STALWART

BOD Analyzer

Operation Manual

Please read and adhere to all recommendations in this manual to ensure the best experience and to maintain your Analyzer in good working order. The manual is for **BOD Analyzer.**

STALWART

1. Instrument

Biochemical oxygen demand (BOD) is an important test item in water quality evaluation and an important quality index to measure the pollution of organic matter to water quality. The BOD automatic tester produced by our company is a new intelligent test instrument for the determination of biochemical oxygen demand by using the air pressure differential method. The instrument simulates the biodegradation process in nature during the test. In the sealed culture bottle, the oxygen in the air above the culture bottle continuously supplements the dissolved oxygen consumed by the decomposition of organic matter in the sample. By removing CO2 produced in the degradation process of organic matter, the air pressure in the culture bottle changes, and the biochemical oxygen demand BOD value of the sample is calculated by monitoring the change of air pressure in the culture bottle.

The method can accurately provide the same measurement results as the chemical dilution method, and the experimental operation is more simple and efficient, and the testing process does not need special care, which greatly saves the time cost of users. When the set culture time is reached, the instrument detection system automatically closes, the test result is visually read, easy to use and maintain, and the biochemical reaction curve is clear at a glance. It can be widely used in environmental monitoring, petrochemical, medical and health, teaching and research departments to monitor water quality.

2. Features

Using color display, the test results of the test process can be displayed in real time

The mercury free pressure difference detection method is used to test BOD in water. The operation is simple and the result is reliable

The microprocessor control system automatically completes the measurement process without special care

Imported sensor, stable performance, small drift, accurate measurement

Measure sample number 1-6, can choose a single sample starting time

The measurement process does not need special care, the whole intelligent monitoring.

3. Technical parameter

3.1. Determination range：0-2000mg/L;
3.2. Accuracy: Qualified for BOD_5 accuracy test (Glucose-Glutamic acid standard solution BOD_5 =180-230mg/L))
3.3. Measurement days: 1-30 days
3.4. Number of sample measurements: ≤ 6
3.5. Printing mode: wireless printing
3.6. Recording interval: 24 minutes to 12 hours / time
3.7. Storage capacity: 10-year BOD 20 result value
3.8. Communication mode: wireless transmission
3.9. Volume of container: 580ml
3.10. Working Temperature: 20 ± 1 ℃
3.11. Working power: AC power 110 -- 220V, 50 / 60Hz
3.Rated power: 10W
3.13. Size: 272mm × 185mm × 75mm
3.14.Main engine weight: 2.5kg

4. **Operation**

4.1.Installation

After the user receives the instrument, remove all the packaging around the automatic water quality instrument and for storage and transportation, and check whether the accessories are complete and damaged according to the contents of the packing list.

In order to maintain the performance of the instrument and have a long service life, the following conditions should be met during installation:

1) Ambient temperature 10 ~ 35℃, relative humidity is not more than 85% (no condensation).

2) Place the instrument on the horizontal experimental platform, and the use environment should be far away from the electromagnetic launcher and high-power electrical devices.

3) Ensure that the room is clean, dry, dust free, vibration free, avoid direct exposure to strong light.

4.2.Button function introduction

Meun/ok: Confirm key

ESC: Cancel and exit keys

↑: Move the cursor up and the Settings increase

↓: Move the cursor down, and the setting value decreases

4.3. The function of the instrument

4.3.1. Main interface display

When the instrument is in sleep state, press **Meun/ok** key to wake up the BOD test terminal.

If you do not operate for 10 seconds, the instrument will automatically enter hibernation state.

4.3.2.Menu

In the main interface of the instrument, press **Meun/ok** key to enter the menu setting interface, press **ESC** key to return to the main display interface.

4.3.3. Set the sampling amount

Press ↑↓ key, move the cursor to [sample volume] option, press **Meun/ok** key to enter the sample volume selection interface, set the appropriate water sample test volume according to the predicted BOD concentration. Press to save **Meun/ok** Settings and exit, press to cancel **ESC** Settings, and return to the menu setting interface.

4.4. Test days setting

Press ↑↓ key, move the cursor to [Test days] option, press **Meun/ok** key to enter the test days selection screen, according to the test requirements, set the appropriate test days (1-30 days). Press to save **Meun/ok** Settings and exit, press to cancel **ESC** Settings, and return to the menu setting interface.

4.5. Constant temperature delay setting

Press ↑↓ key, move the cursor to [Constant temperature delay] option, press **Meun/ok** key to enter the constant temperature delay selection interface, set the appropriate constant temperature delay time (0-96 hours) according to the test requirements. Press to save **Meun/ok** Settings and exit, press to cancel **ESC** Settings, and return to the menu setting interface.

4.6. View detailed data

Press ↑↓ key, move the cursor to the [Detail Data] option, and press **Meun/ok** key once to display the BOD value of the last test end point and the test start time.

Press **Meun/ok** key twice to display the parameters set during the BOD test process and the final test junction

Press **Meun/ok** key three times to display the test data results of each sampling point during the BOD test process. According to ↑↓ Key to view all test point data. The test results can be evaluated according to the changing trend of the test results.

Press **Meun/ok** key four times, the biochemical reaction curve of the BOD test process will be displayed. The C mg/L displayed above the curve is the

concentration value of each cell.

4.7.View historical data

Press to↑↓ move the cursor to [Historical Data] and press to **Meun/ok** enter the View Historical Data screen. 20 groups of historical data can be stored on the screen. You can press to **Meun/ok** view the historical data.

On the historical data screen, press **Meun/ok** and then press **Meun/ok** again You can delete current or all test data.

Press ↑↓ key to move the cursor to the corresponding position Location to perform the deletion operation. After data deletion Therefore, exercise caution when performing this operation.

4.8. Set the terminal number

Press ↑↓ key to move the cursor to [Terminal Number] screen, press **Meun/ok** key to enter the test Terminal number interface, users can test according to the actual The BOD test terminal needs to be numbered.

4.9. Time setting

Move ↑↓ cursor to [when by pressing the key Between setting] option, press **Meun/ok** key to enter the time setting Interface, record experiment time, convenient for later experiment .The results and experimental methods were investigated and recorded.

4.10. Set the backlight brightness

Move ↑↓ cursor to [back] by pressing the key .Brightness] option, press **Meun/ok** key to enter the back light.Degree setting interface, users can according to their own needs Suitable for adjustment.

4.11. View system information

Move ↑↓ cursor to [system] by pressing the key.System information] option, press **Meun/ok** key to enter the viewer.Device system information.

5.Packing List Introduction

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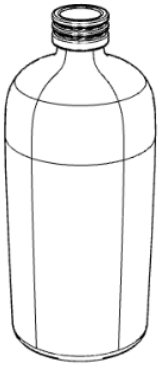
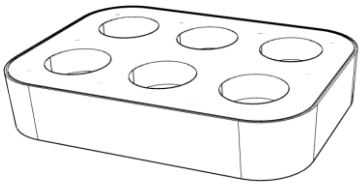
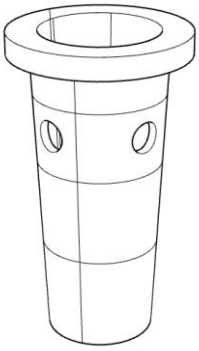
	BOD Test terminal: Used to analyze, display, save and print water samples for testing.
	BOD culture bottle: The samples were placed in a culture bottle for biochemical culture in a simulated natural environment.
	BOD tray host: During the experiment, the stirrer in the culture bottle was driven to stir the sample solution to promote the oxygen in the air in the culture bottle to dissolve in the sample solution.
	Potion cup: It is used to contain flaky solid NaOH or KOH.

	Tweezers: It is used to extract flaky solid NaOH or KOH reagents from pharmaceutical cups.
	Mixer: Used to stir samples during biochemical culture process.
	Power adapter: Used to power mixing trays when conducting sample tests.
	Precision pH test paper: Used to test pH value of sample solution.
	Reagent

6.BOD test process

6.1. Inspection

(1) Check whether the operation is normal according to the incubator instructions. When the control temperature is 20 ° C, the accuracy after constant temperature should be 20±1 ° C, otherwise the experimental accuracy will be affected.

(2) Place the BOD test host in the incubator and connect the power supply of the instrument.

(3) Power on the host.

(4) Take a culture bottle, take an appropriate amount of tap water, tilt a blender into the culture bottle, put it into the instrument, observe the mixer begins to stir, the page appears vortex, then the instrument can work normally.

6.2. test sample volume selection

Roughly estimate the BOD concentration of the test sample (the general BOD amount is 60% of the chemical oxygen demand (CODCr), calculate the approximate concentration range), select the appropriate test sample volume according to the following table, the higher the BOD concentration, the smaller the sample volume.

NO.	Sample concentration range (mg / L)	Sample volume (ML)
1	0-20	500
2	0-40	450
3	0-80	400
4	0-160	300
5	0-320	200
6	0-800	100
7	0-2000	50

6.3.Preparation of test reagents

6.3.1. Nutrient salt solution: Dissolve the whole bottle (pure water cleaning reagent bottle) inorganic salt powder in 300 mL pure water.

6.3.2. Buffer solution: Dissolve the whole bottle (pure water cleaning reagent bottle) buffer reagent in 100mL pure water.

6.3.3. Nitrification inhibitor: Configure according to the reagent instruction manual.

Note: Distilled water and utensils used to prepare the above reagents should not contain microbial growth inhibitors (such as alkali, inorganic acid, residual chlorine, heavy metals, etc.).

6.4. Sample testing

The water sample should be analyzed as soon as possible after collection, and the analysis within 2 hours after sampling does not need to be refrigerated. If it cannot be analyzed in time, the sample should be stored in a refrigerator at or below 4℃ immediately after sampling, and the analysis should be carried out within 6 hours after sampling.

6.4.1. Direct culture method

This method is applicable to the samples with BOD content below 2000mg/L and containing more aerobic microorganisms. The clean water samples can be tested directly for BOD without inoculation.

Water sample pretreatment: Adjust the pH value of the water sample between

6.7 and 7.5 (can be adjusted by sulfuric acid or sodium hydroxide, but the volume should not exceed 0.5% of the sample volume). Nutrient salt solution was added to 3mL per liter of water sample, and the water sample was placed in the incubator at constant temperature on the stirrer for 2-3 hours for aeration.

Remove the water sample: According to the above table, initially estimate the BOD concentration of the sample, select the appropriate sample volume, use a clean cylinder to measure the exact sample volume, and add it to the washed and dried culture bottle.

Place the stirrer in: Tilt the bottle slightly and place the stirrer in the bottle. Allow the blender to slide naturally to the bottom of the bottle to prevent damage to the bottle or the blender.

Add absorbent: Use plastic tweezers to add a small amount of sodium hydroxide flake particles into the potion cup. The amount of sodium hydroxide should be as close to but not more than the absorption hole above the reagent cup, otherwise sodium hydroxide will fall into the culture bottle, resulting in the destruction of the acid-base balance of the water sample, and the experiment will fail; The selection of sodium hydroxide flake particles should be as large as possible, otherwise it will lead to insufficient CO2 absorption and distortion of analysis results.

Install the test terminal: Install the reagent cup and the BOD test terminal on the culture bottle in turn, and tighten it. Air leakage will cause the experiment to fail.

Set the test parameters: Set the appropriate test parameters according to the experimental test requirements.

Start the test: Move the cursor to [Start test] option, press **Meun/ok** key to check whether the test parameters are set correctly, confirm to start the test, press **Meun/ok** key to confirm to save the detail data, the previous detail data result will be overwritten, press **Meun/ok** key to enter the constant temperature waiting state. Put the mixing tray into the constant temperature incubator whose temperature has reached 20℃, turn on the power supply of the agitator, place the culture bottle installed with the test terminal on the mixing tray, and close the door of the constant temperature chamber.

Test completion: When the constant temperature time is up, the test terminal starts automatic testing. When the number of test days is reached, the instrument automatically stops the test and saves the data. Users can view the test results in the [Detail Data] and [Historical data] options, and the data displayed on the instrument is the real BOD test value.

6.4.2. Inoculation culture

If the content of aerobic microorganisms in the test sample is small and cannot meet the needs of fully decomplanting organic matter in the sample, water rich in aerobic microorganisms must be added for inoculation. Such as: industrial sewage, after chlorine disinfection of domestic sewage treatment plant discharge water.

Inoculation solution:

① The supernatant of untreated fresh domestic sewage is placed at 20℃ for 24-36 hours.

② The liquid obtained after the sample was filtered by filter paper after the previous test, the solution can be stored at 20℃ for one month; Effluent from a sewage treatment plant.

A river or lake containing municipal sewage.

Use a pipette to remove about 1%, 5%, 10% of the total test sample and add it to the sample. Refer to the direct culture method for water sample pretreatment and subsequent operations.

6.4.3. Dilution culture method

If the BOD concentration of the test sample exceeds 2000mg/L or contains toxic substances such as copper, lead, zinc, cadmium, chromium, arsenic, and cyanide, it needs to be diluted.

Preparation of vaccination diluent: Fill a two-liter glass container with an appropriate amount of distilled water, control the water temperature at about 20℃, aerate for 1-2 hours by appropriate methods, and add 3mL nutrient salt solution, 1mL buffer solution and about 5%-10% of the total test sample to each liter of distilled water before use.

According to the actual BOD concentration of the sample, the appropriate dilution ratio is selected. Refer to the direct culture method for water sample pretreatment and subsequent operations.

Test data processing: For the samples that have been diluted and pre-inoculated, after the final test result is displayed after the instrument test, the actual BOD concentration value of the sample is calculated according to the following formula:

Sample actual :BOD concentration =(Sample BOD value-BOD value of inoculating fluid*inoculum)/Sample solution*dilution ratio

If the amount of inoculating fluid added is relatively small compared to the amount of test water sample, it is not necessary to correct the test result. If the amount of inoculating fluid added is too small to cause the biological decomposition of organic matter in the water sample, the amount of inoculating

fluid can be increased. At this time, the addition of inoculating fluid will lead to the deviation of the BOD value of the test sample, and the inoculating fluid and the sample can be tested simultaneously for parallel sample determination.

Example: An industrial wastewater was toxic, and the estimated BOD value was about 600mg/L. Before the test, the sample was diluted 10 times. At the same time, the inoculation was carried out with domestic sewage, and the BOD value of the inoculation solution was about 50 mg/L, and the inoculation amount was 10%. After several days of culture, the results showed 55.0 mg/L and 72.3mg/L, respectively.

Sample actual :BOD concentration =(55-72.3*10)/90%*10=530.78mg/L

6.5. Factors affecting the BOD test

6.5.1. pH

The pH of the test water sample should be adjusted to about 6.7-7.5 (7.2 is the best), which can be adjusted by sulfuric acid or sodium hydroxide, but the volume should not exceed 0.5% of the sample volume.

6.5.2. Dissolved oxygen

Since the experimental temperature is 20℃, the dissolved oxygen of the test sample taken in winter will be supersaturated, and the dissolved oxygen of the test sample taken in summer will be undersaturated. These samples should be stirred and aerated prior to BOD testing.

6.5.3. Residual chlorine

The water sample containing a small amount of residual chlorine will disappear after 1-2 hours, and the residual chlorine is greater than 0.1mg/L, which can be removed by adding sodium thiosulfate. The amount of addition can be determined by iodometry.

6.5.4. Nitration

In most of the tested water samples, nitrification was not obvious or did not occur at all. However, the outflow water of the biological treatment tank contains a large number of nitrifying bacteria, which will undergo nitrification reaction in the later stage of the test, resulting in the determination of BOD results containing the oxygen demand of nitrogen compounds. Nitrification inhibitors can be used to inhibit nitrification. 2mL nitrification inhibitor can be added to each litre of sample.

7.Instrument maintenance and troubleshooting

After the test is completed, clean the following steps to ensure the stable performance of the test instrument and the accuracy of each test result.

Culture cleaning: After the test is completed, empty the culture bottle and rinse

the culture bottle with hot water several times, use hot soapy water and brush to clean the sediment on the inner wall of the bottle, and then rinse the culture bottle with water repeatedly to clean the detergent and detergent remaining on the inner wall of the bottle. Finally, use distilled water and place it on the rack of culture bottle for natural control drying.

Stirrers: Wash the stirrers with hot soapy water and soak them in distilled water for a period of time, then put them on dry filter paper to air dry.

Reagent cup: Wash CO2 absorbent with a brush, wash with hot soapy water several times to remove alkaline residue, and then rinse thoroughly with distilled water and put upside down on dry filter paper.

The test terminal is a precision device and cannot be cleaned or touched.

Common test troubleshooting:

During the test culture period, the BOD test value gradually increased, but the increment between each test value gradually decreased with the increase of time.

If the reading continues to drop, it indicates that the instrument is leaking gas, and the test terminal and the culture bottle should be checked to see if the seal is intact. Whether the reagent cup has cracks, aging, deformation.

If the test value in the detail data column is a constant value, possible causes

① Sodium hydroxide leakage, resulting in the change of pH of culture medium;

② serious air leakage;

③ or the range selection is too large, there is interference gas.

It can be avoided by putting too much sodium hydroxide reagent and leaking into the bottle; Find the leak point as above; Choose the right range to solve the above situation.

If the starting point of the test is delayed (compared to the correct test result), the possible reason is that the number of aerobic microorganisms in the test sample is insufficient or the pH is too high or too low, the pH can be adjusted and the sample can be inoculated.

If part of the test point data in the [Detail Data] column drops, it may be that the constant temperature time is too short, which can be solved by extending the constant temperature time.