



Hunan Boromond EPT Co., Ltd.

手提式 BDD 污水降解分析实验设备

Portable BDD sewage degradation analysis experimental equipment

使 用 说 明 书

Instruction Manual

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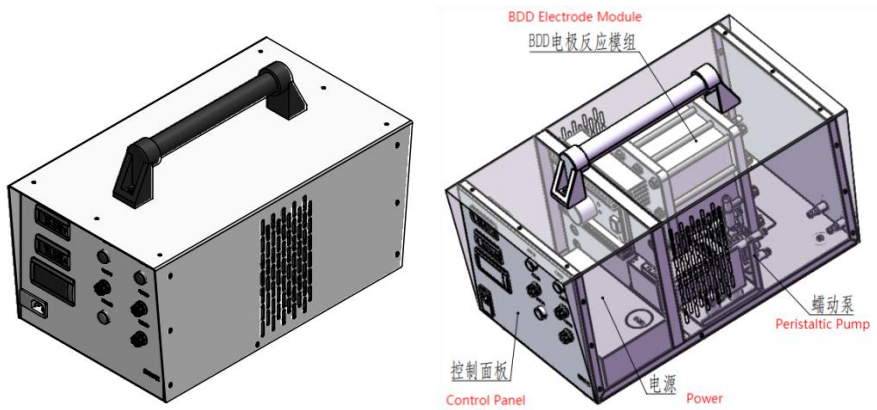
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1.概述 Summarize

手提式 BDD 污水降解分析实验设备主要用于化工、制药、印染、机加工废水及垃圾渗滤液等高浓度、高含盐、高毒性、难降解废水的处理与分析实验。

Portable BDD sewage degradation analysis equipment is mainly used for chemical, pharmaceutical, printing and dyeing, machining wastewater and landfill leachate and other high concentration, high salt content, high toxicity, difficult to degrade wastewater treatment and analysis experiments

2.主要结构 Main Structure



2.1 外壳 Shell

2.2 电源模块 Power Module

2.3 BDD 电极模组 BDD Electrode Module

2.4 蠕动泵 Peristaltic Pump

3.产品性能参数 Product Performance Parameters

3.1 铭牌 Nameplate:

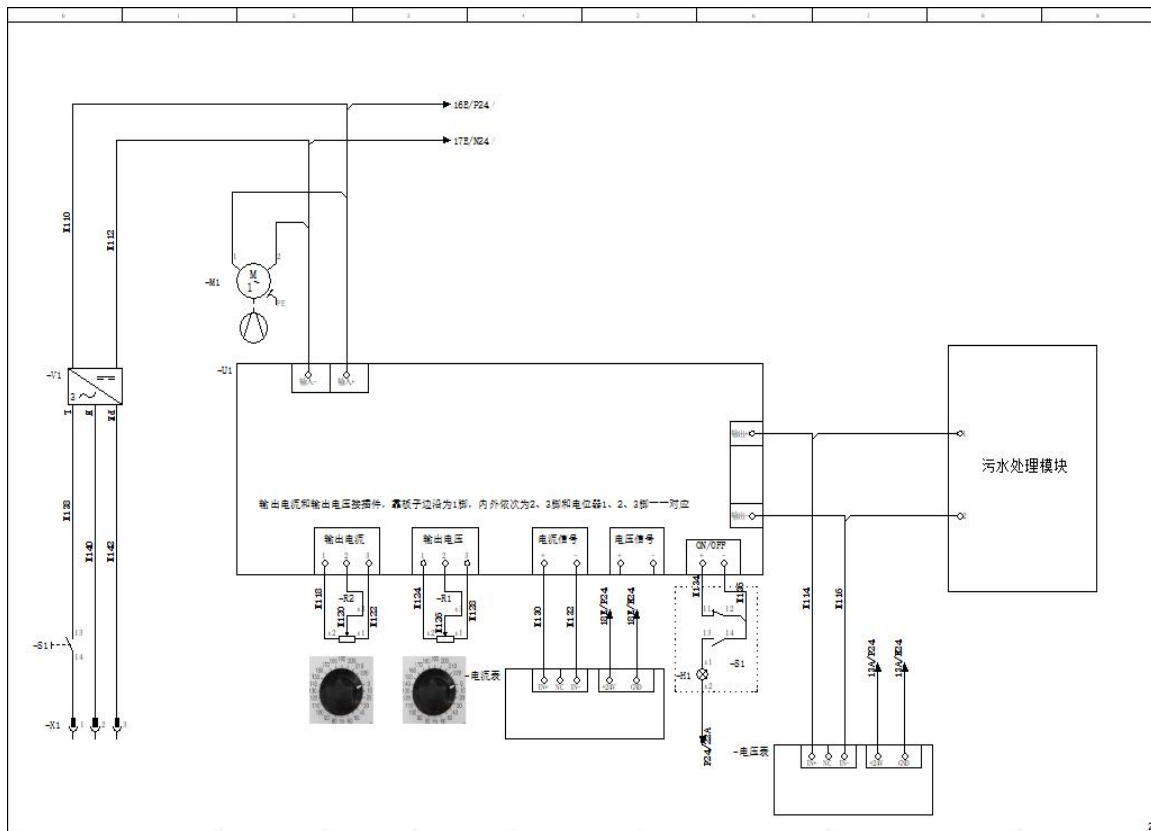
Product model 产品型号	BDD80-002	Factory date 出厂日期	/
Input voltage 输入电压	AC220V/50Hz	Power 功率	500W
Ambient temperature 环境温度	10~45℃	Ambient humidity 环境湿度	≤90%
Pump flow 泵流量	0~1L/min	Working water pressure 工作水压	0.1-0.4Mpa

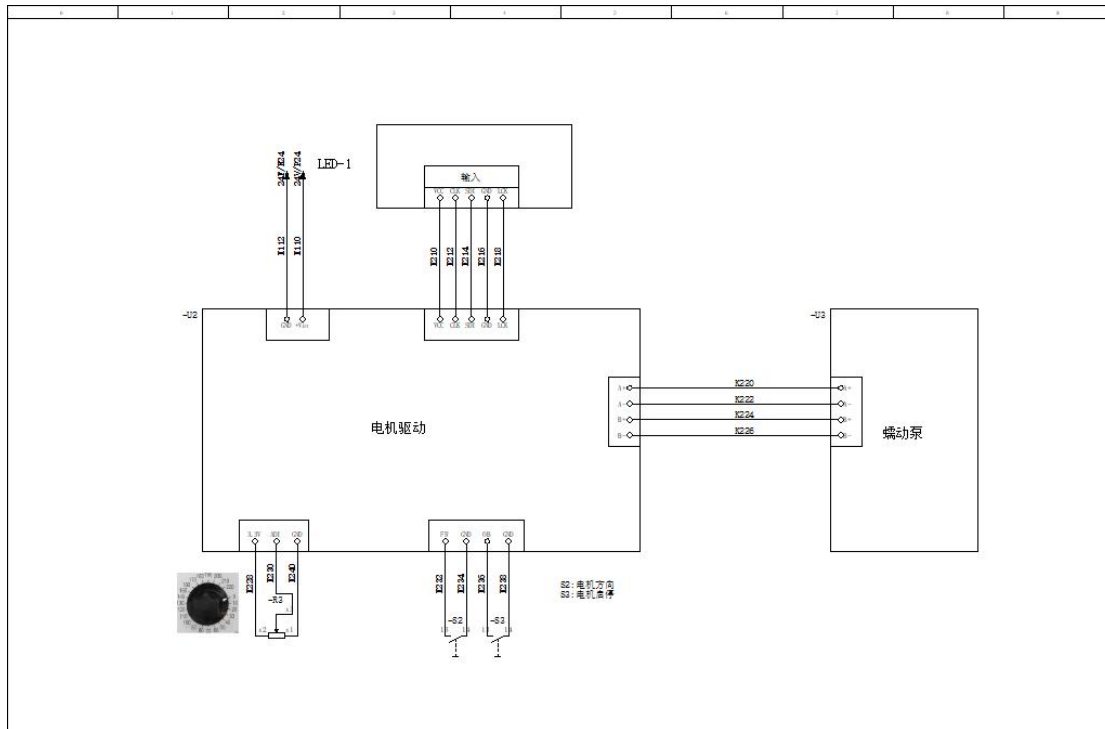
Total weight 整机重量	≤15Kg	Dimension 尺寸	260mm*180mm*380m m
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3.2 电源相关参数 Power related parameters:

Product model 产品型号	ZH--30A12V	Factory date 出厂日期	/
Input voltage 输入电压 (AC)	AC220V/50Hz	Input Current 输入电流 (AC)	1.5A(max)
Power 功率	360W	Power factor 功 率因数	≥90%
Output Voltage 输出电压 (DC)	0~12V	Output Current 输出电流 (DC)	0~30A

3.3 电气原理图 Electrical Schematic Diagram





3.4 BDD 电极模组参数 BDD Electrode Module Parameters:

名称 Name	BDD 电极模组 BDD Electrode Module	规格型号 Specification model	S10
外形尺寸 Dimensions	190mm*137mm*150mm	外壳材料 Material Of Shell	PP
阳极 Anode	材料 Material	硅基掺硼金刚石薄膜（BDD）电极 Silicon-based boron-doped diamond film (BDD) electrode	
	单片规格 Single chip specifications	80mm×40mm×3mm	
	数量 Quantity	10pcs	
	电催化使用面积 Electrocatalytic area	420cm ²	

	阳极承载电流密度 Loading current density	0-80mA/cm ²
阴极 Cathode	材料 Material	Titanium
	数量 Quantity	11pcs

3.5 蠕动泵参数 Peristaltic pump parameters:

名称 Name	蠕动泵 Peristaltic pump	规格型号 Specification model	BJ30-SN15
额定功率 Rated power	50w	材质 Material	工程塑料 Engineering plastics
转速 Rotating speed	Adjustable 4~400rpm	泵管 Pump tube	17#
流速 Flow	13.2~1171ml/min	电压 Voltage	DC24
电流 Current	2.4A	蠕动泵不得长时间空转 Peristaltic pump shall not idle for a long time	

4. 进水要求 Water Inlet Requirements

BDD 电催化设备进水要求：进水口应加过滤装置，不得有明显固体杂质进入蠕动泵和 BDD 电极模组；进水及反应温度 10-60℃，pH 范围：pH<12 且 C (H⁺) <2mol/L，氟<20mg/L（包括有机氟和无机氟），溴<500mg/L，金属离子<200mg/L（包括钙镁和重金属离子），SS<200mg/L，2000mg/L <含盐量<饱和度×70%；水中不得含腐蚀硅和钛的物质。

The inlet requirement of BDD electrocatalytic equipment: The water inlet should be equipped with a filter device, to prevent significant solid impurities shall enter the peristaltic pump and BDD electrode module; inlet and reaction temperature 10-60℃, pH<12 and C (H⁺) <2mol/L, fluorine<20mg/L(include organic fluorine and inorganic fluorine),bromine < 500mg/L,metal ion < 200mg/L(include calcium

magnesium and heavy metal ions),SS<200mg/L, 2000mg/L< saltness< saturability×70%; The water shall not contain substances that corrode silicon and titanium.

5.操作面板主要按键说明 Description Of Main Buttons On The Operation Panel



(illustration of the panel)

5.1 设备正面左下角开关为设备总开关 The switch in the lower left corner of the front of the device is the main switch;

5.2 设备正面左边三个显示屏从上到下分别表示整流电源输出电压值、整流电源输出电流值、蠕动泵转速值 The three displays on the left side of the front of the device indicate the output voltage value of the rectifier power supply, the output current value of the rectifier power supply and the rotational speed value of the peristaltic pump from top to bottom;

5.3 电机运行 Pump ON/OFF: 蠕动泵开关 the switch of peristaltic pump; 为按钮开关 push-button switch, 按下表示电机开启 press to open the motor, 弹上表示电机关闭 flick to off the motor;

5.4 电源运行 Power ON/OFF: 整流电源模块的输出开关 Output switch of the rectifier power module; 为按钮开关 push-button switch, 按下表示电机开启 (此时按钮指示灯亮起) press to open the motor(button indicate light on), 弹上表示电机关闭 flick to off the motor;

5.5 电压/电流调节 Voltage/Current adjustment: 整流电源的电压/电流输出调节 Output voltage/current switch of the rectifier power; 为旋钮开关 rotary switch, 顺时针旋转即调大电压/电流输出 turn clockwise to increase the output of voltage and current, 逆时针旋转即调小电压/电流输出 turn counterclockwise to reduce the output of voltage and current;

5.6 正反切换 Flow Direction: 蠕动泵转动方向切换 change the rotation direction of peristaltic pump; 为按钮开关 push-button switch, 弹上表示电机正转 flick to indicate the motor is moving forward, 按下表示电机反转 press to indicate the motor reversal; Instruction of forward and reversal: 设备进水和电解反应时选择正转模式 choose forward pattern when equipment inlet and electrolytic reaction time, 设备排水时选择反转模式 choose reversal when equipment drainage;

5.7 电机调节 Flow rate: 蠕动泵的转速大小调节 To adjust speed of rotation of peristaltic pump; 为旋钮开关 rotary switch, 顺时针旋转即调大转速输出 turn clockwise to increase the rotation speed, 逆时针旋转即调小转速输出 turn counterclockwise to reduce the rotation speed.

6.操作指南 Operation Guide

操作前, 请仔细检查电源接线是否正确, 各功能键是否复位, 确认一切正常, 方可进行实验。

Before operation, please carefully check whether the power supply wiring is correct, whether the function keys are reset, and confirm that everything is normal before proceeding with the experiment.

6.1 开机 Power ON

开机键在设备正面左下角。The switch in the lower left corner of the front of the device.

6.2 开泵, 进水 pump ON,Inflow

6.2.1 第一次使用前, 先准备适量自来水, 将转速调至最小; 选择电机正转模式(电机正反开关弹上来), 开启蠕动泵开关, 将转速调节至 50rpm, 运行 2-3min, 蠕动泵无卡壳异响后, 再将转速调节至 50, 100, 150, 200, 300rpm, 每次间隔 2-3min 再调节。Before first use, prepare adequate tap water first, set the speed to the minimum; choose the motor be forward pattern(Flow Direction button flicking up). Open the peristaltic pump switch, adjust the rotation speed be 50rpm, operation 2-3min, confirm there is no abnormal sound for the peristaltic pump, then adjust the rotation speed be 50,100,150,200,300rpm, adjust the speed at an interval of 2-3min each time.

6.2.2 平时使用时, 先准备适量水样, 开泵前, 建议先将转速调节至最小, 选择电机正转模式, 待开泵后再将转速在 1min 左右缓调至所需值。In normal use, prepare adequate water sample first. Please set the rotation speed to the minimum before open the pump, choose the motor be forward

pattern, slowly adjust the rotation speed be required value after about 1min.

6.3 开输出电源 Turn On The Output Power

电极模组中水样正常循环后（即循环出水管有水均匀流出且无明显气泡流出）方可开启电源输出。The power output can be turned on only after the water sample in the electrode module circulates normally (that is, the water in the circulation outlet pipe flows out evenly and no obvious bubble flows out)

6.3.1 模式设置 Mode setting

一般选择恒流模式；即开启电源输出前先将电压调节至量程最大值，将电流调节至量程最小值。Normally choose constant current model; Adjust the voltage to maximum value before opening the power output; adjust the current to minimum value.

6.3.2 电流设置 Current setting

先按“电源运行”键，“电源运行”指示灯在亮起通电状态，此时可设置电流，旋转“电流调节”旋钮输入实验所需电流。Press the “Power ON/OFF” button, the indicate light on, then can setup the current. Rotate the “Current” rotary switch to reach the required current for the experiment.

6.3.3 电流输出，开始反应 Current output, begin reaction

待电流设置好后，即已进行水样降解处理。After finishing setup the current, begin to degrade the water sample

6.4 排水 Water Draining

6.4.1 反应结束后，先将电流输出调节至最小，关闭电源输出 after reaction, adjust the current output be minimum value, turn off the power output;

6.4.2 1-2min 后再将电机正反调至反转模式（电机正反开关按下去），将进出水管从水中拿出（防止其进水到设备中），待水管水样排尽，即表示设备中水样排出；Set the Flow Direction be reversal mode(press the Flow Direction button), remove the inlet and outlet pipe from the water(to prevent the water into the equipment), after the water sample of the pipe all drained, means the water sample inside the equipment is drained.

6.4.3 将蠕动泵转速调节至 100rpm 以下，关闭电机运行开关 Adjust the rotation speed of the peristaltic pump under 100rpm, turn off the Pump ON/OFF switch.

6.5 清洗 Cleanout

6.5.1 按设备运行操作步骤，准备 1L 左右自来水，进水、循环 3-5min、排水（不用开电源输出）；此步骤将设备内残留的水样置换出大部分；According to the operation steps of the equipment, prepare

approx.1L tap water, inlet、circulation、draining(no need to open the Current output); this step can replace most of the remaining water sample in the equipment;

6.5.2 按设备运行操作步骤，准备 1L 1-2%硫酸钠溶液或氯化钠溶液，进水、循环、20-25A 电解 0.5-1h、排水；此步骤将电极模组阴极可能吸附的固体杂质清洗；According to the operation steps of the equipment, prepare 1L1-2% sodium sulfate solution or sodium chloride solution, inlet、circulation、20-25A electrolysis for 0.5-1h、draining; this step can clean out the solid impurity that adsorbed on cathode of the BDD module.

6.5.3 按“6.5.1”步骤重复 2-3 次，将设备内残留的硫酸钠/氯化钠溶液置换出。Repeat the step “6.5.1” for 2-3times, replace the remaining sodium solution or sodium chloride solution.

6.6 关机 Power OFF

实验结束，设备内部清洗完成，即可关机。After finished the experiment, finished the cleaning of the equipment, then can turn off the equipment.

7.注意事项 Matters Need Attention

7.1 设备需置于通风橱或其他通风良好的场地 The equipment should be installed in a clean, dry and well-ventilated place.;

7.2 第一次操作采用自来水试运行，确认没有问题后排空自来水，按需求注入废水测试或运行；For the first operation, shall use tap water, draining out the tap water after confirming no problems, then infuse the wastewater or operation according to the requirements.

7.3 进出水管不要离得太近，防止水样循环短流，影响降解效果；进水管口不要紧挨烧杯底部，防止吸底；Don't get the inlet and outlet pipes too close together, to prevent short circulation of water sample, and influence the degrading effluence; the inlet pipe month shall not touch the bottom of the beaker, to prevent suction.

7.4 蠕动泵禁止长时间无水空转(不得超过 2 分钟)Peristaltic pump is forbidden to idle without water for a long time(can't exceed 2mins);

7.5 严禁在水样未正常循环或循环流量过低(转速低于 100rpm)时开启整流电源输出 Strictly forbidden to turn on the Current output when the water sample was not under normally circulation or the circulation flow was too low(the rotating speed under100rpm);

7.6 设备最小循环水量为 0.3L，反应水量建议 0.8-2L；The min.circulating water volume is 0.3L, min.reaction water volume is 0.8-2L.

7.7 当电压/电流超过最大量程值时，设备会跳闸进行自我保护，因此进水总盐分建议大于 0.5%（电导率大于 10ms/cm）；The equipment will be turn off automatically when the Current/Voltage over Max.value. So the total salt shall be over 0.5%(conductivity over 10ms/cm)

7.8BDD 电极反应发热量较大，若反应时长超过 1-2h（升温速度受电流大小、电导率大小、环境温度影响大），水温很可能超过 50℃，因此需要在水样烧杯外加冷却水进行降温（恒温水箱和简易储水容器均可）；且水样易被蒸发，因此需要在烧杯口进行格挡（注意严禁完全密封，需要预留出气口），避免水样蒸发量过大造成的实验结果失真；盐分较高的水样需格外注意，防止水样蒸发造成盐分过饱和析出，堵塞、损坏设备。If the calorific value of BDD module is larger, the reaction time over 1-2h(Heat-up speed is highly influenced by Current value/conductivity value/environment temperature), the water temperature may over 50℃. Then need add cooling water outside the water sample beaker to drop the temperature(both of thermostatic water tank and simple water storage container can be used); and the water sample can be easily evaporated, so the mouth of the beaker needs to be blocked(Do not seal completely. Reserve an air outlet), to avoid distortion of experimental results caused by excessive evaporation of water samples; please pay more attention for the water sample with higher saltness, to avoid the evaporation of water samples caused by salt supersaturation, blockage, damage to the equipment.

7.9 设备沾水、漏水后应及时清洁/擦干，并做好防锈措施，防止残留废水腐蚀设备配件。Clean/dry the equipment in time after it is wet or leaking, and take anti-rust measures to prevent residual waste water from corroding equipment accessories

8.维护保养 Equipment Maintenance

8.1 BDD 电极模组维护保养 Maintenance Of BDD Module

8.1.1 应用对象 Application Object

含有少量钙镁或重金属离子的水样；SS>50mg/L 的水样；降解反应过程中会产生固体杂质的水样。该清洗方法适用于模组结垢程度较轻时。The water sample with less fytic acid abd heavy metal ion; water sample with SS > 50mg/L;The water samples of solid impurities which will be produced during the degradation reaction. This cleaning method suitable when the scale of the module is light.

8.1.2 清洗方法步骤 The Cleaning Step

1) 酸洗：配适量 2-3%（pH 大概 0.2-0 之间）的盐酸到反应循环桶，正常开启循环泵或搅拌器，循环清洗 1-2h，清洗后的盐酸清液可以回用。如果结垢比较严重，可以用 2-5%的盐酸清洗更长时间。

清洗频次较多、模组结垢不严重时，或不方便对盐酸进行回用，为避免浪费，可配 0.5-1%浓度盐酸清洗。Pickling: Add an appropriate amount of 2-3% hydrochloric acid (pH 0.2-0) to the reaction cycle barrel, start the circulation pump or agitator normally, cycle cleaning 1-2h, and the cleaned hydrochloric acid clear liquid can be reused. If the scale is more serious, it can be cleaned with 2-5% hydrochloric acid for a longer time. When the cleaning frequency is more, the scale of the module is not serious, or it is not convenient to reuse the hydrochloric acid, in order to avoid waste, it can be cleaned with 0.5-1% concentration hydrochloric acid

2) 电解清洗: 酸洗后, 配适量 1%硫酸钠溶液, 加少量盐酸 (每 100L 硫酸钠溶液加 0.5-1L 36% 盐酸), 用 400-700A/m²的电流密度电解 0.5-1h。注: 盐酸被电解会产生一定量氯气和次氯酸, 根据现场条件酌情添加。Electrolytic cleaning: After pickling, add an appropriate amount of 1% sodium sulfate solution, add a small amount of hydrochloric acid (0.5-1L 36% hydrochloric acid per 100L sodium sulfate solution), and electrolyze 0.5-1h with a current density of 400-700A/m². Note: Hydrochloric acid by electrolysis will produce a certain amount of chlorine gas and hypochlorous acid, according to the site conditions as appropriate to add

3) 自来水清洗: 电解清洗后, 用自来水清洗 1-2 次。Tap water cleaning: After electrolytic cleaning, wash 1-2 times with tap water

8.1.3 清洗频次 Cleaning Frequency

1) 一般情况下建议 1-2 周清洗一次, 或运行 50-100h 清洗一次; 若该水样易产生结垢物质, 则建议清洗频次更多; Normally suggest to clean every 1-2weeks, or clean after operation for 50-100h; If the water sample is prone to producing scaling substances, it is recommended to clean more frequently.

2) 若设备长时间不使用, 停用前也需用此方法对设备进行保养清洗一次, 至少需电解清洗+自来水清洗一次。If the equipment is not used for a long time, it is also necessary to use this method to maintain and clean the equipment once before deactivation, at least electrolytic cleaning + tap water cleaning

8.2 设备整体维护保养 Equipment Maintenance

8.2.1 本设备应安置在清洁、干燥、通风良好处使用。This equipment should be installed in a clean, dry and well-ventilated place.

8.2.2 设备应轻拿轻放, 防摔、防刮蹭。This equipment should be handle lightly, anti-drop, anti-scratch

8.2.3 实验完成后, 应将 BDD 电极模组、蠕动泵及管路通水清洗干净, 并将水排干。After finished

the experiment, shall clean the BDD module、peristaltic pump、 pipe, and drain out the water.

8.2.4 长时间不使用应切断电源，妥善保管。If not used for a long time, cut off the power supply and keep it properly.

8.2.5 设备如发生故障，应及时与厂商联系，不得由非专业技术人员盲目随意维修。Please contact with us in time if there have problems with the equipment, shall not be blindly repaired by non-professional technicians.

9. 易损件清单 Wearing Parts List

序号 No	名称 Name	材料 Material	规格 Specifications
1	蠕动软管 Peristaltic tube	含氟橡胶 Fluorine-containing rubber	17#; OD 外径*ID 内径= 9.6*6.4mm
2	O 型密封圈 O-ring seal	氟橡胶 Fluororubber	ID 内径*线径 wire diameter= 162.5*3.55
3	O 型密封圈 O-ring seal	氟橡胶 Fluororubber	ID 内径*线径 wire diameter= 12.1*2.65
4	O 型密封圈 O-ring seal	氟橡胶 Fluororubber	ID 内径*线径 wire diameter= 18*2.65
5	O 型密封圈 O-ring seal	氟橡胶 Fluororubber	ID 内径*线径 wire diameter= 8*1.8

注：设备发货时，蠕动管备用件随货发出；O 型密封圈损坏几率不大，且 O 型圈需厂家专业人员更换，暂不发备用件。

Note: When the equipment is shipped, spare parts of peristaltic tube are shipped with the goods; The O-ring is less likely to be damaged, and the O-ring needs to be replaced by professional personnel of the manufacturer, so there is no spare parts.

10. 常见问题分析及解决方式 Common Problem Analysis And Solution

常见问题 Common problem	可能原因 Possible reason	解决方式 Solution
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蠕动泵电机堵转 Peristaltic pump motor blocked	电机加速时堵转 Blocked when the motor is speeding up	加速时间太短 The acceleration time is too short	逐步提速 Increase the speed slowly
	正常运行下堵转 Blocked when normally operation	蠕动管进固体杂质 There have solid impurity inside the peristaltic tube	更换干净水样，降低电机转速或更换蠕动管 Replace the clean water sample, reduce the motor rotation speed or replace peristaltic tube
		进水管吸底 The inlet pipe touch the bottom	调整进水管位置 Adjust the location of inlet pipe
电流过低/电压过高 Too lower current/too higher voltage	开机/降解时电流过低，达不到设定值，而电压在电源量程最高值 The current value is too low when turn on/degrading, and the voltage is be max.value	水样电导率过低 Conductivity of the water sample is too low.	确认水样电导率，若低于 10ms/cm，则需补充适量电解质，建议补充至电导率 10-40ms/cm Confirm the water sample conductivity, if lower than 10ms/cm, it is necessary to supplement the appropriate amount of electrolytes, suggest to keep the conductivity be 10-40ms/cm.
电流电压急剧变化 Big change for Current and Voltage	电流急剧变大或电压急剧变小 A big increase in current or a big decrease in voltage	极板间堵塞造成电极短路	按说明书“8.1 BDD 电极模组维护保养”模块对电极进行清洗恢复；若效果不佳，则联系售后
	电流急剧变小或电压急剧变大 A big decrease in current or a big increase in voltage	反应水量不够或水样电导率变低 Reaction of less water sample or the conductivity is lower	观察水位、观察进水管是否吸空或吸底，测电导率、补充电解质 Observe the water level, observe whether the inlet pipe is vacuous or bottom-sucking, measure the electrical conductivity, and supplement the electrolyte
水量/水位异常变化 Abnormal changes in water	水位变低速度异常快或明显发现设备漏水 The water level drops abnormally fast or the	蠕动管或其他管路破损漏水 Peristaltic tube or other pipes	打开设备外盖观察，若蠕动管破损，则按说明书附件视频“蠕动管更换操作指南”进行更换；若其他管路破损（概率小），可先截取部分进出水管暂用，并联系售后重

volume/level	equipment is obviously leaking	are damaged and leaking	发配件 Open the outer cover of the equipment and observe. If the peristaltic tube is damaged, replace it according to the video "Peristaltic Tube Replacement Operation Guide" attached to the instruction manual; If other pipes are damaged (the probability is small), you can first cut off part of the inlet and outlet water pipes for temporary use, and contact the after-sales parts to resend
		模组漏水 Module leaking	将水样排空并尽可能用自来水将模组和蠕动泵内部清洗 2-3 遍，联系售后 Empty the water sample and clean the inside of the module and peristaltic pump 2-3 times with tap water as much as possible, and contact the after-sales service

11. 售后服务及其他 After-sales Service And Others

11.1 我司免费为用户提供基本操作、日常保养的培训服务。 Our company provides users with basic operation and daily maintenance training services for free

11.2 我司售后服务响应时间为 4-8 小时，为客户提供解决方案，如需更换核心配件或需整机拆装维修，需请客户寄回我司处理。 The response time of our after-sales service is 4-8 hours, and we can provide customers with solutions. If you need to replace core parts or disassemble and repair the whole machine, please send back to our company for processing.

用户不得擅自改变本产品的原设计、不得擅自拆卸设备中的核心部件 BDD 电极模组，否则后果自负。 The user is not allowed to change the original design of this product without authorization, or disassemble the core component BDD electrode module in the device without authorization, otherwise, the user is responsible for the consequences.

11.3 设备质保期限为出厂开始 1 年。对保修期内用户自身原因造成的产品故障和事故，我公司在维修过程中按相关规定费用标准进行收费 The equipment warranty period is one year from delivery. For product failures and accidents caused by the user during the warranty period, our company charges fees according to the relevant regulations during the maintenance process.

11.4 保修期外，用户可选择有偿服务，如需更换配件，我公司按配件成本价格收费。 After the warranty period, users can choose paid services. If you need to replace accessories, our company charges the cost of the accessories.

11.5 本说明书最终解释权归湖南波乐美环保科技有限公司，本说明书内容若有变动恕不另行通知。
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