Certain formaldehyde tests also gave some promise of control and will be reported as soon as they are tested under more varying conditions.

The Use of “Activated Sludge” As a Fertilizer For Golf Courses

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Milwaukee’s new $10,000,000 sewage disposal plant is now in operation, and by October 1, 1925, will produce approximately 100 tons of so-called “activated sludge” fertilizer daily. This plant is unique, inasmuch as it will recover some of the valuable plant-food elements now lost to agriculture by the present-day wasteful methods of sewage disposal.

Activated sludge is a granular, porous, organic material containing less than 10 percent moisture, and of uniform chemical composition. The finished product is slightly acid, testing about pH 4.4, because sulphuric acid is added to the wet sludge in order to facilitate dewatering. This acid treatment, together with the high temperatures in the dryers, produce a sterile product, free from weed seeds and bacteria of all kinds. The chief plant-food element is nitrogen, which constitutes 6 to 7\% percent, calculated as ammonia. In addition, it contains from 2\% to 3\% percent of available phosphoric acid, and less than one-half percent of potash.

In order to obtain definite information regarding the value and utilization of its product, the Milwaukee Sewerage Commission established a fellowship at the University of Wisconsin, where investigations have been conducted for several years under the direction of Prof. E. Truog. It seems desirable to present some of the results pertaining particularly to the use of activated sludge on golf courses.

When obtainable, good manure is prized for use in topdressing mixtures, but, unfortunately, supplies are rapidly diminishing. It must be composted to destroy weed seeds and subsequently screened to obtain a desirable mechanical condition, processes which involve time, possible shrinkage of the manure, and large labor expense. Activated sludge can be used to replace manure in topdressing mixtures, and actually possesses some distinct advantages for this purpose. Composting and screening are unnecessary; hence the sludge is available for immediate use. Where sulphate of ammonia is mixed with the topdressing, activated sludge, due to its colloidal properties, fixes the ammonia and reduces the possibilities of burning. The nitrogen will be released gradually and a longer continued feeding of the plant thus results.

Very satisfactory results have been obtained by using 100 pounds of activated sludge to each 3,000 square feet of green. Applications three times as strong have been made without any bad effects due to so-called burning.

To obtain quick and certain results, activated sludge should be used in conjunction with sand and soil in order to provide bacterial inoculation and to insure conversion of the nitrogen into soluble

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1The manufacture of activated sludge is part of the sewage-disposal system of the city of Milwaukee. The material is sold not for profit but to defray as far as possible the expenses of the sewage disposal.
forms available to the plant. Activated sludge, in supplying nitrogen, causes the grass to take on a dark green color and to grow more vigorously, which is evident in the larger amount of clippings obtained. Two methods of application on established greens have been successfully used and are recommended.

1. Mix the desired amounts of sludge, sand, and soil, allow the mixture to stand in a pile for 10 to 14 days, and then apply to the green as a topdressing.

2. Broadcast the sludge over the surface of the green and apply a soil and sand mixture over this.

When the topdressing mixture is allowed to stand in the open for 10 to 14 days, heavy rains may destroy its mechanical condition and make uniform distribution difficult. This necessitates reworking the compost, involving extra labor, which, however, can be avoided by storing under cover.

Activated sludge has been applied to greens on a large number of courses in Milwaukee, Chicago, St. Louis, Cleveland, Detroit, Louisville, Kenosha and other cities for the past three years. All applications were made by the greenkeepers based on instructions forwarded with the sludge. On the whole, very satisfactory and positive results were secured.

Proper fertilizing of new greens prior to planting bent stolons will undoubtedly bring the greens into play earlier. The indiscriminate use of large quantities of manure on the average good loam soil is not only unnecessary but positively harmful. Thick layers of manure imbedded deep in the greens not only place the plant food beyond reach of the feeding roots but may also encourage worms, and may eventually produce an uneven surface due to settling.

Activated sludge has been used at the rate of 100 pounds per 1,000 square feet as the only fertilizer on a number of new greens. It was worked into the surface soil prior to planting the stolons. At the Lynx Club, Milwaukee, the green which received sludge at the

No. 12 fairway, Milwaukee Country Club; photographed May 2, 1925. Seeded August 28, 1924, to mixture of Kentucky bluegrass (70 percent), reedtop (20 percent), and ryegrass (10 percent), at 250 pounds per acre. The dark strip in the center of the picture had been fertilized with 5-6-4 activated sludge, at 2,000 pounds per acre. The light strip in the foreground had been left unfertilized.
time of planting was in playing condition before any other green on the course. The following spring the grass on this green was the first to start growth and forged ahead so rapidly that the difference was evident at a distance of 80 rods. Very good results were obtained at the Milwaukee Country Club during the past year.

By exercising foresight in the selection, fertilizing and preliminary treatment of turf nurseries, much subsequent hand labor can be eliminated and a maximum growth of stolons assured. A mellow loam soil, easily worked, and which does not bake after rains, is to be preferred. Early plowing is essential so weeds can be killed by frequent disk ing and harrowing prior to planting. Then the liberal use of fertilizer will promote growth and insure an abundant production of stolons in a short time. While nitrogen is essential, the use of phosphoric acid, in addition, on many soils will stimulate root development and aid in quickly establishing the plant.

In the fall of 1924 fertilizer experiments were started on some new fairways in the process of construction. The soils were good silt loams, which, while they had been cropped for about 50 years, had received regular applications of manure and were considered fertile. A 5-6-4 mixture (5 percent nitrogen as ammonia, 6 percent phosphoric acid, 4 percent potash) in which the nitrogen was supplied from activated sludge was used at the rate of 2,000 pounds per acre. The fertilizer was applied broadcast and disked into the soil prior to seeding. By October 1 the half-acre fertilized plots, on fairways seeded the latter part of August, were completely covered with grass, and by early spring were in good playable condition, while the unfertilized plots still contained many bare spots, which have since been reseeded.

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**A Monument to Jock Inglis**

The Country Club of Montgomery, Alabama, has erected on its golf course a monument to the memory of the late John M. Inglis, who died January 17, 1924. Mr. Inglis was for a long time the greenkeeper of the club, and by careful observations and experiments developed putting greens of Bermuda grass of surpassing excellence; indeed, for years they were generally regarded as the best in the South. The Club has continued to maintain the high standard of its greens. During the year the course has been improved in many particulars. It is now building a new club house along the lines urged by Mr. Inglis so that it can entertain the winter guests who in increasing numbers are using its splendid advantages.

Building a monument to a greenkeeper is a unique thing in the world of golf, and one which some other clubs may emulate.

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**Washing balls with liquid soap in pails.—**“We tried two of the ball washers on the market in which the balls are placed and washed by turning a handle, but the players did not like them. We then bought some gallon pails, which we painted and hung on fire hooks at the various tees, either on trees favorably situated or on upright posts. Towels are attached to the pails. We use water in the pails, to which a small amount of liquid soft soap is added. This cleans the balls in fine shape. At first we supplied brushes at the pails, but found they were not needed, as the soap loosens the dirt so that it comes right off.” —Earl B. Kent, Highland Country Club, Attleboro, Mass.