

Procedure for Laboratory Gravity Drainage Test

The purpose of the Laboratory Gravity Drainage Test is to select and quantify a treatment program for dewatering wastes containing greater than 1% suspended solids (i.e., sludge). Aliquots of sludge are treated one-at-a-time with different dosages of polymer solution. After mixing the treated sludge (by beaker-to-beaker transfer), the slurry is transferred to a Büchner Funnel fitted with the appropriate filter fabric and supported over a graduated cylinder. Filtrate evolution is recorded as a function of time; the highest rate of filtration at the lowest polymer dosage is the optimum dosage for that polymer.

The general procedure for the Gravity Drainage Test is as follows:

1. Measure 200 mL of well-mixed, fresh sludge into a 400 or 500 mL beaker.
2. Add the desired volume of polymer solution all at once.¹
3. Mix the treated sludge by pouring from one beaker to another 16 times.² Keep the pours as similar as possible and avoid spilling sludge.
4. Rapidly transfer the conditioned sludge to a 10 cm Buchner Funnel equipped with the filter fabric held in place with a section of 2.5" o.d. stainless steel pipe and supported over a 250 mL graduate.
5. Start timing filtration when liquid is first observed falling from the funnel tip.
6. Record on Drainage Test Data Sheet the volume of filtrate collected at 5, 10, 15, 20 30 and 60 sec.³ Also note the quality of filtrate⁴ and ease of cake release from the filter fabric.
7. Carefully clean beakers, funnel, ring and cylinder, and especially the filter fabric.
8. Repeat Steps 1-7 as necessary with additional dosages (until performance has leveled off) to generate a performance (filtrate volume vs. dosage) curve.

¹ Polymer dosages can be calculated from the equation:

$$\text{Dosage (\#/dry T)} = \frac{2000 (\text{Polymer solution volume})(\text{Polymer solution concentration})}{(\text{Sludge volume})(\text{Sludge \% sol.})(\text{Sludge sp.gr.})}$$

² The mixing provided by 16 pours provides a good "average" amount of mixing, but anywhere from 10 to 30 pours could be required in some cases, depending on the nature of the polymer solution, sludge and system.

³ The effect of pressure on the cake can also be investigated after 60 sec. drainage by positioning a 1 Kg weight on top of the cake or placing another piece of fabric on top of the cake and squeezing.

⁴ The quality of the filtrate can be determined by turbidimetric measurement or gravimetric suspended solids analysis.

