COMPUTRAC®
By Arizona Instrument LLC

Using Rapid Loss on Drying Technology to Measure Simulated Biosolids Content

Arizona Instrument LLC

Introduction

Identifying the optimal solids content of the various byproducts of the wastewater treatment process can provide significant cost savings for the facilities involved. Knowing and maintaining a specific solids level saves money on chemical additives, haulage and incineration. It also helps optimize process control and ensure a consistent final product whether it is destined to be reborn as fertilizer or to make its home at a landfill.

There are several methods to test for the solids content of wastewater cakes, slurries and sludge. Throughout this experiment, the Computrac® MAX® 4000XL has been proven to correlate well with the standard oven method while being significantly easier to use and providing accurate results in a much shorter time frame. It has also demonstrated a level of durability and reliability that other types of moisture balances, such as microwave analyzers and analyzers with halogen based heating elements, do not share.

All of the methods mentioned above use loss-on-drying to calculate the moisture and/or solids content of a sample. This paper will briefly explain the differences between the various methods and will be followed by an experiment to test the most common form of solids analysis - the oven method - against the advanced technology of the Computrac® MAX® 4000XL.

Methods of Solids Analysis

The oven method is the most commonly used method to test the solids content of wastewater cakes, slurries and sludge. Although this method is generally considered to be easy, accuracy of test results may vary among different users. Testing times are also much longer than other methods, which can cause decreased plant productivity and increased delays in sending the final product to its ultimate destination.

Microwave and halogen based moisture balances are good alternatives to the standard oven method, but they also have their downfalls. Microwave analyzers utilize volumetric heating to heat the entire volume of the substance at relatively the same rate. The downside is that the distribution of heat is not necessarily uniform. This can lead to cold and hot spots on the substance being tested and can decrease the repeatability of test results.

Halogen based moisture balances use halogen lamps to test the solids content of a sample. Test times are faster than the traditional oven method, but the fragile nature of the heating element can cause problems when the instrument is operated in a more active environment. The nature of the halogen heating element also means that samples that are not uniform in color will experience uneven heating, which can decrease repeatability of test results.

The Computrac® MAX® 4000XL

The Computrac® MAX® 4000XL utilizes an advanced nickel chromium heating element that ensures a more uniform heating of the sample regardless of variances in sample color. This improves the accuracy and repeatability of test results. The MAX 4000XL requires little to no training to operate and its rugged design makes it tough enough for accurate use in the lab or in the plant. The exclusive rapid cooldown system improves throughput by 25% over other loss-on-drying (LOD) instruments.

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Putting the MAX® 4000XL to the Test

In this test, we will demonstrate that the Computrac® MAX® 4000XL can quickly and accurately analyze simulated biosolids samples to determine percent solids. We will do this by comparing results after testing three samples of simulated biosolids with different levels of solids content using both the MAX 4000XL and the traditional oven method.

Municipal lake water was used to represent the low solids sample, diluted clay soil for the medium solids sample and fertilizer soil for the high solids sample.

Sample Preparation

Municipal lake water was collected in Chandler, Arizona and stored in a 500 mL plastic bottle prior to use. There were some algae and other particulates suspended within the liquid. The clay and fertilizer soil were purchased from commercial distributors and stored in air-tight, glass mason jars prior to testing.

Test Conditions

All samples were run under the same conditions with the exception of sample size. The two liquid samples (lake water and diluted clay) were set to 10 g ± 0.5 g, while the mostly-solid fertilizer soil sample was set to 5.0 g ± 0.5 g. A greater sample size was used for the liquid samples so that they would spread evenly over the surface area of the sample pan.

Simulated Biosolids: MAX® 4000XL Parameters

Test Temperature:	160 °C
Idle Temperature:	80 °C
Ending Criteria:	Rate, 0.5000%/min
Sample Size:	10 g ± 0.5 g or 5.0 g ± 0.5 g
Pan Tare:	Standard
Sample Tare:	Standard
Results Display:	% solids (4 decimals)

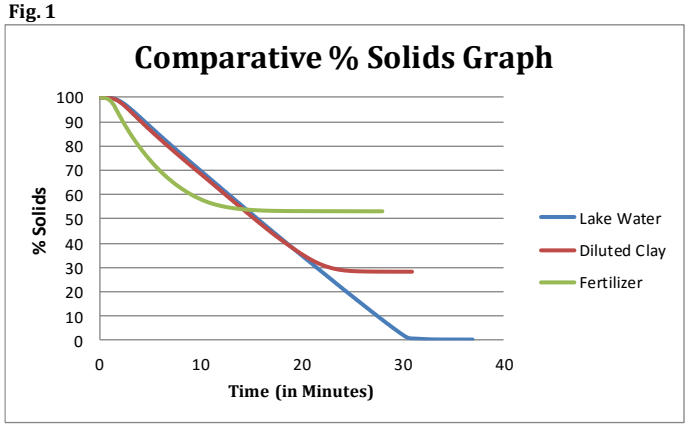
Simulated Biosolids Standard: Oven Parameters

Test Temperature:	130 °C
Ending Criteria:	Time, 2 hours
Sample Size:	10 g ± 0.5 g

Results

Figures 1 & 2 illustrate the % solids and rate (%/minute), respectively. All three samples analyzed by the MAX® 4000XL plateaued between 20 and 30 minutes, signifying a relatively stable level of % solids. The ending rate could be adjusted higher in order to end the test more quickly while maintaining accuracy of the test results. 160 °C was chosen as a test temperature since higher temperatures can thermally degrade organic material within a sample.

Fig. 1



The % solids from the three products shown above are: lake water (0.35%), diluted clay (28.59%) and fertilizer soil (53.11%).

Fig. 2

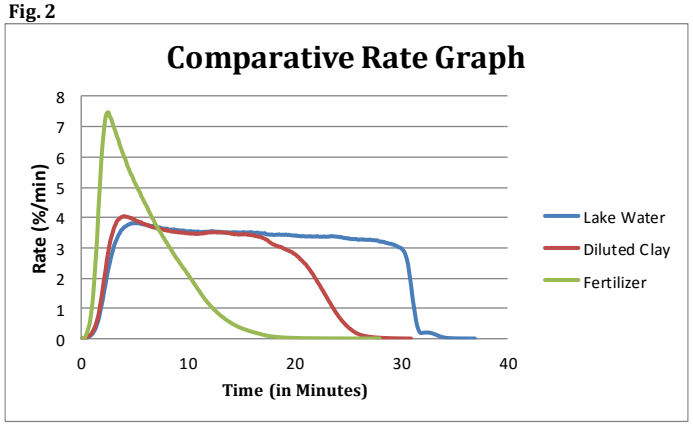


Table 1 shows a comparison of the results found by testing the fertilizer soil sample on the Computrac® MAX® 4000XL and in a standard oven. Test times are considerably shorter for the MAX® 4000XL than for the standard oven method.

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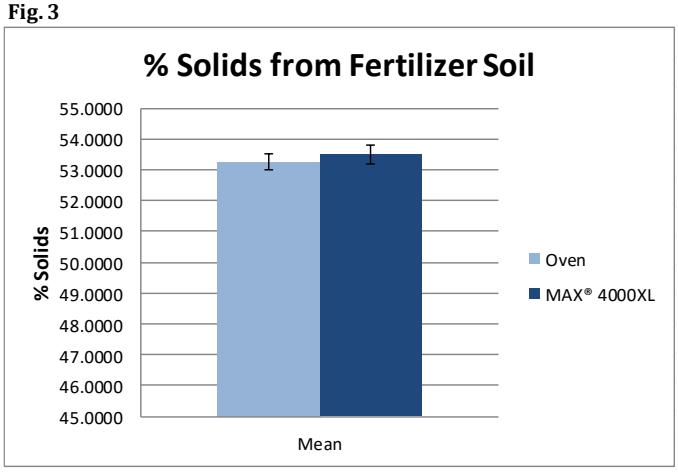
Table 1.

Fertilizer	Oven	Time	MAX® 4000XL	Time
Test 1	53.5478	2:00:00	53.7742	0:28:34
Test 2	53.1263	2:00:00	53.5106	0:32:47
Test 3	53.1149	2:00:00	53.1547	0:28:00
Mean	53.2630		53.4798	
S.D.	0.2467		0.3109	
R.S.D.	0.4632		0.5813	

Figure 3 demonstrates the mean of each of these data sets with respect to their standard deviations. The error bars are a graphical representation of ± the standard deviation. Statistically speaking, each data set is the same value.

Fig. 3



Conclusion

The Computrac® MAX® 4000XL yields results that are just as accurate as those found using the standard oven method but is significantly faster and less dependent on individual operator technique. The three samples used in this experiment also demonstrate the versatility of the MAX 4000XL in its ability to consistently obtain reliable and repeatable results when testing samples with varying levels of solids content. This is important because knowing the % solids at different points in the dewatering process allows operators to track how efficiently the plant is able to produce a high quality final product. Overall, the Computrac® MAX® 4000XL saves time and improves productivity by helping wastewater facilities consistently produce biosolids products that meet quality and compliance standards.

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