



COD Reflux Digestion Reactor LMCDR-A100

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1. Safety Measures

- Before using the instrument, read the safety instructions carefully to ensure the correct and safe use of the instrument.
- Under the premise of complying with the usage principles, the service life of the product can be increased, and dangers can be avoided.

Safety symbols:

	Prohibited
	Caution
	Compulsory
	Disassembly is strictly prohibited
	Remove the power plug

The following regulations are safety warnings and precautions and must be followed:



Prohibited:

- Do not store or operate the instrument in places with high humidity, high temperature, or excessive dust to avoid hardware failure of the instrument.
- The instrument spare parts are not waterproof and should be kept away from the water.
- Avoid strong collision and vibration, which may cause damage to the instrument. It is recommended to use the original packaging of the instrument during transportation.
- It is forbidden to operate the instrument in a space with corrosive gas to avoid damage to the circuit system.
- Do not plug or unplug the instrument power cord with wet hands to avoid electric shock.
- Do not put your limbs in direct contact with the heated part of the instrument to avoid burns from high temperatures.



Caution:

- During the experiment, personal protection must be done (lab coat, gloves, goggles, masks, etc.) and personal safety must be paid attention to.
- If the power cord is damaged (the wire is exposed or broken), do not use it to avoid electric shock.
- If the reagent splashes during use, clean up the splashed reagent immediately. Read the reagent instructions and instructions provided with each reagent to obtain comprehensive information about the reagent.
- Avoid placing any flammable liquid near the instrument in use, as this may cause a fire hazard.
- The oxidation reflux process of the water sample experiment should be carried out in a fume hood to prevent harmful gases such as chlorine from endangering the health of the operator.
- When digesting the water sample, if splashing occurs, cut off the power supply immediately and wait until the temperature returns to room temperature before taking corresponding measures reason.
- Because the heating power of the instrument itself is relatively large, it should be used to avoid sharing the same power with other electrical equipment with relatively large power.



Disassembly prohibited:

- Do not disassemble the instrument for repair or change its internal structure without authorization to prevent accidents and malfunctions.
- During the use of the instrument, if any hardware abnormality or software operation failure occurs, do not repair or disassemble the instrument without authorization.



Remove the power plug:

- When water or other liquids accidentally enter the instrument, turn off the instrument immediately and unplug the power plug from the socket.
- If splashing or digestion bottle rupture occurs while the instrument is working, turn off the instrument immediately and unplug the power plug from the socket.



Compulsory:

- After the instrument is used, the waste liquid generated during the experiment should be stored and processed in a centralized manner and should not be left alone or dumped at will.
- During use, if the solution sticks to your skin or clothes, wash it immediately with plenty of water to avoid skin damage.

2. Introduction

COD Reflux Digestion Reactor LMCDR-A100 features 6 digestion pores for efficient sample processing. It ensures uniform heating and efficient digestion. Equipped with digital temperature controller for consistent regulation. Integrated with corrosion-resistant housing for durability. Our Reactor is ideal for wastewater and environmental analysis.

3. Features

- User-friendly operation
- LCD Screen
- Compact design
- Stable performance

4. Specifications

Model No.	LMCDR-A100
Digestion Temperature Range	Room temperature to 400°C
Timing Range	1 min to 10 hrs
Timing Accuracy	0.2s/h
Number Of Digestion Pores	6
Working Temperature Range	5 to 40°C
Ambient Humidity	Less than or equal to 85%
Display	LCD Screen
Power Consumption	1800 W
Power Supply	AC220V±10%/50Hz
Dimension	404×434×507 mm
Weight	16.5 Kg

5. Applications

COD Reflux Digestion Reactor LMCDR-A100 ensures controlled high-temperature digestion for consistent chemical oxygen demand analysis. It supports environmental monitoring of wastewater treatment and research laboratories for reliable water quality assessment.

6. Instrument Introduction

Instrument Structure:

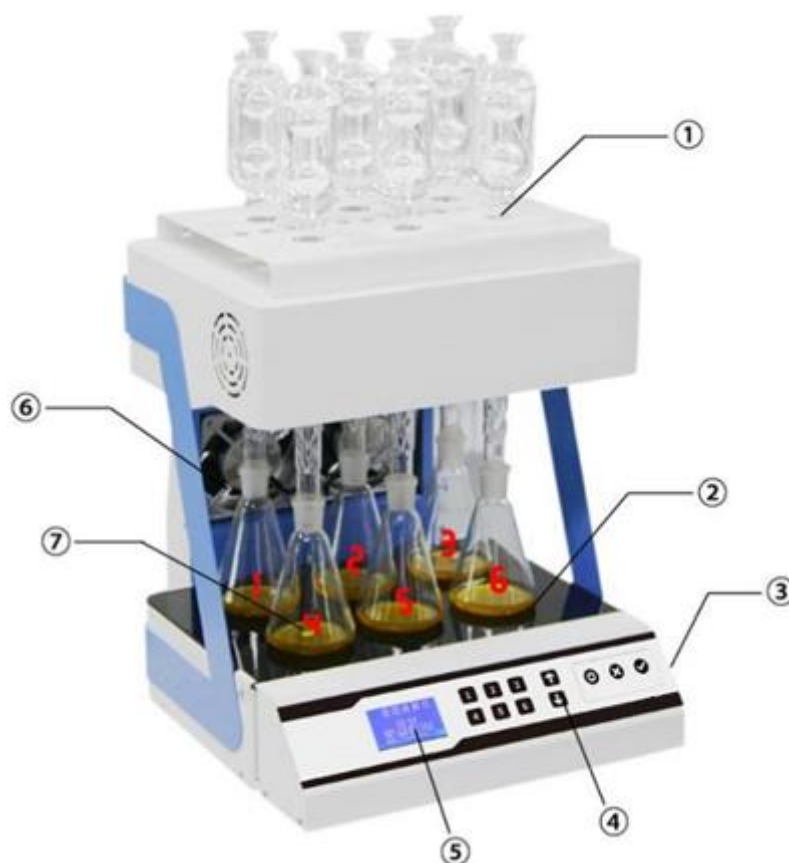


Figure-1

- 1) Condenser tube rack
- 2) Digestion platform
- 3) Power switch
- 4) Operation keyboard
- 5) Display screen
- 6) Cooling fan
- 7) Heating plate number

7. Installation

7.1 Environment conditions

- 1) **Ambient temperature:** 5-40°C
- 2) **Ambient humidity:** 85%RH (no condensation)
- 3) **Working power supply:** AC220V±10%/50Hz
- 4) **Power:** 1800W

7.2 Before using the instrument

Before powering on the instrument, distilled water should be added from the condenser water inlet (as shown in the figure below) until the amount of distilled water reaches the lower edge of the water inlet, serving as condensation water for the condenser.

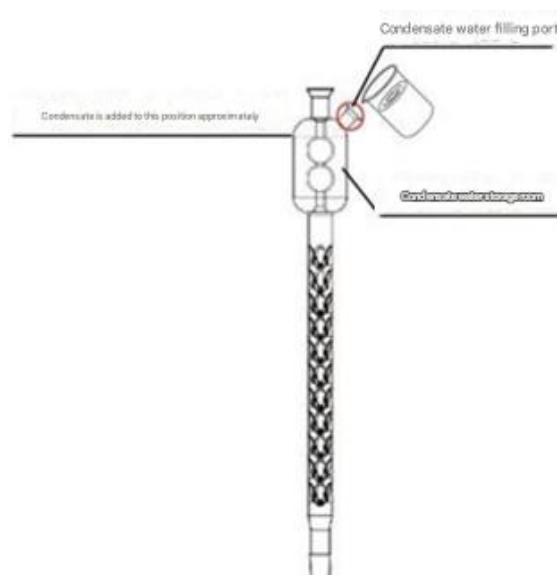


Figure-2

8. Working Principle

Principle of the method:

Add a known amount of potassium dichromate solution to the water sample, and use silver salt as a catalyst in a strong acid medium. After boiling and refluxing, use ferrocyanide as an indicator. The unreduced potassium dichromate in the water sample is titrated with ammonium ferrous sulfate, and the amount of ammonium ferrous sulfate consumed is converted into the mass concentration of consumed oxygen.

Under the acidic potassium dichromate conditions, aromatic hydrocarbons and pyridine are difficult to oxidize, and their oxidation rates are low. Under the catalysis of silver sulfate, straight-chain aliphatic compounds Can be effectively oxidized.

9. Operations

9.1 Key function introduction

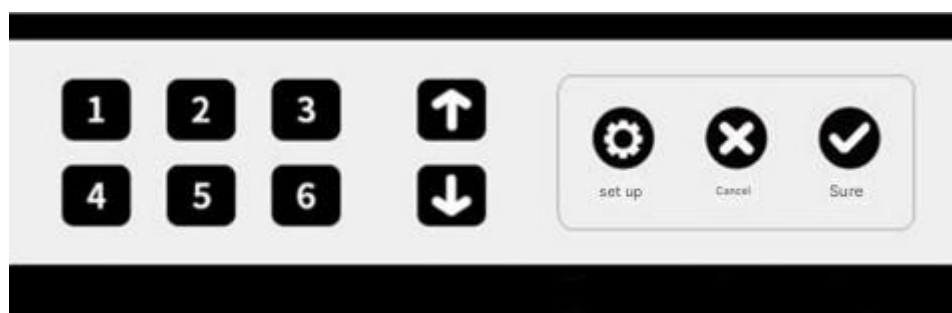


Figure-3

Name	Interface	Function
Number keys	In the Reflux digestion timing interface	Press the number key to enter the power adjustment interface.
	On the switch interface	Press the number key to turn the heating plate on or off.
	In the power setting interface	Press the number key to select the heating plate represented by the number.
Keys	Settings interface	To select a setting option
	In the digestion interface	To adjust the time, press the OK key to save and exit.
	In the cooling time interface	To adjust the time, press the OK key to save and exit.
	In the power setting interface	To adjust the power factor, press the OK key to save and exit.
	In the cooling time interface	To adjust the time, press the OK key to save and exit.
Set up	Switch the interface	Press the setting key to enter the instrument setting interface.
Cancel	Any interface	Return to the previous menu
		Cancel the current setting and return to the previous menu.
Sure	Settings interface	Save modified parameters
	Switch the interface	Press the OK button on the switch interface to start heating.

Note: The factory parameters of the system are empirical data, which can meet the general needs of the users. For example, due to differences in room temperature and water samples, the water sample does not boil or boil during digestion.

If the digestion is too intense, the user can enter the instrument power setting interface by pressing the setting key (Refer to the system setting menu function introduction for details) and adjust the instrument power coefficient to make the digestion.

9.2 Introduction to the Instrument User Interface

9.2.1 Start interface



COD Reflux Digestion Reactor
LMCDR-A100
www.labmate.com

Figure-4

Instrument name: COD Reflux Digestion Reactor

Instrument model: LMCDR-A100

Company website: www.labmate.com

9.2.2 Switching interface



switch switching
1:Off 2:Off 3:off
4:off 5: off 6: off
Press <OK> key to start

Figure-5

- 1) The instrument jumps to the switch-switching interface.
- 2) Press the number keys to turn the heating plate on or off. Turn on several heating plates for each sample (the instrument is turned on by default).
- 3) After setting the heating plate, press the OK button to start heating.
- 4) The digital position corresponds to the heating plate position.
- 5) The fan function can be turned on and off by pressing the up and down keys. Press the up key on the fan. Press the key to turn off the fan.



switch switching
1:on 2:Off 3:off
4:off 5: off 6: off
Press <OK> to start

Figure-6

9.2.3 Preheating

- 1) After turning on the heating, the heating plate set to “on” starts heating. The factory default warm-up time setting is 6 minutes.
- 2) Press the OK button to skip preheating. This function is only available when the instrument is powered off and restarted. It is used at startup and is not recommended under normal circumstances.



Figure-7

9.2.4 Timing interface

- 1) After preheating is completed, the instrument automatically enters the digestion timing interface.
- 2) If the user presses the cancel button during the digestion process, the instrument will display "Confirm to abandon this Operation?" and press the **OK** button to cancel the digestion countdown.



Figure-8

9.2.5 Cool timing phase

- 1) After digestion is completed, the instrument automatically enters the cooling timing state and the heating state. Close, fan starts.
- 2) After cooling is completed, other experimental operations can be performed according to experimental requirements.

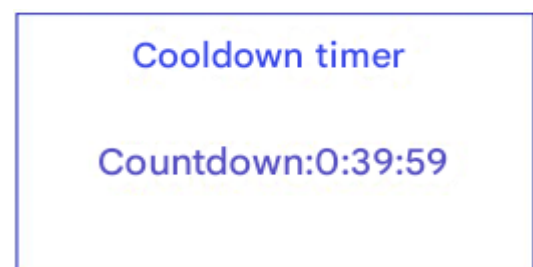


Figure-9

9.3 System settings menu function introduction

1) Press the Settings button



Figure-10



Figure-11

- The instrument enters the system setting interface.
- Use the keys to select the item to be modified.
- Press the **OK** button to enter.

2) Select “Digest Time” and press the Confirm key to enter.



Figure-12

- The digestion time can be freely set from 0 to 10 hours. The default digestion time of the instrument is 2 hours when it leaves the factory.
- If the user has special needs, the user can use the keys to modify changes.

3) Select Cooling Time, and press the **Confirm** key to enter.



Figure-13

- The cooling time can be freely set from 0 to 10 hours. The default cooling time of the instrument is 40 minutes when it leaves the factory.
- If the user has special needs, the user can use the keys to modify.

4) Select “Power Settings”, and press the Confirm key to enter.

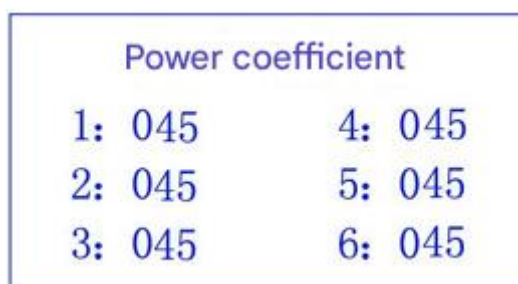


Figure-14

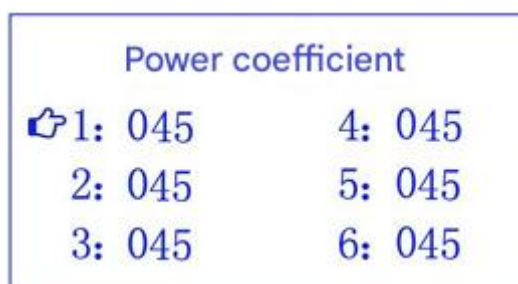


Figure-15

- The power factor can be freely set from 1 to 100. The factory default power factor is 45.
- Select Power Setting to modify the power factor and press the corresponding. Use the numeric keypad to select the heating plate to be modified. Mark, and then modify it by pressing the keys.
- The higher the power factor, the higher the temperature.

5) Select "Preheat Settings" and press Confirm key to enter.

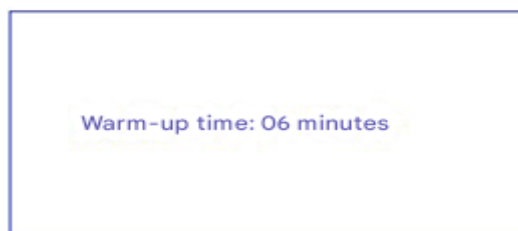


Figure-16

- The preheating time can be set freely from 3 to 10 minutes. The default factory warm-up time for the instrument is 6 minutes.
- If the user has special needs, the user can use the keys to modify changes.

6) Select "Recover Factory", and press Confirm key to enter.

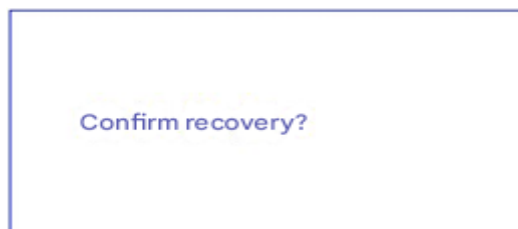


Figure-17

After selecting Factory Reset, the screen will display "**Confirm Reset?**". Just press **OK**.

Note:

- 1) After interrupting the experiment, the user needs to wait for the temperature to drop before restarting. Residual temperature will cause the preheating temperature to be too high and boiling to be violent.
- 2) During the experiment, the heating power can be adjusted to keep the boiling level consistent. It will take about 20 minutes to stabilize after adjustment.
- 3) During the digestion process, the temperature of the operating panel is about 60°C. Be careful to prevent low-temperature burns.
- 4) If the number of samples to be tested is less than 6, the power factor needs to be appropriately increased. (The power factor for 3 samples is about 60)
- 5) During the experiment, the user must follow the experimental steps and add all water samples and reagents before turning on the instrument for heating and reflux. If the user preheats the instrument in advance, when reagents are added to the water sample, a large amount of heat will be released, causing splashing, etc.

9.4 Introduction to Determination Methods

9.4.1 Reagent Preparation

- 1) **Potassium dichromate standard solution (0.25 mol/L):** Weigh 12.258g of standard or high-purity potassium dichromate that has been dried at 120°C for 2 hours and dissolved in. Transfer the solution into a 1000mL volumetric flask, dilute to the mark, and shake well.
- 2) **Potassium dichromate standard solution (0.025mol/L):** Prepared by diluting 0.25mol/L potassium dichromate standard solution 10 times.
- 3) **Ferrocyanate indicator solution:** Weigh 1.458g of o-phenanthroline (C₁₂H₈N₂.H₂O) and 0.695g of ferrous sulfate (FeSO₄.7H₂O), dissolve in water, dilute to 100mL, and store in a brown bottle.
- 4) **Ammonium ferrous sulfate [(NH₄)₂Fe(SO₄).6H₂O] Standard solution (about 0.05mol/L):** Weigh 19.5g of ammonium ferrous sulfate and dissolve it in water. Slowly add 10mL of 2 concentrated sulfuric acid while stirring. After cooling, transfer it to a 1000mL volumetric flask, add water to dilute to the mark, and shake well. Before use, use dichromic acid.

Standardization with potassium standard solution:

Ammonium ferrous sulfate concentration (C) mg/L = 0.2510/V.

- 5) **Calibration method:** Accurately add 10.00mL of 0.25mol/L potassium dichromate solution, add 100mL of distilled water, and slowly add 30mL of concentrated sulfuric acid. After cooling, add 3 drops of ferrous acid indicator, calibrate with ammonium ferrous sulfate standard solution, and record the volume of standard solution consumed (V standard).
- 6) **Sulfuric acid-silver sulfate solution:** Add 25g of silver sulfate to 2500 mL of concentrated sulfuric acid. Leave for 1-2 days to dissolve. (If you do not have a 2500mL container, 5g of silver sulfate can be added to 500mL of concentrated sulfuric acid).
- 7) **Ammonium ferrous sulfate (NH₄)₂Fe(SO₄) 2.6H₂O standard solution (about 0.005mol/L):** Prepared by diluting 0.05mol/L ammonium ferrous sulfate standard solution 10 times and calibrating with 0.025mol/L potassium dichromate standard solution.
- 8) **Mercuric sulfate:** Accurately weigh 10g of mercuric sulfate (HgSO₄) and dissolve it in 100mL of sulfuric acid solution (volume ratio 1+9), the solution concentration is 100g/L.

9.4.2 Detailed explanation of the measurement process

- 1) **Step 1:** Inject condensed water into the condensed water inlet.
In the water storage chamber of the condenser, the water-adding position is shown in the figure below.



Figure-18

- Add distillation water to the condenser water inlet water, distilled water is added to reach.
 - The lower edge of the water inlet can be as condensation water for the condenser.
- 2) **Step 2:** After the condenser is filled with condensed water, insert it into the condenser rack with the ground end facing downward.



Figure-19

The condenser should be handled with care. Set steady.

3) Step 3:

- (1) Prepare several digestion bottles for use.
- (2) Put 3-5 tablets in each digestion bottle.

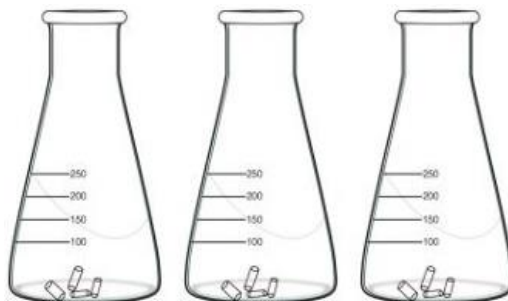


Figure-20

- Digestion bottles used in the experiment and the utensils must be cleaned.
- When placing the explosion-proof magnetic tube, note that the digestion bottle should be tilted to prevent the magnetic tube is slowly placed into the digestion bottle.
- To prevent the explosion-proof magnetic tube from being damaged digestion bottle.

4) Step 4:

- (1) Accurately measure 10 mL of distilled water and add it to digestion bottle No.1.
- (2) Then accurately measure each water sample 10 mL, add to other digestion bottles in turn medium (water sample volume is V0).
- (3) Add mercuric sulfate solution (by mass ratio)
Ratio of m [HgSO₄]: m [CL⁻] 20:1
Add no more than 2mL, mask
1000mg/L or less of chloride ion);
- (4) Add to each digestion bottle in turn 5mL potassium dichromate standard solution.

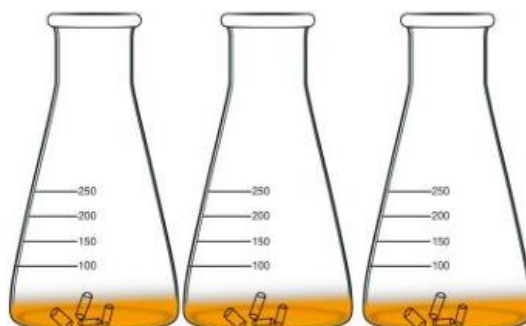


Figure-21

COD Reflux Digestion Reactor LMCDR-A100

- Sample measurement must be accurate.
- If the user uses the same pipette when measuring different samples, remember to clean it every time.
- Prevent cross-contamination between sample dyes.
- It is recommended to add potassium dichromate standard solution: Use a 5mL pipette when dissolving Liquid pipe to ensure the addition of reagents accuracy and identity.

5) Step 5:

- (1) Add the digestion bottle with reagents and water samples. Place it in the digestion hole of the reflux digestion instrument.
- (2) Grind the condenser and digestion bottle, mouth connected.
- (3) Then add 15mL sulfuric acid-silver sulfate. The solution was added to the disinfectant from the upper end of the condenser. Unlock the bottle.



Figure-22

- Before placing the digestion bottle into the instrument, quickly shake, oscillate, etc.
- Mix the reaction solution thoroughly.
- Sulfuric acid-silver sulfate should be added slowly. This is a corrosive reagent.
- Pay attention to operating safety.

6) Step 6:

- (1) Turn on the instrument and turn on the required heating plate. (start heating (about 6 minutes) bell.
- (2) After heating, the instrument automatically (Experimental process including decomposition and cooling.)



Figure-23

- Ensure that the sample is in a micro boiling state, otherwise it needs to be adjusted power factor.
 - The instrument automatically enters the preheating state after completion. The digestion timer is two hours. Automatically shut down after the digestion timer ends. Close the heating state, and open it. The cooling fan cools the instrument to Set the temperature.
- 7) After cooling is completed, open the condenser tube from the top. Pour about 40 ml of distilled water into the mouth of the total amount of water sample in the digestion bottle the volume is about 70mL.



Figure-24

Distilled water should be added slowly to prevent water from flowing too far poor flow.

8) Step 8:

- (1) Remove the digestion bottle and place it in the digestion bottle rack, and cooled to room temperature.
- (2) Add 2-3 drops of ferrous acid to test the indication dose.

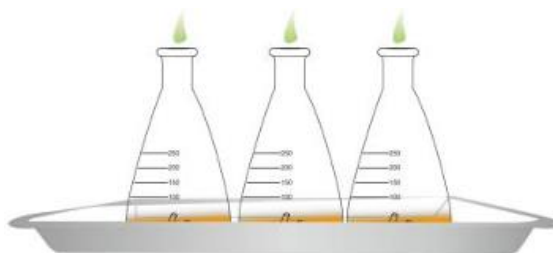


Figure-25

To ensure accurate operation, cool the reaction solution after digestion to room temperature.

9) Step 9:

- (1) Mix the blank water sample No. 0 with sulfuric acid Titrate with ammonium ferric standard solution, shaking while adding.
- (2) The solution color changes from yellow to blue-green Stop titration when it turns reddish brown and record the titration result. The standard solution of ammonium ferrous sulfate used was Quantity V1.



Figure-26

- Shake and digest continuously during titration bottle to mix the solution thoroughly.
- After the solution turns blue-green, Slow titration speed to prevent sulfuric acid. The standard solution of ammonium ferrous oxide is in excess.
- This causes measurement errors.

10) Step 10:

- (1) Mix water sample No. 1 with ammonium ferrous sulfate. The standard solution is titrated while shaking.
- (2) The solution color changes from yellow to blue-green Stop titration when it turns reddish brown and record the titration result. The standard solution of ammonium ferrous sulfate used was Quantity V2.

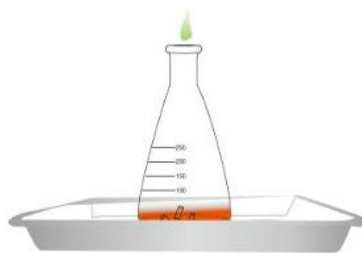


Figure-27

Use the same procedure to titrate other water samples, and record the titration Ammonium ferrous sulfate standard solution Dosage V2.

11) Calculate the COD concentration of the water sample:

$$\text{COD (mg/L)} = C(V_1 V_2) 8000 / V_0$$

Where:

C - Concentration of standard ammonium ferrous sulfate titration solution, mol/L.

V1 - The volume of the standard titration solution of ammonium ferrous sulfate consumed in the blank test, mL.

V2 - The volume of the standard titration solution of ammonium ferrous sulfate consumed in the test of the sample, mL.

V0 - Volume of the sample, mL.

8000 - $\frac{1}{4}$ the molar mass of O₂ converted in mg/L.

The test results are generally kept to three significant figures. For water samples with small COD values, when the calculated COD value is less than 10mg/L, It should be expressed as "COD 10mg/L".

Calculate the COD concentration in other water samples.

Note: When the measurement results are biased, please check the experimental operation process or the influence of interfering elements in the water sample. This digestion instrument only provides sample digestion. Not directly related to the measurement results.

- The boiling temperature of the water sample digested by the digestion instrument will vary with external factors such as region, season, laboratory ambient temperature, etc. Increase or decrease, the experimenter can observe the boiling power coefficient of the water sample in the first experiment and modify the power coefficient of the instrument to this coefficient (water The coefficient of the sample starting to boil) ensures that the water sample is slightly boiling, which can effectively reduce the condensed water temperature, improve the reflux efficiency, and prevent the water sample from overflowing.
- Before using the reflux digestion apparatus, add an appropriate amount of distilled water or tap water to the condensation water inlet of the barbed condenser to ensure the reflux condensation effect. (To keep the condenser clean and free of scale or bacterial growth, it is recommended to inject distilled water into the water inlet or prepare a weak acid solution).

- When measuring low-concentration COD water samples, some possible interfering factors may affect the measurement results, such as distilled water in polyethylene barrels. or deionized water, its COD value will increase over time, sometimes even reaching 10mg/L. When using distilled water or deionized water, please note that the pure water in beverages is essentially different from the distilled water in the experimental sense, and there may be air gaps when replacing them. The white value increases.
- The ammonium ferrous sulfate standard titration solution should be calibrated for each experiment, and the concentration change should be paid special attention to when the room temperature is high.
- After the water sample is refluxed and digested, add distilled water or deionized water slowly from the liquid filling port above the condenser tube to remove the liquid adhering to the inner wall of the tube. The volatile organic matter is washed back into the test solution.
- If a water sample is accidentally spilled on the instrument, turn off the power first, and then wipe it clean repeatedly with a damp cloth.
- When the digester is not in use, turn off the power supply in time.
- To ensure safety and the health and safety of operators, this operation should be carried out in a fume hood.
- Do not shake the digestion bottle violently during titration, and the solution in the bottle should not splash out, otherwise it will affect the measurement results.

10. Maintenance

10.1 Sample preservation

Water samples should be collected in glass bottles and analyzed as soon as possible. If analysis is not possible immediately, analytical grade sulfuric acid should be added to adjust the pH to < 2 and stored at 4°C . However, the storage time shall not exceed 5 days. The volume of the water sample collected shall not be less than 100mL.

10.2 Sample interval removal

When measuring COD, inorganic reducing substances in the sample, such as nitrite, sulfide, and divalent iron salt, will increase the measurement result and use their oxygen demand as the main interfering substance in this experiment is chloride, which can be partially removed by adding mercuric sulfate. After reflux, chloride ions can combine with mercuric sulfate to form soluble chlorine-mercury complexes. When the chloride ion content exceeds 1000 mg/L, the minimum allowable value of COD is 250 mg/L. L, below which the accuracy of the results is unreliable.

11. Troubleshooting

Fault	Solution
The sample was sprayed during the digestion process	Check whether the water sample is shaken before digestion.
	It is caused by the components contained in the water sample and can be appropriately diluted before digestion.
	The digestion temperature is too high. The boiling temperature of the water sample digested by the digestion instrument will vary with the region, season, and laboratory ambient temperature. The power coefficient at which the water sample starts to boil can be observed during the experiment. The power coefficient of the instrument is modified to this coefficient (the coefficient when the water sample starts to boil).
	Check and confirm whether the water sample analysis process is correct; and whether it is placed in the explosion-proof magnetic tube as required.
	Check and confirm whether the samples are digested at the specified temperature.
The sample does not boil	Check and confirm whether the amount of reagent added to the water sample meets the requirements.
	If some water samples do not boil after being heated for a period, the power coefficient of the instrument can be adjusted appropriately.
When the digestion bottle appears during the digestion process	Cut off the power supply of the instrument and open the windows for ventilation.
	After cooling down, take out the broken digestion bottle and clean up the broken residue.
	Use a clean wet cloth to wipe the liquid on the instrument surface and the heating plate repeatedly.
	Power on the instrument 1-2 times (half an hour each time) in a ventilated place. If there is no abnormality, it can be used normally.
The instrument is not powered	The instrument and other high-power equipment share the power connection equipment, causing voltage instability.

12. Accessories

Standard Accessories

Accessory	Quantity	Unit
Thorn-shaped condenser tube	6	Piece
Conical flask	6	Piece
Explosion-proof porcelain tube	6	Piece
COD special consumable	1	Bottle



Labmate Scientific Inc

Email: info@labmate.com | Website: www.labmate.com