

HG

Chemical Industry Standard of the People's Republic of China

HG/T 4331—2012

Water treatment chemicals
coagulation performance valuation
method

水处理剂混凝性能的评价方法

(English Translation)

Issue date:2012-11-07

Implementation date:2013-03-01

Issued by Ministry of Industry and Information Technology of the People's
Republic of China

Foreword

SAC/TC63/SC5 is in charge of this English translation. In case of any doubt about the contents of English translation, the Chinese original shall be considered authoritative.

This standard is drafted in accordance with the rules given in the GB/T 1.1—2009.

Annex A of this standard is an informative annex.

This standard was proposed by China Petroleum and Chemical Industry Federation.

This standard was prepared by SAC/TC63/SC5 (Subcommittee on Water treatment Chemical of China National Standardization Technical Committee on Chemistry).

Water treatment chemicals coagulation performance valuation method

1 Scope

This standard specifies methods for evaluating coagulation performance of water treatment chemicals, including jar test, decolorization test and organics removal test.

This standard is applicable to determining coagulation performance of water treatment chemicals for working out their formula, dosage and design parameters.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 601 *Chemical reagent—Preparations of reference titration solutions*

GB/T 602—2002 *Chemical reagent—Preparations of standard solutions for impurity*

GB/T 603—2002 *Chemical reagent—Preparations of reagent solutions for use in test methods*

GB/T 6682—2008 *Water for analytical laboratory use—Specification and test methods*

GB/T 15456—2008 *Industrial circulating cooling water—Determination of the chemical oxygen demand—Potassium permanganate method*

3 Test methods

3.1 Jar test

3.1.1 General

Use a Jar tester as testing apparatus. Take a water sample and add the water treatment coagulants in it. Then stir the solution, and let it flocculate sedimentation under certain hydraulic condition. Evaluate the coagulation performance of water treatment chemicals according to the result of water quality parameters measured.

3.1.2 Reagents and materials

3.1.2.1 Water, GB/T 6682, Grade 3.

3.1.2.2 Hydrochloric acid standard solution, $c(\text{HCl}) \approx 0.5 \text{ mol/L}$.

3.1.2.3 Sodium hydroxide solution, $c(\text{NaOH}) \approx 0.5 \text{ mol/L}$.

3.1.2.4 Water treatment coagulants: Counted as effective component, weigh a certain amount of coagulants to the nearest 1 mg. Dissolve it in water, then transfer to a 100 mL volumetric flask, and dilute to the mark with water, and mix thoroughly. The effective component in the solution is $1.0 \text{ mg/mL} \sim 10.0 \text{ mg/mL}$. The solution shall be used within 4 hours.

3.1.3 Apparatus

3.1.3.1 Jar Tester

3.1.3.1.1 Main technical requirements for Jar Tester

3.1.3.1.1.1 The deviation between the set stirring speed and the actual operating speed of each paddle shall not exceed 1.0%.

3.1.3.1.1.2 The size and installation position of paddle is shown in figure 1. The deviation shall not exceed 1.0 mm.

3.1.3.1.1.3 Lighting device is equipped at the bottom of the equipment, in order to observe the floc structure clearly. At the same time, heat insulation measures shall be taken to prevent the water temperature in the mixing jar from rising.

3.1.3.1.1.4 Each Jar is equipped with a dosing tube, and has synchronous dosing function.

3.1.3.1.1.5 The velocity gradient G generated by the paddle shall be adjustable from 10 s^{-1} to 1000 s^{-1} .

3.1.3.1.1.6 The stirring time and the sedimentation time shall be set within 99 minutes and be adjustable. The deviation shall not exceed 1.0s.

3.1.3.1.1.7 Capable of measuring the water temperature.

3.1.3.1.1.8 Operating parameters shall include water temperature, stirring speed, time, G value and program numbers, and etc.

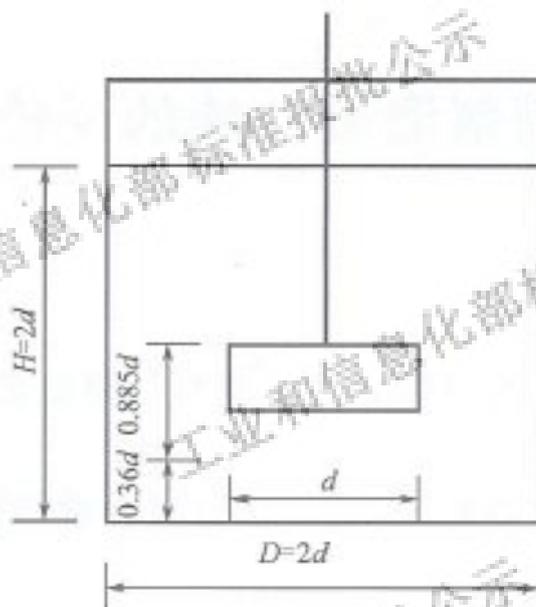


Figure 1 The size and the installation position of the paddle

3.1.3.2 Technical requirements for Jar

3.1.3.2.1 The Jar volume of 2 L, 1 L or 0.5 L is selected as needed. The jar shape is cylinder or cuboid, usually the cylinder preferred.

3.1.3.2.2 There shall be volume scale on the Jar. The deviation shall not exceed 1.0%.

3.1.3.2.3 The Jar should be made of transparent organic glass, plastic material or glass, which shall have sufficient chemical stability. There shall be a sample hole on the Jar.

3.1.3.3 Scattering turbidimeter, the scale interval is 0.01 NTU.

3.1.3.4 pH-meter, the scale interval is 0.01 pH.

3.1.4 Setting of test programs

Test programs include three stages: stirring, flocculation and sedimentation. Set the programs according to the following parameters.

stirring	the velocity gradient G-Value: $500\text{s}^{-1}\sim 1000\text{s}^{-1}$	time: 10s~60s
Flocculation	the velocity gradient G-Value: $100\text{s}^{-1}\sim 10\text{s}^{-1}$	time: 5min~30min
GT-value	$10^4\sim 10^5$	
G-value	Gradually decreasing	

Sedimentation time: 10min~30min

3.1.5 Test procedures

3.1.5.1 Stir the water sample to mix evenly, and put it into six jars to the required marks. If needed, adjust the pH value with hydrochloric acid solution or sodium hydroxide solution. Measure the water's turbidity with the turbidimeter. Measure the pH value of the raw water or adjusted water with a pH-meter.

3.1.5.2 Transfer the diluent of water treatment chemicals into the dosing tubes with pipette.

3.1.5.3 Put down the paddle, turn on the Jar tester, set the test programs, then press the running button to carry out the test according to the programs. After the sedimentation, take the clarified water from the jar and measure its turbidity and other water quality parameters.

3.1.5.4 During the testing period, observe the floc's forming time, shape and size and the status of the sediments, and record the observing result according to Annex A.

3.2 Decolorization test

3.2.1 General

Prepare the color water with direct blue 199 or reactive red KE-7B (i. e. color raw water). Add the coagulants, then carry out the decolorization test of coagulation sedimentation. Measure the absorbance of purified water at the maximum absorption wavelength (direct blue 199: 590 nm, reactive red KE-7B: 530nm) with the spectrophotometer, then calculate the coagulation decolorization ratio.

3.2.2 Reagents and materials

3.2.2.1 Water, GB/T 6682, Grade 3.

3.2.2.2 Hydrochloric acid solution, $c(\text{HCl}) \approx 0.5 \text{ mol/L}$.

3.2.2.3 Sodium hydroxide solution, $c(\text{NaOH}) \approx 0.5 \text{ mol/L}$.

3.2.2.4 Direct blue 199 solution, 5.0 g/L.

3.2.2.5 Reactive red KE-7B solution, 5.0 mg/L.

3.2.3 Apparatus

3.2.3.1 Jar tester, same as 3.1.3.1.

3.2.3.2 pH – meter, the scale interval is 0.01 pH.

3.2.3.3 Spectrophotometer, wave length is from 200 nm to 1000 nm.

3.2.4 Test procedures

3.2.4.1 Adjust pH value of the water sample to 7.5, measured by pH-meter, with sodium hydroxide solution or hydrochloric acid solution. Then transfer the water into six jars. In each jar, add 1.0 mL of direct blue 199 solution or reactive red KE-7B solution per 1L of water, and dilute to the mark with water accurately and mix thoroughly.

3.2.4.2 Transfer the diluent of water treatment chemicals into the dosing tubes with pipette.

3.2.4.3 Put down the paddle, turn on the Jar tester, set the test programs, then press the running button to carry out the test according to the programs. After the sedimentation, take the clarified water from the jar and measure its absorbance at the corresponding wavelength.

3.2.5 Result calculation

Decolorization ratio W , expressed in percentage, is calculated as formula (1):

$$W = \left(1 - \frac{A}{A_0}\right) \times 100 \quad (1)$$

Where

A is the absorbance of the treated water after coagulation decolorization;

A_0 is the absorbance of the untreated water.

3.3 Organics removal test

3.3.1 General

Add the coagulants into the waste water or sewage which contains organics. Carry out the jar test. Measure the COD content of the untreated water and the treated water according to GB/T 15456-2008, or measure the absorbance at the wavelength of 365 nm and 253.7 nm with a spectrophotometer. And evaluate the organics removal performance of the coagulant.

3.3.2 Reagents and materials

Same as 3.1.2.

3.3.3 Apparatus

Same as 3.1.3.

3.3.4 Test procedures

3.3.4.1 Stir the water sample to mix evenly, and put it into six jars to the required marks. If needed, adjust the pH value with hydrochloric acid solution or sodium hydroxide solution. Measure the COD content or the absorbance of the raw water or adjusted water at the wavelength of 365nm and 253.7nm with the spectrophotometer.

3.3.4.2 Transfer the diluent of water treatment chemicals into the dosing tubes with pipette.

3.3.4.3 Put down the paddle, turn on the Jar tester, set the test programs, then press the running button to carry out the test according to the programs. After the sedimentation, take the clarified water from the jar and measure the COD content or the absorbance at the wavelength of 365nm and 253.7nm.

3.3.5 Result calculation

3.3.5.1 The organics performance W_1 , expressed in percentage, is calculated as formula (2):

$$W_1 = \left(1 - \frac{\rho}{\rho_0}\right) \times 100 \quad \dots\dots\dots (2)$$

Where

ρ is the COD content of the treated water after coagulation, in milligram per liter (mg/L);

ρ_0 is the COD content of the untreated water, in milligram per liter(mg/L).

3.3.5.2 The organics removal performance W_2 , expressed in percentage, is calculated as formula (3):

$$W_2 = \left(1 - \frac{A_{253.7} - A_{365}}{A_{0\ 253.7} - A_{0\ 365}}\right) \times 100 \quad \dots\dots\dots (3)$$

Where

$A_{253.7}$ is the absorbance of the treated water after coagulation at the wavelength of 253.7nm;

A_{365} is the absorbance of the treated water after coagulation at the wavelength of 365 nm;

$A_{0\ 253.7}$ is the absorbance of the untreated water at the wavelength of 253.7nm;

$A_{0\ 365}$ is the absorbance of the untreated water at the wavelength of 365 nm.

Annex A

(Informative annex)

The Record of Jar Test

Jar Test Record Form

Sample _____		pH _____		Turbidity _____		Date _____			
Location _____		Alkalinity _____		Water Temperature _____		Gt _____			
Items				No. of Jar					
				1	2	3	4	5	6
Dosing order and dosage (mg/L)	1.								
	2.								
	3.								
Mixing	1st stage	Stirring speed							
		Time							
	2nd stage	Stirring speed							
		Time							
Flocculation	1st stage	Stirring speed							
		Time							
	2nd stage	Stirring speed							
		Time							
	3rd stage	Stirring speed							
		Time							
Time of floc occurred									
Sedimentation	Time								
	Sedimentation speed								
	Water quality Parameters	Turbidity/NTU							
		Chromaticity/Degree							
		Alkalinity/mg/L							
		pH							
		COD							
Effect of the Jar test									