BDD Beaker sewage degradation analysis experimental equipment

Instruction manual

Catalogue

1. Overview

Electrochemical treatment of wastewater is a new method, through the transfer of electrons to achieve REDOX reaction, with no chemical additives, high controllability, small footprint characteristics. Electrochemical method In the process of treating the effluent water containing COD and TN&TP, COD and ammonia nitrogen can undergo electrochemical oxidation reaction at the anode, nitrate nitrogen and nitrite nitrogen can undergo electrochemical reduction reaction at the cathode, and finally COD and TN can be converted into CO2 and N2.

In the electrochemical treatment of wastewater, boron-doped diamond (BDD) electrode has a wide electrochemical window, and the high oxygen evolution potential can make it efficiently generate various kinds of strong oxidizing free radicals (such as hydroxyl radicals, etc.), so as to efficiently oxidize various organic compounds in pollutants. Moreover, BDD electrode has the advantages of low background current, high electrochemical stability and good corrosion resistance.

2. Main structure

The structure of BDD module is shown in Photo 1. A complete module is composed of two BDD positive electrodes and two titanium cathodes. Using with a special beaker, the electrode is fully immersed in sewage. The electrodes are connected to the power supply through a terminal at the top of the module,

where the BDD electrode is connected to the positive terminal of the power supply and the titanium cathode terminal is connected to the negative terminal of the electrode.

3. Product performance parameters

3.1 Nameplate:

Product model	BDD100-000-000	Date of manufacture	/
Input voltage/current	DC20V/50Hz	Work rate	200W
Ambient temperature	10~45℃	Ambient humidity	≤90%
Weight	≤0.5Kg	Overall dimension	φ106mm×169mm

3.2 Related parameters of power supply ：

Input voltage (DC)	DC20V/50Hz	Input current (DC)	5A(max)

Work rate	200W	Power factor	⩾90%
Output voltage (DC)	0~20V	Output current (DC)	0~10A

3.3 BDD electrode module parameters:

Name	BDD electrode module	Specification and model	S10
Dimension	100mm×50mm×21mm	Shell material	Nylon + glass
Anode	material	Silicon - based boron-doped diamond film (BDD) electrode	
	Single piece specification	100mm×50mm×3mm	
	quantity	2 pieces	
	Electrocatalytic area	⩽17000mm²	
	Anode carrying current density	0-80mA/cm²	
Cathode	material	titanium	
	quantity	3 pieces	

4. Water inlet requirement

At the beginning, water should be passed through the filter, the significant solid impurities can't enter the BDD electrode module; Water inlet temperature 10-70℃; pH range: 1-12; And C (H+) < 2mol/L, fluorine < 20mg/L (including organic fluorine and inorganic fluorine), bromine < 500mg/L, metal ions < 200mg/L (including calcium and magnesium and heavy metal ions), SS < 200mg/L, 2000mg/L < salt content < saturation ×70%. The water shall not contain fluoride ions, large amounts of bromine, or substances that will corrosion silicone substrate and titanium.

5. Operation Guide

Please remember to check the correctly connected of power supply, whether all function keys are reset. Confirm that everything is normal before we proceed with the experiment

5.1 Water sample preparation

Pour the water sample into a pre-washed and dried beaker (0.9-1L of water is recommended).

5.2 Installation of BDD module

A magneton is placed in the beaker containing the water sample, and the BDD module is installed on washed and dried beaker in advance, so that the BDD electrode is fully immersed in the water sample. Be careful for the screws and interfaces that are easy to be corroded into the water sample. When pressing the seal ring, do not press into the beaker by brute force to avoid fragmentation (if the water sample is not easy to foam, suggest to remove the seal ring).

5.3 Turn on magnetic stirrer

Put the beaker on the magnetic stirrer which in the fume hood, turn on the magnetic stirrer and adjust the speed. Make sure the magneton and magnetic stirring are working properly. The experiment only can be carried out in a fume hood or other ventilated environment.

5.4 Power on

Connect the power output line with BDD module, please note that the positive terminal of the power supply is connected to the electrode anode, and the negative terminal of the power supply is connected to the electrode cathode, Middle terminal of BDD module is the anode, the two sides are the cathode (the cathode connection only needs one side, as shown in Photo 2).

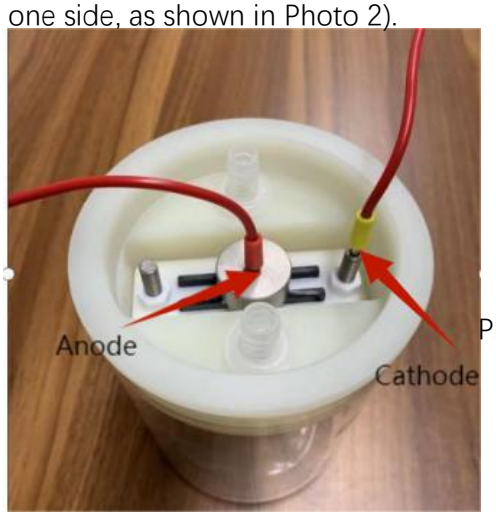


Photo 2

5.5 Setting power parameters

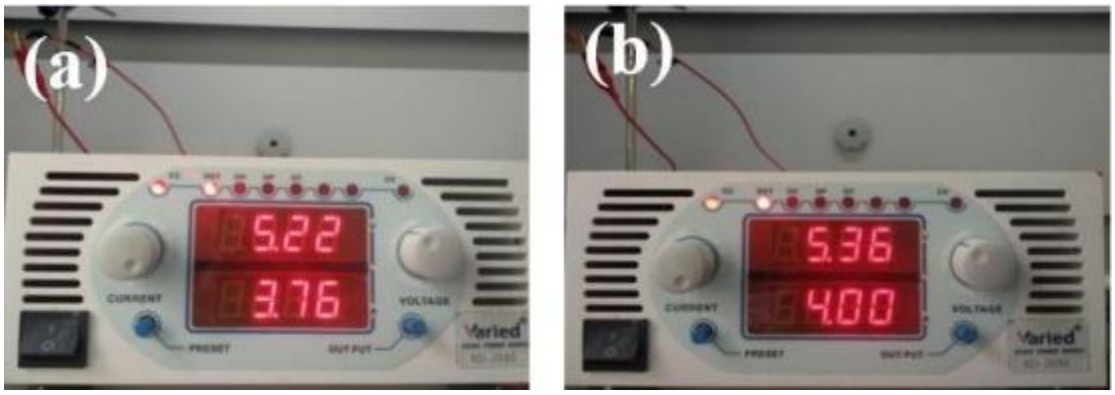
Turn on the power switch (as shown in Photo 3A), set the current, voltage and other parameters; Suggest to choose constant current mode. Adjust voltage to maximum range, and the current is adjusted to the required value (Photo 3B). If the pulse power supply is used, the duty cycle, frequency and other parameters need to be set (reference value: steady current, positive pulse, high frequency band, duty cycle 40%-80%, frequency 10000-20000Hz, depending on the nature of the water sample, the effect will be different. Refer to Photo 3 c)

Photo 3

5.6 Power output

Press the "Output" button, the power supply will start to work (as shown in Photo 4A). At this time, the current may deviate from the set value. Adjust current to the set value to start degradation (as shown in Photo 4B), Keep ventilator is in normal operation status

during degradation.



5.7 Periodic sampling

Take samples at regular intervals, record current and voltage values, and measure temperature (keep water temperature under 70℃) and pH value. If a large amount of foam is produced, it is necessary to connect the foam drum through a hose on the diversion pipe to collect the foam.

5.8 Power off

Power off operation is the opposite of power on; After the reaction is over, firstly adjust the current output to minimum value, turn off power output is turned off. Then Turn off the stirrer.

5.9 Cleaning

Remember to clean module after reaction. Suggest to use milder reagents such as dilute acid and alcohol, use with a soft brush; Don't use high frequency ultrasonic when cleaning; Do not scratch the electrode with the sharp edge of the tool.

6. Matters Need Attention

6.1 Place the equipment in a fume hood or other well-ventilated area.

6.2 Make sure BDD electrode is in good contact with the conductive clip, and keep a large contact area; Avoid poor connect which will lead to excessive

current density and damage to the electrode.

6.3 BDD electrode and power supply should not be connected inversely. BDD positive pole to the anode electrode, and the negative pole is connected to the cathode electrode.

6.4 Keep current density of the BDD electrode module under 80mA/cm2 (Suggest to keep current density below 60mA/cm2 for long-term operation), and the corresponding current density of each current is as follows:

No	Water Volume (L)	Electrode Area (cm2)	Current (A)	Current Density (mA/cm2)
1	1	150	0	0
2			4.5	30
3			9.0	60
4			12.0	80

Note: Current density is calculated according to the actual water inlet area of the BDD electrode.

6.5 The reaction water level should be 0.8-1L of the beaker, and it is strictly prohibited to run the electrode when the water level is lower than 0.8L. Smaller electrode working area will result large current density, and reduce electrode life.

7. Equipment Maintenance

7.1 Maintenance Of BDD Module(Cleaning)

7.1.1 Application

Water samples that containing small amounts of calcium and magnesium or heavy metal ions; SS > 50mg/L water sample; Water samples of solid impurities are produced during the degradation reaction. The cleaning method is suitable for module with light scale.

7.1.2 Cleaning method steps

1) Acid pickling: Add an amount of 2-3% (pH 0.2-0) hydrochloric acid to the reaction cycle barrel, and normally start the circulation pump or stirrer,recirculating cleaning for 1-2h. If the scale is more serious, it can be cleaned with 2-5% hydrochloric acid for a longer time. To avoid waste, it can be cleaned with 0.5-1% concentration hydrochloric acid, if the scale is less or already finish regular cleaning.

2) Electrolytic cleaning: After acid pickling, add an amount of 1% sodium sulfate solution, add a small amount of hydrochloric acid (add 5-10mL 36% hydrochloric acid per 1L sodium sulfate solution), and electrolyze for 0.5-1h with a current density be 30-50mA/cm². Note: Hydrochloric acid will produce chlorine gas and hypochlorous acid after electrolyze, please control the amount according to the site conditions as appropriate.

3) Tap water cleaning: After electrolytic cleaning, cleaning with tap water for 1-2 times.

7.1.3 Cleaning frequency

1) Normally, we recommend to clean once every 1-2 weeks, or clean after running 50-100h ;If the water sample is prone to scale formation substances, it is recommended to clean more times.

2) If you don't use the equipment for a long time, it is also necessary to use this method to maintain and clean the equipment before deactivation, at least required for electrolysis cleaning and tap water wash for one time.

7.2 Equipment Maintenance

7.2.1 The equipment should be placed in a clean, dry and well-ventilated place.

7.2.2 The equipment should be lightly handled , anti-falling and anti-scratching.

7.2.3 Clean BDD electrode module、peristaltic pump and pipeline after the completion of the experiment, and drain out all water.

7.2.4 Cut off the power supply and keep it properly in case long period of non-use.

7.2.5 Please contact with us in case of equipment failure. Avoid non-professional technicians blindly and arbitrarily maintenance.

8. After-sales Service And Others

8.1 We provide basic operation and daily maintenance training services free of charge.

8.2 Our after-sales service response time is 10-24 hours to provide solutions for customers. If core parts need to be replaced or the whole machine needs to be disassembled and repaired, please send back to us for processing.

8.3 The user shall not change the original design of the product or disassemble the BDD electrode module of the core component of the device without authorization, otherwise the user shall be liable for the consequences.

8.4 Outside the warranty period, users can choose paid service, if you need to replace parts, our company charges according to the cost of parts.

8.5 Hunan Boromond EPT Co., LTD reserves the right of final interpretation of this manual. Contents of this manual are subject to change without prior notice.

9. Attachment

Reference table for the relationship between COD degradation and reaction time in beaker BDD equipment

COD Original (mg/L)	COD Final (mg/L)	Current (A)	Water Volume (L)	Estimated reaction time (h)
100000	50000	9	1	5-7
50000	10000	9	1	5-7
10000	5000	9	1	1.5-2.5
5000	2000	9	1	1-2
2000	500	9	1	0.8-1.4
500	200	9	1	0.2-0.5
200	50	9	1	0.2-0.5

Note:

1. The BDD reaction effect is greatly affected by the composition and structure of organic matter, and the table above is only for the reference of initial users.

2. When COD concentration is too low, the reaction time is not easy to predict (greatly affected by water quality)

3. To make sure the water quality can match the standard and avoid invalid experiments, it is recommended that the actual reaction time longer than the estimated time .

4. During the reaction process, it is recommended to take timely sampling (it is recommended to take 4-8 samples for each reaction) to detect the corresponding indicators, make a degradation curve, and obtain its degradation law.

5. The amount of water and current can be adjusted according to the situation, and the reaction time can be changed with its proportional ratio (the reaction time is proportional to the amount of water and is inversely proportional to the current).