Troubleshooting
Jar Testing Procedure

The following jar test procedure is intended to simulate the coagulation/flocculation process and determine appropriate dosages. The lab-scale results are used to optimize the performance of systems such as water treatment plants by determining the concentration of coagulant to be added to the source water. For further instruction, please contact MANN+HUMMEL Water & Fluid Solutions Technical Service.

EQUIPMENT

For the jar testing procedure, you will need the equipment listed in Table 1.

TABLE 1. NECESSARY EQUIPMENT FOR JAR TEST PROCEDURE.

Required	Optional
1,000 mL Graduated Cylinder	6 Magnetic Stirrers
(6) 1,000 mL Beakers *	Magnetic Stirring Device
Aluminum Sulfate (Alum) Stock Solution (1.0% by weight) **	Turbidimeter
(5) 10 mL Pipettes	Sample Tubes
Stopwatch or Clock	

* Alternative beaker sizes may be used; alum dosages should be adjusted accordingly.
** See *Alum Solution Preparation* for *Dry Products* and *Liquid Products* below.

ALUM SOLUTION PREPARATION

If an alum solution of 1.0% by weight is not on hand, please follow the guidelines below to prepare a solution.

Dry Products:

Weigh 10 grams of chemical and dissolve in DI water to make a 1,000 mL solution. This is a 10 g/L solution or 1.0% by weight. In a 1 L test beaker this solution yields 1 mL/L = 10 ppm.

Liquid Products:

Liquid aluminum sulfate (alum) is typically sold and accounted for on a dry basis which is 48.5% $Al_2(SO_4)_3 \cdot 14\ H_2O$. Specific gravity is 1.335 ± 0.005. For example:

10.0 grams / (1.335 x 0.485) = 15.4 mL liquid alum for a 10 g/L (1.0% by weight) dry basis solution.

1 mL of this solution in a 1 L jar test beaker = 10 ppm dry alum.

PROCEDURE

The procedure for a jar test is as follows:

1. Using a 1,000 mL graduated cylinder, add 1,000 mL of raw feed water to be coagulated to each of the jar test beakers.
2. Using a prepared alum stock solution (1.0% by weight), dose each beaker with increasing amounts of solution shown in Table 2.

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TABLE 2. INCREASING DOSAGES OF ALUM.

Jar #	Alum Added (mL)	Alum Dosage (mg/L)
Control	0.0	0.0
1	0.5	5.0
2	1.0	10.0
3	1.5	15.0
4	2.0	20.0
5	2.5	25.0

3. After dosing each beaker, turn on the stirrers (if these aren't available, swirl beaker by hand to mix the alum and feed water solution) to a setting that best mimics the plant's operation as shown in Table 3.

TABLE 3. PLANT OPERATION VS. JAR TEST PROCEDURE OPERATING PARAMETERS.

Current Plant Operation	Jar Test Procedure
1. Alum addition followed by static mixing 2. Flocculation for 35 minutes 3. Settling for 90 minutes	1. Alum addition followed by mixing at a high RPM 2. Reduce mixing speed to match conditions in the flocculator for 35 minutes 3. Turn off mixer to match conditions in the settler for 90 minutes

4. Examine the beakers and determine which dosage produced the best results (i.e. Figure 1). Under-dosing coagulant will cause the sample to look cloudy with little or no floc and almost no settling. Over-dosing coagulant will cause a dense fluffy floc to occur and will not settle well. The beaker with an appropriate dosage of coagulant will have floc that has settled to the bottom and the water above it will be clear. If none of the beakers appear to have good results then the procedure should be run again using different dosages until the correct dosage is determined.

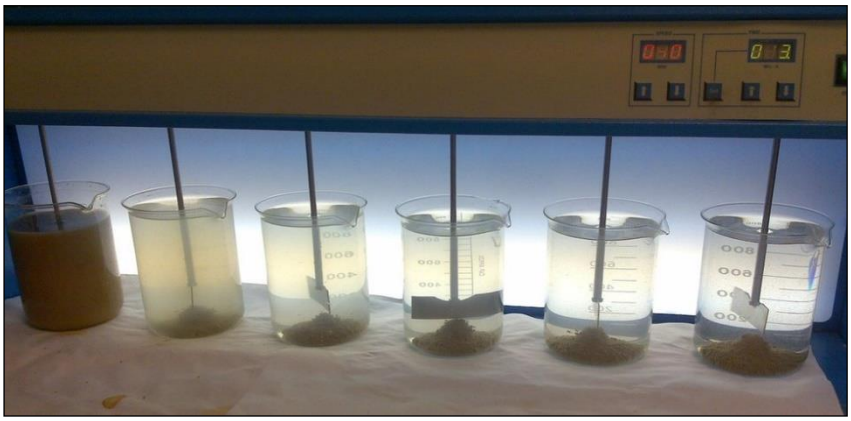

Figure 1. The beakers on the left are under-dosed with coagulant and appears cloudy with little or no floc and almost no settling. The beakers on the far right, however, appear to have floc that has settled to the bottom and the water above looks clear. In this figure, the beaker on the far right exemplifies the correct coagulant dosage.

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