CARUS
WATER



Jar Test
(Treatability Study) for
Wastewater Treatment

CAIROX® POTASSIUM PERMANGANATE

ANALYTICAL METHOD 111

OBJECTIVE

This method can be used to determine the amount of CAIROX® potassium permanganate needed to remove various organic/inorganic contaminants (e.g. phenol, trichloroethylene, sulfides, mercaptans, etc) from municipal, industrial and other water sources.

EQUIPMENT/REAGENT REQUIRED

1. 1 - Six place paddle stirrer or individual stir plates
2. 6 - Graduated beakers (1000 mL)
3. 1 - Graduated Cylinder (1000 mL)
4. 1 - Volumetric Flask (500 mL)
5. 2 - Graduated pipettes (10 mL)
6. 1- Volumetric Flask (100 mL)
7. 5 gram sample CAIROX potassium permanganate (Option: Scale for measuring $KMnO_4$)

1% (10,000 mg/L) Stock Solution: Place 5 grams of $KMnO_4$ into a 500 mL volumetric flask and add approximately 250 mL of distilled water. Agitate the solution to insure all the permanganate is dissolved. When complete, add the remaining distilled water to the proper volume (500 mL). Mix well. This will produce a 1% $KMnO_4$ solution. One mL of this solution equals 10 mg/L potassium permanganate when added to 1 liter of wastewater.

Standard Solution "A" (100 mg/L) Pipette 1 mL of the 1% stock solution into a 100 mL volumetric flask and dilute with distilled water to volume (100 mL). Mix well. One mL of this solution added to 1 liter of wastewater sample is equivalent to 0.1 mg/L CAIROX potassium permanganate.

Standard Solution "B" (1000 mg/L) Pipette 10 mL of the 1% stock solution into a 100 mL volumetric flask and dilute with distilled water to volume (100 mL). Mix well. One mL of this solution added to 1 liter of wastewater sample is equivalent to 1.0 mg/L CAIROX potassium permanganate.

SCREENING PROCEDURE

In any wastewater there are going to be a number of compounds, in addition to the one of interest, that will react with potassium permanganate. To determine a starting point for treatment, a potassium permanganate demand is required.

To estimate the potassium permanganate demand, the following procedure can be used.

1. A one-liter sample of the contaminated water is treated with the 1% stock solution to an end point that retains pink color.
2. The initial pink color of the solution will change to a straw or brown color as the potassium permanganate reacts.
3. When the pink color remains stable for the total amount of reaction time desired, the approximate demand has been found.

Note: For waters that have a very low potassium permanganate demand or when samples size is limited, Solution A or B can be substituted for the 1% Stock Solution.

The approximate demand in mg/L is equal to the number of milliliter (mLs) of the Stock Solution multiplied by 10. For example if a 1-liter sample required 30 mLs of the Stock Solution to reach a stable pink end point, the approximate demand of that water would be 300 mg/L.

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JAR TESTING

Using a graduated cylinder, measure 1000 mL (or other suitable volume) of untreated wastewater into each of the six beakers. Place the beakers onto a jar stirrer. Any adjustments to the sample that may be required (e.g. pH) should be made at this time. Add the Stock Solution (or Standard Solution "A" or "B" as required) in approximately equal increments approaching the amount indicated by the initial screening procedure. A blank sample containing no permanganate should also be made. Make sure at least one sample has more permanganate added than indicated in the screening test.

In the example, the approximate demand of the water was 300 mg/L. Suggested amounts of potassium permanganate for the jar test would be 75, 150, 225, 300, 375 mg/L, and no permanganate (used as a baseline measurement).

The samples should be mixed slowly on the jar stirrer for the available allowed time. At the end of the this time, note the samples may still have a residual pink color. This indicates an overfeed of potassium permanganate. Set these samples aside and analyze the remaining samples for the compound of interest.

Before analysis can take place, clarification of the sample may be required. This can be accomplished either by allowing the sample to settle or by gentle filtration. Once a clear solution is obtained, determine the remaining compound concentration using the appropriate method specified in standard methods for the examination of water and wastewater, EPA, or other acceptable methodology.

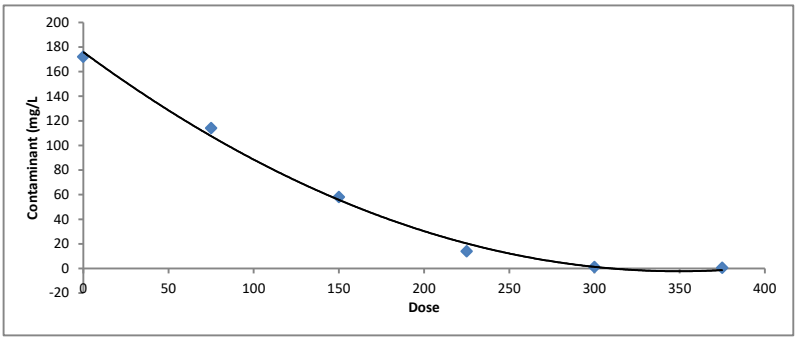
From the data obtained, a dose response curve can be generated. Plot the contaminant residual concentration along the Y axis and the CAIROX potassium permanganate dose on the X axis. From the graph the proper amount of potassium permanganate required to obtain the desired removal efficiency can be determined.

From the example give, Table 1 and Figure 1 can be generated. If the desired goal for the residual contaminants was 25 mg/L the required CAIROX potassium permanganate dose would be 190 mg/L.

Table 1

$KMnO_4$ Dose (mg/L)	Contaminant (mg/L)
0	172
75	114
150	58
225	14
300	1.2
375	0.5

Figure 1



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