven miles around the plant.

#### HOUSTON

From Houston, Tex., Mr. J. C. McVea reports that during the calendar year 1922, four cars of sludge were sold. The buyers preferred sludge which had not been pulverized. Five tons were delivered to local truck growers and others for use near Houston. The results obtained by various gardeners and by the Houston City Park Superintendent on the municipal golf course and in the parks have been very gratifying. Growing experiments were made on a small scale with turnips, tomatoes, lettuce and radishes, in which the value of the sludge as a fertilizer was demonstrated. In particular, the turnips were vastly improved, the ones fertilized with sludge being the only ones edible, being sound and sweet, the others being dry and fibrous. The results on the turnips are given by the table on page 236.

#### PREPARATION OF SLUDGE

In the preparation of the sludge, development of methods and apparatus is still progressing with very encouraging results.

At Milwaukee, the tests have been concluded on sludge handling, with the conclusion that provision should be made for the use of acid and heat with the Oliver filter.

At the Des Plaines River Sewage Treatment Plant of the Sanitary District of Chicago dewatering has proceeded, using alum, or acid, with and without heat. At first only a Worthington bag platen press and a Simplex plate press were available. In August tests were begun on a novel hydraulically operated bag press, designed by Berrigan, with direct squeeze, which has the advantage of taking care of any desired thickness from  $\frac{1}{4}$  inch upwards. The press cake (in moisture content from 73 to 83 per cent moisture) is dried in a rotary direct-indirect dryer. A pulverizer is required to crush the balls which occur, though not in large number.

At the Calumet Sewage Treatment Works of the Sanitary District, dewatering has proceeded, using alum or acid on the Oliver filter.

## PERCENTAGE INCREASE OVER UNFERTILIZED TURNIPS

No.	Weight in Ounces			Per Cent Increase			How Fertilized
	Total	Roots	Tops	Total	Roots	Tops	
1	11	3	8	0	0	0	Not fertilized
2	18	7	11	64	133	38	Blood
3	41	14	27	273	367	237	Nitrate Soda
4	63	28	35	473	832	338	Activated Sludge
5	59	31	28	436	932	250	Activated Sludge and Phosphoric Acid

TABLE 1  
PRODUCTION DATA AND ANALYSIS OF SLUDGE, REPORTED FOR 1922

City	Baltimore	Rochester	Chicago	Houston
Plant	Hydrolytic	Imhoff	Activated	Activated
Production in 1922; net tons, dry weight	5,421	6,440	*400	**70
Air dried — cu. yd.		10,600		
Analysis on dry basis		Per Cent		
Nitrogen				
Average	2.45	2.00	5.0	4.6
Maximum		2.17	5.6	
Minimum		1.95	4.3	
Phosphoric Acid	0.52	0.8	2 to 4	1.9

\* Approximate amount on 12 months, 1922-23.

\*\* Produced for experimental use and sold as fertilizer, estimated production would be 1720 tons, if prepared.

installed. This filter is the largest size built, the drum being 11 feet 6 inches diameter with a face 14 feet wide. Space has been left in the house for a Basco-ter-Meer centrifuge. A dryer similar to the one at the Des Plaines River Sewage Treatment Works operates on the sludge cake intermittently.

At the testing station, operated jointly by the Sanitary District and the Corn Products Refining Company at Argo, tests have been run on plate filters and a single wheel American rotary filter. Alum has proved more successful as a coagulant than acid.

At Houston, the cost of preparing the sludge has not yet developed to a point where definite costs can be given. Several methods have been tried. At present the use of sulphur dioxide gas is being tried to prepare the sludge for pressing. There has been no complaint of odor from sludge handling or the preparation of the sludge.

The nitrogen recovery in activated sludge at the various points of operation is as follows:

ACTIVATED SLUDGE  
RECOVERY OF NITROGEN AND PHOSPHORIC ACID NITROGEN  
AS N; PHOSPHORIC ACID AS P<sub>2</sub>O<sub>5</sub>  
PER CENT DRY BASIS.

Location	N	P <sub>2</sub> O <sub>5</sub>
Sanitary District of Chicago		
Argo.....	7 to 8	6 to 7
Tannery.....	3.0	
Packingtoun.....	4.2	2.7
Des Plaines R. S. T. W.....	4.5 to 5.5	2 to 4
Calumet S. T. W.....	4.2 to 4.4	
Houston.....	4.6	1.9
Milwaukee.....	6.0	2.3

By the alkaline permanganate method the total available ammonia in the Milwaukee sludge is 4.61 per cent, 63 per cent of the total ammonia.

LANGDON PEARSE, *Chairman.*

T. CHALKLEY HATTON.

C. H. HURD.

EARLE B. PHELPS.

W. L. STEVENSON.