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楚天华通医药设备有限公司

TRUKING WATERTOWN PHARMACEUTICAL EQUIPMENT CO.,LTD.

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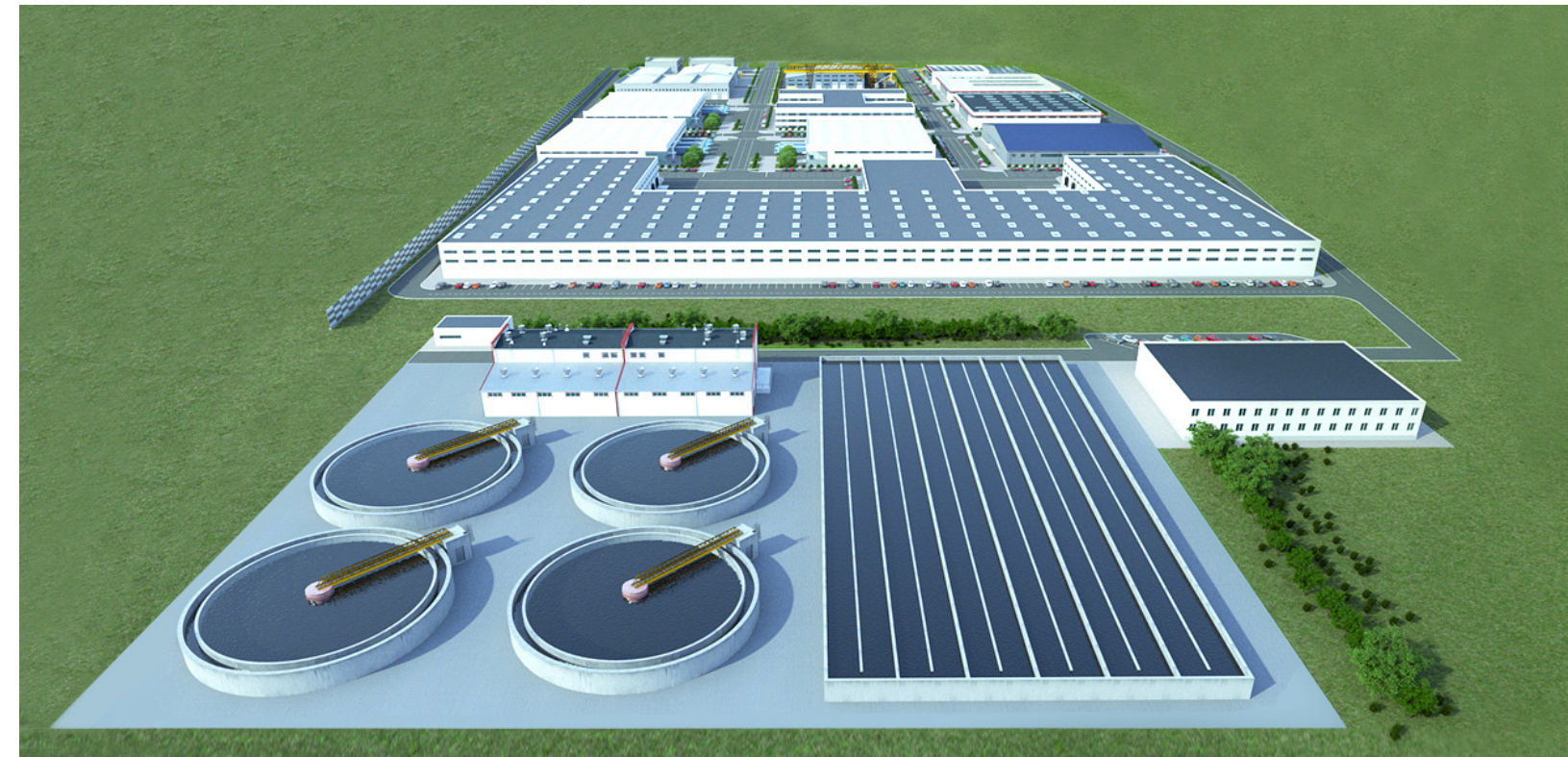
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May 2023 Edition



**Pharmaceutical wastewater
and waste gas treatment solutions**
制药废水、废气处理解决方案

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Core Technology of Waste Gas Treatment

让世界制药工业插上智慧的翅膀
Equip global pharmaceutical manufacturing industry with intelligent wings.





楚天华通医药设备有限公司系楚天科技股份有限公司全资子公司，始建于1993年，是目前亚洲领军制药用水系统（制备、储存和分配）、配液系统、不锈钢压力容器、污水处理、蒸发浓缩结晶、换热器研发制造基地，装备及制造工艺处于行业优级水平，员工总数1300余人，资产总额20亿元，服务于全球1000余家制药企业。

公司位于长春九台经济开发区，是中国制药装备行业协会理事单位，中国医药设备工程协会、中国膜工业协会会员单位，获评定为国家级高新技术企业、吉林省专精特新企业、吉林省级企业技术中心，获得省级创新型科技企业、长春市百强民营企业、长春市科技型小巨人企业等荣誉。公司拥有中国特种设备压力容器D级（10MPa以下的一类、二类、三类压力容器）设计与制造资质、压力管道（GC2）安装许可证、建筑机电安装工程专业承包贰级资质、环保工程专业承包贰级、环境工程设计专项（水污染防治工程）乙级、美国ASME（U）钢印设计与制造资质、欧盟CE（PED、MD）认证资质。截至2023年4月，公司共提出中国专利申请320项，有效专利180项，另提出1件PCT国际专利申请。产品已出口美国、意大利、比利时、希腊、土耳其、俄罗斯、韩国、泰国、越南、印尼、印度、埃及、沙特、摩洛哥、秘鲁等30多个国家和地区，国际市场占有率正逐年快速提升。

公司拥有经验丰富的研发技术团队，覆盖工程设计、项目管理、测试调试、验证与咨询服务，联合楚天科技、德国ROMACO集团、四川省医药设计院共同承接制药企业EPCM总包服务，为制药企业提供工程工艺优化、产品的全生命周期管理与服务。

2021年公司确认新建楚天华通医药装备智能制造产业园项目，位于长春市九台经济技术开发区中医药产业园。项目新购地36.1117万平方米，计划在5年内分三期完成项目整体建设任务，项目建成后，将崛起楚天华通研发中心大楼、智能车间、员工公寓以及商务接待中心等现代化智能配套公用工程。一期工程建筑面积6万平方米，预计2023年7月投产。作为楚天华通年产5000台套医药装备的智能制造基地，楚天华通医药装备智能制造产业园项目完成后将大幅提升企业产能，将进一步推动企业战略目标的实现。

公司坚持“做受尊敬的人、造受尊敬的产品、办受尊敬的企业”的核心价值观，秉承“要么唯一，要么第一”的理念，弘扬“因为执着，所以卓越”的精神，将楚天华通打造成全球制药用水系统领军企业之一。

Truking Watertown Pharmaceutical Equipment Co., LTD., a wholly-owned subsidiary of Truking Technology Limited, was founded in 1993. It is the leading R&D and manufacturing base of pharmaceutical water system (preparation, storage and distribution), liquid preparation system, stainless steel pressure vessel, sewage treatment, evaporation, crystallization and heat exchanger in Asia. With more than 1300 employees and 2 billion yuan of assets, the company serves more than 1000 pharmaceutical enterprises around the world.

Truking Watertown is located in Jiutai Economic Development Zone, Changchun. It is a member of China Pharmaceutical Equipment Industry Association, China Pharmaceutical Equipment Engineering Association and China Membrane Industry Association. It has been rated as a national high-tech enterprise, Provincial Specialized and Sophisticated Enterprise, Provincial Enterprise Technology Center. It has been honored as provincial innovative technology Enterprise, Changchun Top 100 Private Enterprise, and Changchun Small Giant Technology Enterprise. Truking Watertown has Chinese special equipment Class D (Class I, Class II and Class III below 10MPa) pressure vessel design and manufacturing license, Pressure pipeline (GC2) installation license, construction mechanical and electrical installation engineering contracting Class II, environmental engineering contracting Class II, environmental engineering design special (water pollution control engineering) Class B, ASME(U) steel seal design and design manufacturing qualification, EU CE(PED, MD) certification qualification. Truking Watertown has applied for 320 patents, 180 patents of which have been authorized until April 2023, and one PCT international patent application. Products have been exported to the United States, Italy, Belgium, Greece, Turkey, Russia, South Korea, Thailand, Vietnam, Indonesia, India, Egypt, Saudi Arabia, Morocco, Peru and other 30 countries and regions, the international market share is rapidly increasing year by year.

Truking Watertown has an experienced R&D technical team, covering engineering design, project management, testing and commissioning, validation and consulting services. Together with Truking Technology, Germany ROMACO Group and Sichuan Pharmaceutical Design Institute, the company jointly undertakes EPCM general contract services for pharmaceutical enterprises, providing engineering process optimization and product lifecycle management and services for pharmaceutical enterprises.

In 2021, Truking Watertown pharmaceutical equipment Intelligent Manufacturing Industrial Park project started, located in Jiutai Economic and Technological Development Zone of Changchun Medicine Industrial Park. The new plant occupies 361,117 square meters. It is planned to complete the overall construction in three phases within 5 years. After the completion of the construction, Truking Watertown R&D Center building, intelligent workshop, employee apartment and business reception center and other modern intelligent supporting utilities will be used. The first phase of the project covers a construction area of 60,000 square meters and is expected to be put into operation in July 2023. As base of Truking Watertown with an annual output of 5,000 sets, pharmaceutical equipment intelligent manufacturing Industrial Park will greatly improve the enterprise's production capacity after the completion of the project, which will further promote the realization of the strategic objectives of the enterprise.

We insist on the core value of being respected person, making respected product and running respected enterprise and adhere to the philosophy to be the unique or to be the first and promote the spirit of Because of persistence, we are superexcellent to make Truking Watertown be one of the leading pharmaceutical water system enterprises all over the world.

随着社会经济的飞速发展，制药行业企业不断发展壮大，取得了许多举世瞩目的成就；随着国家生态环境要求的逐步提高，制药工业废水处理，已成为困扰企业和政府的巨大难题。

制药工业为精细化工行业，具有原料种类多、数量大、成分复杂等特点，已被国家环保规划列为重点治理的12个行业之一，其废水是国际上公认的严重的环境污染源之一，也是环境监测的重中之重。自2010年7月1日起，《制药工业水污染物排放标准》开始全面强制实施，制药企业的环保责任与企业生存和发展已密切相关，废水合规排放已刻不容缓。

深耕制药行业20余载，从制药行业角度深度分析，楚天华通致力于制药企业提供合规、高效、可靠的废水、废气处理解决方案，可满足包括实验室、小试中试、大生产在内的多种生产模式需要；为制药行业废水、废气达标排放、中水回用或零排放、超低排放等需求提供可靠支持，推动制药行业向绿色循环能源经济模式健康发展。

With the rapid development of social economy, pharmaceutical industry enterprises have been growing and made many remarkable achievements; With the gradual improvement of national ecological environment requirements, wastewater treatment in pharmaceutical industry has become a huge problem perplexing enterprises and governments.

Pharmaceutical industry is a fine chemical industry, which has the characteristics of many kinds of raw materials, large quantity and complex composition. It has been listed as one of the 12 industries to be treated in the national environmental protection plan. Its wastewater is one of the internationally recognized serious environmental pollution sources and the top priority of environmental monitoring. Since July 1, 2010, the discharge standard of water pollutants for pharmaceutical industry has been fully enforced. The environmental protection responsibility of pharmaceutical enterprises is closely related to the survival and development of enterprises, and the compliance discharge of wastewater is urgent.

After more than 20 years of deep cultivation in the pharmaceutical industry and in-depth analysis from the perspective of the pharmaceutical industry, Truking Watertown is committed to providing compliant, efficient and reliable wastewater and waste gas treatment solutions for pharmaceutical enterprises, which can meet the needs of various production modes including laboratory, small-scale pilot test and large-scale production. Provide reliable support for the pharmaceutical industry's demand for up to standard discharge of wastewater and waste gas, reclaimed water reuse or zero discharge and ultra-low discharge, and promote the healthy development of the pharmaceutical industry to the green circular energy economic model.

整体解决方案 Overall solution

原料药制药废水 / API pharmaceutical wastewater

原料药制造是污染负荷量最大的制药子行业，约占全行业的 80%。不同种类原料药、不同工序产生的原料药废水特点不同，处理难度不尽相同，其中发酵废水和化学合成废水处理难度最大。

API manufacturing is the pharmaceutical sub-industry with the largest pollution load, accounting for about 80% of the whole industry. The API wastewater produced by different kinds of API and different processes has different characteristics and different treatment difficulties, among which fermentation wastewater and chemical synthesis wastewater are the most difficult to treat.

• 化学合成制原料药废水特点

- ◎ 成分复杂，含大量有机物，高毒性；
- ◎ 间歇排放，水质、水量变化大；
- ◎ 残留多种化学合成物质、残留药物成分以及药物降解中间产物；
- ◎ 大量的氯化物、硫酸盐等盐类物质。

Characteristics of pharmaceutical wastewater from chemical synthesis

- ◎ Complex composition, containing a lot of organic matter, high toxicity;
- ◎ Intermittent discharge, water quality and quantity change greatly;
- ◎ Residue of a variety of chemical synthetic substances, residual drug components and drug degradation intermediates;
- ◎ A large amount of chloride, sulfate and other salts.

• 发酵制原料药废水特点

- ◎ 废滤液、母液的 COD 在 10000mg/L 以上；
- ◎ 间歇排放，水质、水量变化大；
- ◎ 生物毒性高，含氮量高，C/N 低，严重影响微生物的生长与代谢；
- ◎ 硫酸盐浓度高、废水色度高。

Characteristics of pharmaceutical wastewater from fermentation

- ◎ COD of waste filtrate and mother liquor is above 10000mg/L;
- ◎ Intermittent discharge, water quality and quantity change greatly;
- ◎ High biological toxicity, high nitrogen content, low C/N, seriously affect the growth and metabolism of microorganisms;
- ◎ High sulfate concentration, high color of wastewater.

• 解决方案

- ◎ 设计抗负荷能力高的预处理系统；解毒、预脱盐系统配置；
- ◎ 各工艺材质耐腐蚀、耐污损优化配置，分质收集、调节单元预留抗冲击的容量；
- ◎ 高污泥负荷处理能力的生化系统、膜滤系统；可回用及零排；
- ◎ 装配式模块、标准化安装；
- ◎ 自动化运行，可远程维管，提高系统稳定性。

Solution

- ◎ Design the pretreatment system with high load resistance. Detoxification and pre-desalting system configuration;
- ◎ The optimized configuration of corrosion and stain resistance of each process material, the mass collection and adjustment unit reserve the capacity of impact resistance;
- ◎ Biochemical system and membrane filtration system with high sludge load treatment capacity. Reusable and zero discharge;
- ◎ Assembly module, standardized installation;
- ◎ Automatic operation, remote maintenance, improve system stability.

• 工艺流程 / Process



生物制药、混装制剂类废水 / Biopharmaceutical and mixed preparation wastewater

生物制药、混装制剂类废水主要由工艺废水、制水设备排水、清洗设备包装容器废水以及实验室废水构成。生物制药废水中含有微生物残留、洗罐废液、制水设备高盐浓水等；混装制剂废水中工艺排水部分 COD 浓度较高，但水量一般较小。此类综合废水，一般 COD 较低，B/C 较好，TN 浓度较高。具体参数，随制药品类及排水周期会有波动。

Biopharmaceutical and mixed preparation waste water is mainly composed of process wastewater, water preparation equipment drainage, cleaning equipment packaging container waste water and laboratory waste water. Biopharmaceutical wastewater contains microbial residue, waste liquid of washing tank, high-salt concentrated water of water making equipment, etc. The COD concentration in the process drainage part of mixed preparation wastewater is high, but the water quantity is generally small. This kind of comprehensive wastewater, generally COD is below 2000mg/L, B/C is good, TN concentration is high. The specific parameters vary with the type of medicine and drainage cycle.

Some physical and chemical methods are used as the pretreatment process to reduce the sulfur, salt and chemical oxygen demand in the water, reduce the biological inhibitors in the wastewater, increase the degradability of the wastewater, and facilitate the subsequent biochemical treatment of wastewater.

• 工艺流程 / Process



中药类、提取类制药废水 / Traditional Chinese medicine and extraction pharmaceutical wastewater

中药类、提取类废水主要在中药生产的原料洗涤、药物提取和冲洗等过程中会产生，综合废水所含有机污染物 COD、BOD₅ 浓度高、悬浮物 SS 含量高、色度高、生化抑制因素等；pH 需调节，带有中药气味；废水间歇排放，日均水质波动较大；污水的 B/C 为 0.5，可生化性能好。

Traditional Chinese medicine and extraction wastewater is mainly produced in the process of raw material washing, drug extraction and washing in the production of traditional Chinese medicine. The comprehensive wastewater contains high concentration of organic pollutants COD and BOD, high content of suspended solids SS, high chroma, biochemical inhibition factors, etc. PH needs to be adjusted, with the smell of Traditional Chinese medicine; Intermittent discharge of wastewater, daily water quality fluctuates greatly. The B/C of wastewater is 0.5 and the biodegradability is good.

• 工艺流程 / Process



污水处理核心技术 Core Technology of Wastewater Treatment

多相强化混凝技术 / Multiphase enhanced coagulation technology

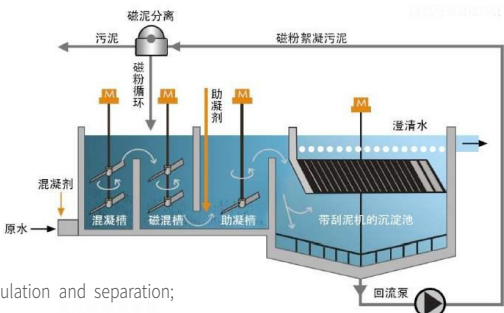
针对不同类型的制药废水，预处理通过电解、电絮凝、磁泥及混凝药剂配比的方式，压缩胶体颗粒的扩散层，产生吸附、中和微粒间电荷、压缩双电层等作用，破坏废水中胶体的稳定性，使胶体微粒聚合、集结而形成絮体；浮力作用下机械隔除，重力作用下沉淀，协同完成吸附捕集。

For different types of pharmaceutical wastewater, pretreatment through electrolysis, electric flocculation, magnetic mud and the ratio of coagulation agents, compression of the diffusion layer of colloidal particles, adsorption, neutralization of charge between particles, compression of the double electric layer, destroy the stability of the colloidal particles in the wastewater, so that colloidal particles polymerization, aggregation and the formation of flocs; Mechanical separation under the action of buoyancy, precipitation under the action of gravity, synergistically complete adsorption and capture.

• 技术特点 / Technical characteristics • 工艺流程 / Process

- ◎ 多相强化，快、慢混结合，密实，加速絮凝及分离；
- ◎ 一体化紧凑设计，减少占地 30%；
- ◎ 撬装置配置，施工周期缩短 25%；
- ◎ 磁泥、絮体部分回流回用，缩短混凝时间；
- ◎ 电解、电絮凝装置电极高密度排布，减少药剂使用，脱色效果好。

- ◎ Multi-phase strengthening, fast and slow mixing combination, dense, accelerate flocculation and separation;
- ◎ Integrated compact design, reduce space by 30%;
- ◎ Equipped with skid device, the construction period can be shortened by 25%;
- ◎ Part of magnetic mud and flocs are recycled to shorten the coagulation time;
- ◎ Electrolysis and electric flocculation device electrode density arrangement, reduce the use of agents, good decolorization effect.



铁基臭氧催化氧化技术 / Iron based ozone catalytic oxidation technology

在酸性且 Fe^{2+} 存在条件下，可用 H_2O_2 催化氧化生成强氧化羟基自由基 ($\cdot\text{OH}$)，并引发更多的其他活性氧以实现对有机物的降解。

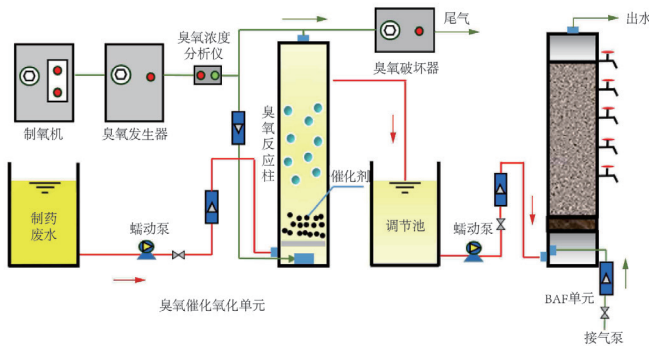
分步沉淀形成铁基催化剂 r-FeOOH ，表面羟基氧化物钝化层，对臭氧分解并产生羟基自由基 ($\cdot\text{OH}$)，进一步实现对有机物的降解，损耗量小，产物 $\text{Fe}(\text{III})$ 有益无害。

In the presence of Fe^{2+} , H_2O_2 can catalyze oxidation to form strongly oxidized hydroxyl radicals ($\cdot\text{OH}$), and trigger more reactive oxygen species to achieve degradation of organic matter.

The iron-based catalyst r-FeOOH is formed by step-by-step precipitation, with hydroxyl oxide passivation layer on the surface, which degrades ozone and produces hydroxyl radicals ($\cdot\text{OH}$), further realize the degradation of organic matter, the loss is small, the product $\text{Fe}(\text{III})$ is beneficial and harmless.

• 技术特点 / Technical characteristics • 工艺流程 / Process

- ◎ 降低废水毒性，改善废水可生化性；
- ◎ 高效去除难降解有机物；
- ◎ 加药量、产泥量小；
- ◎ 整砌化、装配性好；
- ◎ 比表面积大，反应效率高。
- ◎ Reduce the toxicity of wastewater, improve the biodegradability of wastewater;
- ◎ Efficient removal of refractory organic matter;
- ◎ Small dosage and mud production;
- ◎ Integrated, good assembly;
- ◎ Large specific surface area, high reaction efficiency.
- ◎ Efficiency increase



高效中温内循环厌氧技术 / High efficiency Intermediate Temperature IC

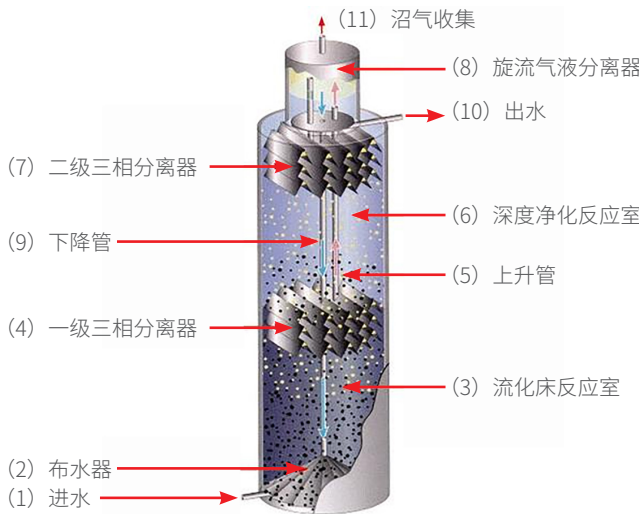
废水由设备底部进入，与颗粒污泥、内部气体循环回水进行有效地混合，使高浓进水水质均化；通过高浓度颗粒污泥膨胀床，废水和污泥充分接触，使系统具有高活性和高有机负荷；系统上部为深度处理区，长的水力停留时间和推流的流态使沼气产生的扰动较低，使得系统去除率较高；系统可选配夹套控温装置，根据反应适宜条件控制温度需求。

The wastewater enters from the bottom of the equipment, and is effectively mixed with granular sludge and internal gas circulation back water to homogenize the water quality of high concentration influent. Through the high concentration granular sludge bulking bed, the wastewater and sludge fully contact, so that the system has high activity and high organic load. The upper part of the system is the deep treatment area. The long hydraulic retention time and the flow pattern of pushing flow make the methane disturbance low and the system removal rate high. The system can be equipped with jacket temperature control device, according to the appropriate reaction conditions to control the temperature demand.

• 技术特点 / Technical characteristics • 工艺流程 / Process

- ◎ 容积负荷高，高效降解有机污染物；
- ◎ 耐冲击负荷能力强，毒性耐受力强；
- ◎ 调控中温、完全厌氧环境；
- ◎ 循环回流投碱量小；
- ◎ 颗粒污泥培养时间缩短 30%。
- ◎ 进水、出水布水均匀，不堵塞；
- ◎ 两级三相分离，出水水质稳定；
- ◎ 高径比设计较大，占地面积小。

- ◎ High volume load, efficient degradation of organic pollutants;
- ◎ Strong impact load resistance, strong toxicity resistance;
- ◎ Control medium temperature, completely anaerobic environment;
- ◎ Small amount of circulating reflux alkali;
- ◎ The cultivation time of granular sludge is reduced by 30%.
- ◎ Water inlet and outlet evenly distributed, not blocked;
- ◎ Two stage and three phase separation, stable effluent quality;
- ◎ Height to diameter ratio is designed large, small floor place.



恒温升流厌氧技术 / Constant Temperature UASB

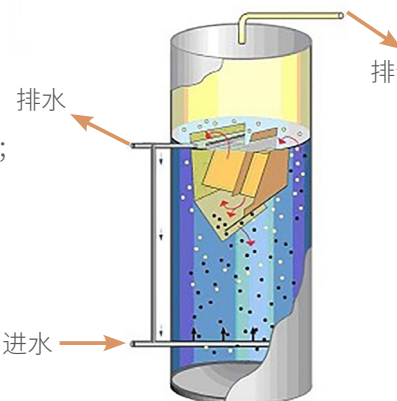
废水由设备底部进入，经过恒温型高浓度、高活性污泥床，将有机污染物厌氧发酵降解为甲烷和二氧化碳；废水升流过程中夹带沼气和厌氧菌固体物，气室区固液分离，净化水由反应器顶部排走，完成废水处理全过程，沉淀区大部分污泥返回污泥床区，保持足够的生物量；系统可选配夹套控温装置，根据反应适宜条件控制温度需求。

The waste water enters from the bottom of the equipment, and the organic pollutants are degraded into methane and carbon dioxide by anaerobic fermentation through the constant temperature type high concentration and high activity sludge bed. Biogas and anaerobic bacteria are entrained in the process of wastewater rising, solid-liquid separation in the gas chamber area, and purified water is discharged from the top of the reactor to complete the whole process of wastewater treatment. Most of the sludge in the precipitation area is returned to the sludge bed area to maintain sufficient biomass; The system can be equipped with jacket temperature control device, according to the appropriate reaction conditions to control the temperature demand.

• 技术特点 / Technical characteristics

- ◎ 容积负荷较高；
- ◎ 无搅拌，产泥率低；
- ◎ 调控恒温厌氧条件；
- ◎ 启动、驯化时间较短。
- ◎ 全高取样设计、多点排泥；
- ◎ 布水均匀、易清洗，维护简单；
- ◎ 高径比设计较小，适宜限高配置。

- ◎ High volume load;
- ◎ No stirring, low mud yield;
- ◎ Control constant temperature anaerobic conditions;
- ◎ Short start and acclimation time.
- ◎ Full height sampling design, multi-point mud discharge;
- ◎ Uniform water, easy to clean, easy to maintain;
- ◎ Height to diameter ratio is designed small, suitable for limited height configuration.



MBR 恒温膜罐 / MBR thermostatic membrane tank

MBR 恒温膜罐技术，是在平板膜分离技术基础上，通过标准化、模块化设计，提高设备整体装配效能，使污水生化反应处理单元高效运行；极大提高膜生物反应器污泥浓度、抗冲击负荷程度及单位时间溶解氧利用效率；膜罐罐体选配夹套控温装置，可进行气相和液相增温，根据反应适宜条件控制生化反应温度需求。膜组件材质为不锈钢膜架、PVDF 膜片，系统避免活性污泥的流失，并截留难于降解的大分子有机物，延长 HRT，使反应进行完全。

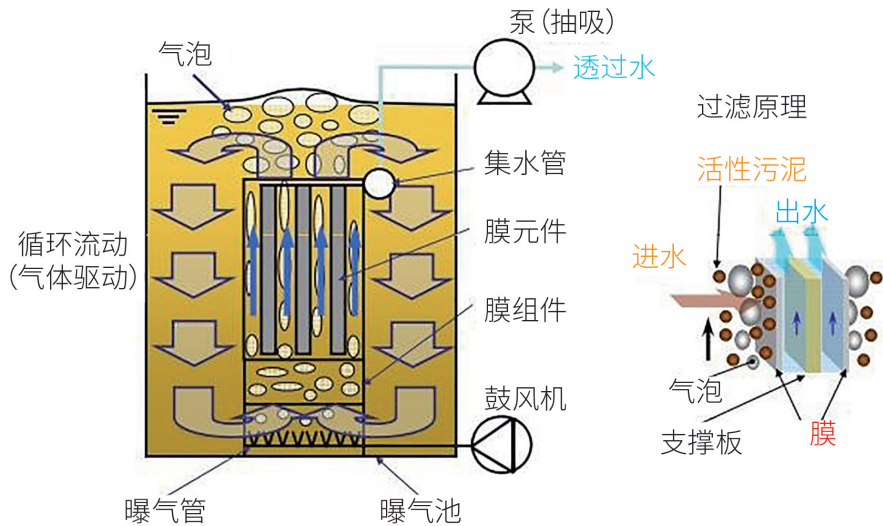
MBR constant temperature membrane tank technology is based on flat membrane separation technology, through standardized, modular design, improve the overall assembly efficiency of equipment, make wastewater biochemical reaction treatment unit efficient operation. It can greatly improve sludge concentration, impact load resistance and dissolved oxygen utilization efficiency per unit time of membrane bioreactor. The membrane tank body is equipped with jacket temperature control device, which can increase the temperature of gas and liquid phase, and control the biochemical reaction temperature according to the appropriate reaction conditions. The membrane module is made of stainless steel membrane frame and PVDF membrane, the system avoids the loss of activated sludge, and intercepts the macromolecular organic matter that is difficult to degrade, prolonging HRT and making the reaction complete.

• 技术特点 / Technical characteristics

- ◎ 占地面积小，节省土建投资；
- ◎ 自动化程度高，操作管理方便；
- ◎ 装配模块设计，高效节能；
- ◎ 调控恒温反应。
- ◎ 污泥浓度高，剩余污泥产量极低；
- ◎ 高品质出水，可直接回用；
- ◎ 维护费用低，能源利用率高。
- ◎ Small floor area, saving civil construction investment;
- ◎ High degree of automation, easy operation and management;
- ◎ Assembly module design, high efficiency and energy saving;
- ◎ Control the thermostatic reaction.
- ◎ High sludge concentration, low output of surplus sludge;
- ◎ High quality water, can be directly reused;
- ◎ Low maintenance cost, high energy efficiency.



• 结构设计 / Structure design



撬装式一体化处理设备 / Skid mounted integrated treatment equipment

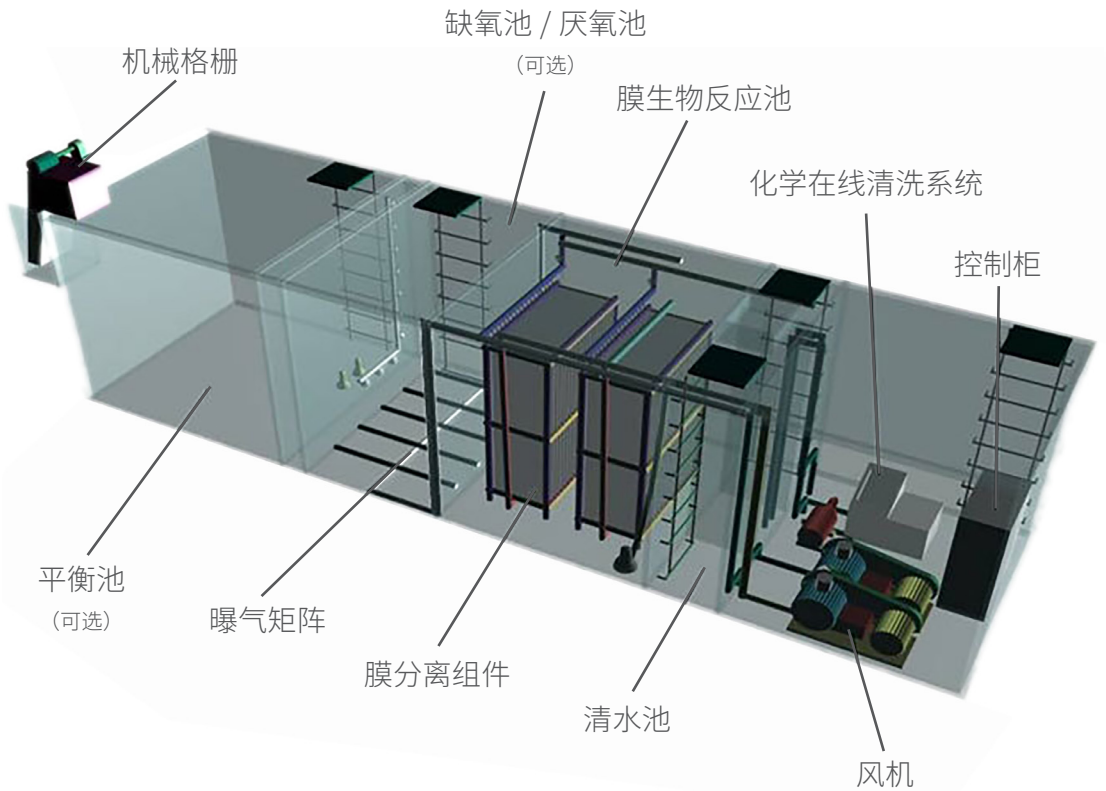
采用撬装式模块化设计，便于工程运输及地上、地埋、集装箱等各种落位方式；国际先进的生化处理组合技术，集成楚天华通优化工艺包，性能稳定可靠，处理效果好，维护方便等优点。

Adopt ski-mounted modular design, convenient for engineering transportation and ground, buried, container and other landing modes; International advanced biochemical treatment combination technology, integrated huatong optimization process package, stable and reliable performance, good treatment effect. Convenient maintenance and other advantages.

• 技术特点 / Technical characteristics

- ◎ 集成化程度高，设备体积紧凑；
- ◎ 水力流程短，水头损失小；
- ◎ 具有脱氮除磷能力；
- ◎ 内置填料不易产生污泥膨胀；
- ◎ 出水水质稳定；
- ◎ 自动化程度高，可远程维管。
- ◎ High degree of integration, compact volume of equipment;
- ◎ Short hydraulic flow, small head loss;
- ◎ With nitrogen and phosphorus removal ability;
- ◎ The built-in filler is not easy to produce sludge swelling;
- ◎ Effluent water quality is stable;
- ◎ High degree of automation, remote maintenance.

• 结构设计 / Structure design



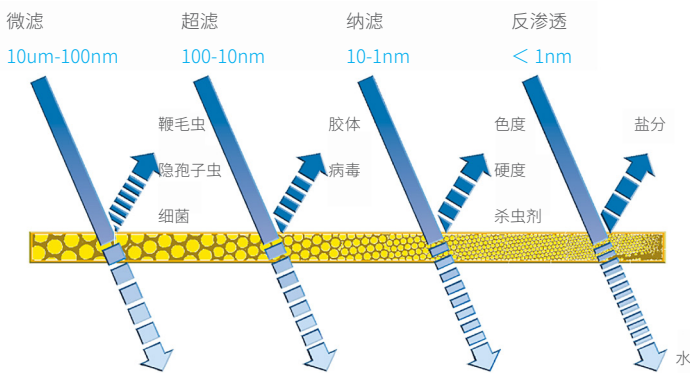
中水回用深度处理系统 / Reclaimed water reuse advanced treatment system

在污水处理单元出水达到环保要求的相关排放标准基础上，进行中水回用，是污水处理项目资源化的必由之路，也是国家倡导的资源利用方案；有效的对污水进行深度处理，达到中水回用的标准，根据不同水质回用需求，量身定制微滤、超滤、纳滤、反渗透等组合装配方案；我司通过多段多级复合技术，提高能效和回收率，高效实现中水回用，为企业提供模块化方案。

On the basis of the discharge standards of the effluent from the wastewater treatment unit meeting the environmental protection requirements, the recycling of reclaimed water is the only way for the reclamation of wastewater treatment projects and the resource utilization scheme advocated by the state. Effective deep treatment of waste water, to meet the standard of water reuse, according to different water reuse needs, tailored to micro filtration, ultrafiltration, nanofiltration, reverse osmosis and other combined assembly programs. Through multi-stage multistage composite technology, our company improve energy efficiency and recovery, efficiently realize water reuse, provide modular solutions for enterprises.

• 技术特点 / Technical characteristics • 工艺原理 / Process principle

- ◎ 占地面积小，系统集成度高；
 - ◎ 自动化程度高，操作管理方便；
 - ◎ 装配模块设计，高效节能；
 - ◎ 中水回用率高，可达 92% 以上。
 - ◎ 高品质出水，可直接回用；
 - ◎ 系统稳定，故障率低；
 - ◎ 维护费用低，能耗低。
- ◎ Small floorspace, high system integration;
◎ High degree of automation, easy operation and management;
◎ Assembly module design, high efficiency and energy saving;
◎ High water reuse rate, up to over 92%.
◎ High quality water, can be directly reused;
◎ Stable system, low failure rate;
◎ Low maintenance cost, low energy consumption.



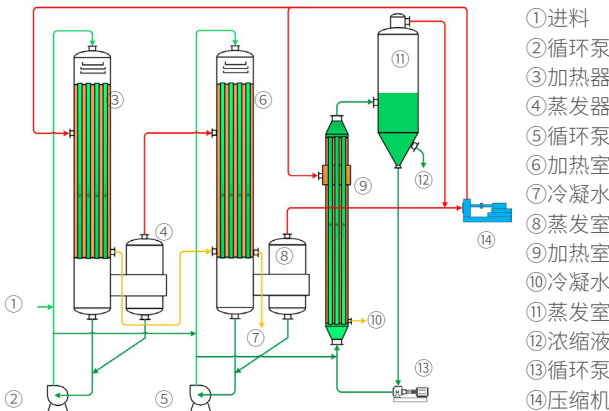
零排放蒸发结晶系统 / Zero emission evaporative crystallization system

二次蒸汽，经 MVR 压缩机压缩，压力、温度升高，热焓增加后，送到蒸发器的加热室当作加热蒸汽使用；多级闪蒸，使料液维持沸腾状态，可低温常压下运行；回收了潜热，提高了热效率，接近水沸点附近 (80-90℃)，水蒸气在空气中的含量可以接近 50-75%。

Secondary steam, compressed by MVR compressor, pressure, temperature and enthalpy increase, sent to the evaporator heating chamber as heating steam; Multistage flash, so that the material liquid to maintain boiling state, can run under low temperature and atmospheric pressure; Recovery of latent heat, improved thermal efficiency, close to the boiling point of water (80-90℃), water vapor content in the air can be close to 50-75%.

• 技术特点 / Technical characteristics • 工艺原理 / Process principle

- ◎ 低温蒸发、常温蒸发；
 - ◎ 可连续和间歇出料；
 - ◎ 在线清洗，不易结垢；
 - ◎ 物料流速高，气液传质性好；
 - ◎ 自动化程度高、运行成本低。
- ◎ Low temperature evaporation, ambient temperature evaporation;
◎ Continuous and intermittent discharge;
◎ Online cleaning, not easy to scale;
◎ High flow rate of material, good gas-liquid mass transfer;
◎ High degree of automation, low operation cost.



废气治理核心技术 Core Technology of Waste Gas Treatment

• 制药工业废气治理 / Pharmaceutical Industry Waste Gas Treatment

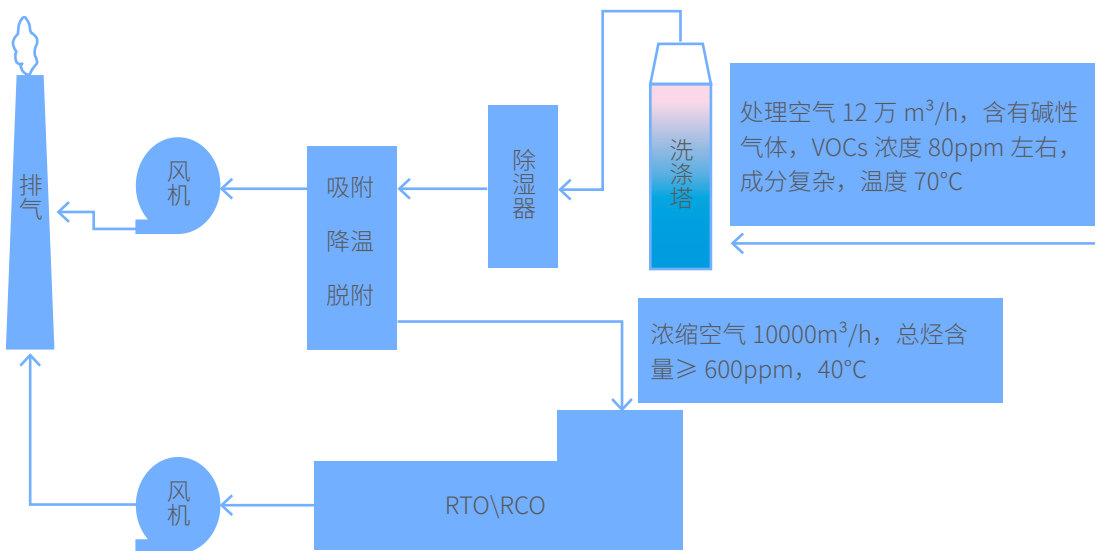
制药工业企业生产过程中产生的大气污染物主要可分为两大类：一类是生产过程产生的废气（包括储运过程），另一类是污染治理过程产生的废气。

The air pollutants produced in the production process of pharmaceutical industry enterprises can be divided into two categories: one is the waste gas generated in the production process (including storage and transportation process), and the other is the waste gas generated in the pollution treatment process.

• 制药工业 VOCs 及恶臭废气总体的处理思路 / Pharmaceutical industry VOCs and odor waste gas overall treatment ideas

- ◎ 做好清洁生产和智能化生产的技术革新工作，选用环境友好型的原材料，优化生产工艺，减少生产和物料储运环节的气体散逸，从源头上减少废气排放。
 - ◎ 做好散逸气体的收集，选择合理有效的废气处理工艺，满足各项废气排放标准的要求，最大限度减少对企业内部和周边环境的影响。
- ◎ Do a good job in the technological innovation of clean production and intelligent production, choose environment-friendly raw materials, optimize the production process, reduce the gas leakage in production and material storage and transportation, and reduce the waste gas emissions from the source.
◎ Do a good job in the collection of scattered gas, choose reasonable and effective waste gas treatment process, meet the requirements of the waste gas emission standards, minimize the impact on the internal and peripheral environment of the enterprise

• 制药工业典型 VOCs 治理工艺分析 / Analysis of typical VOCs treatment process in pharmaceutical industry



吸收 + 吸收浓缩 + RTO\RCO 技术组合
Absorption + absorption concentration + RTO\RCO technology combination

吸收技术 / Dissolved absorption technology

采用低挥发或不挥发液体为吸收剂，依据废气中各 VOCs 组分在吸收剂中的溶解度差异（物理吸收）或化学反应特性差异（化学吸收），通过填料塔、喷淋塔等吸收设备使废气中污染物组分被吸收净化。目前常采用中和喷淋塔，一般用作复合工艺中的前端预处理和后端中和吸收，是重要的处理工艺之一。

Using low volatile or non-volatile liquid as absorbent, according to the difference in the solubility of each VOCs component in the waste gas absorbent (physical absorption) or chemical reaction characteristics (chemical absorption), through the packing column, spray column and other absorption equipment to make the pollutant components in the waste gas absorbed and purified. Neutralization spray column is often used at present, which is generally used for the pretreatment of the front end and the absorption of the back end of the composite process. It is one of the important processing technologies.

• 技术优点 / Technical advantages

- ◎ 合理的结构设计、规范的加工制造，设备净化率高。

◎ 结构设计精确，焊接强度高，确保产品密封性绝佳。

◎ 优质原材料，抗腐蚀、耐风化，防火阻燃，使用寿命长。
- ◎ Reasonable structure design, standard processing and manufacturing , high equipment purification rate.

◎ Precise structure design, high welding strength, to ensure excellent sealing.

◎ High quality raw material, corrosion resistance, weathering resistance, fire retardant, long service life.

• 应用领域 / Application field

适用于制药工业、除臭及其它水溶性空气污染物等生产加工环节产生废气的企业。

It is suitable for pharmaceutical industry, deodorization and other water-soluble air pollutants production and processing of waste gas enterprises.

吸附技术 / Adsorption technology

吸附技术是一种物质附着在另一种物质表面上的缓慢作用过程。常采用活性炭为原材料，其比表面积大，具有吸附废气中多种组分的能力。

Adsorption is a slow process by which one substance attaches to the surface of another. Activated carbon is often used as raw material, its specific surface area is large, has the ability to adsorb a variety of components in waste gas.

• 技术优点 / Technical advantages

- ◎ 吸附效率高，吸附容量大，适用面广

◎ 维护方便，无技术要求

◎ 比表面积大，良好的选择性吸附
- ◎ 原材料具有来源广泛价格低廉等特点

◎ 吸附效率高，能力强

◎ 操作简易、安全
- ◎ High adsorption efficiency, large adsorption capacity, wide application area

◎ Easy maintenance, no technical requirements

◎ Large specific surface area, good selective adsorption

◎ Raw materials have a wide range of sources and low prices and other characteristics

◎ High adsorption efficiency, strong capacity

◎ Easy and safe operation

• 应用领域 / Application field

适用于医药工业低浓度中小风量或高浓度间歇排放废气的作业环境。

It is suitable for the working environment with low concentration and small air volume or high concentration of intermittent waste gas discharge in pharmaceutical industry.

RTO 蓄热式焚烧法 / RTO Regenerative Incineration

RTO 蓄热式焚烧法是将可燃有机废气在摄氏 760~1000 度发生热氧化反应，生成二氧化碳和水等。废气首先通过蓄热体加热到接近热氧化温度，而后进入燃烧室进行热氧化，氧化后的气体温度升高，有机物基本转化成二氧化碳和水。净化后的气体，经过另一蓄热体，温度下降，达到国家排放标准后进行排放。

RTO regenerative incineration method is to produce carbon dioxide and water by thermal oxidation reaction of combustible organic waste gas at 760~1000-degrees Celsius. The waste gas is first heated to a temperature close to thermal oxidation through the regenerator, and then enters the combustion chamber for thermal oxidation. The temperature of the oxidized gas rises, and the organic matter is basically converted into carbon dioxide and water.

• 技术优点 / Technical advantages

- ◎ 对工况要求低，废气中可以含有多种有机成分，处理风量范围大：1000~300000Nm³/h；

◎ 净化率高，两床式 RTO 净化率在 95% 以上，三床式 RTO 净化率在 98% 以上，并且不产生 NO_x 等二次污染；

◎ 全自动控制，操作简单，操作费用低；

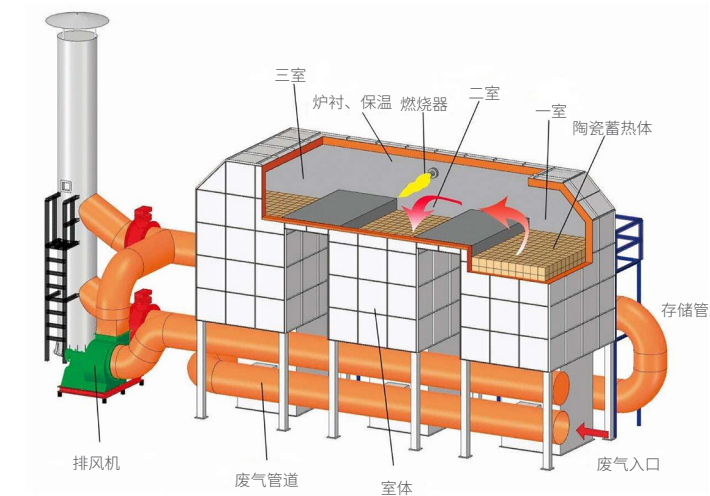
◎ 运行费用低，当 VOC_s 浓度达到 400ppm 时，不需要额外的燃料消耗。
- ◎ Low requirements for working conditions, waste gas can contain a variety of organic components, large range of air treatment: 1000~300000Nm³/h;

◎ High purification rate, two-bed RTO purification rate is more than 95%, three-bed RTO purification rate is more than 98%, and without NOX secondary pollution;

◎ Automatic control, simple operation, low operation cost;

◎ Low operating cost, no additional fuel consumption is required when VOC concentration reaches 400ppm.

• 工艺原理图 / Process diagram



• 应用领域 / Application field

适用于制药工业大风量、低浓度，有机废气浓度在 100PPM—20000PPM 之间。或在同一生产线上，因产品不同，废气成份经常发生变化或废气浓度波动较大的场合。

It is suitable for pharmaceutical industry with large air volume and low concentration, and the concentration of organic waste gas is between 100PPM and 20000PPM. Or in the same production line, because of different products, in the condition that waste gas components often change or waste gas concentration fluctuates.

RCO 蓄热式催化燃烧法 / RCO Regenerative Catalytic Combustion

RCO 蓄热式催化燃烧技术是用催化剂使废气中可燃物质在较低温度下氧化分解的净化方法。所以，催化燃烧又称为催化化学转化。由于催化剂加速了氧化分解的历程，大多数碳氢化合物在 300~450℃的温度时，通过催化剂就可以氧化完全。

RCO regenerative catalytic combustion technology is a purification method that uses catalysts to oxidize and decompose combustible substances in wastegas at lower temperatures. Therefore, catalytic combustion is also called catalytic chemical conversion. As the catalyst accelerates the process of oxidative decomposition, most hydrocarbons can be completely oxidized by catalyst at 300~450℃.

• 技术优点 / Technical advantages

- ◎ 工艺流程简单、设备紧凑、运行可靠；

◎ 净化效率高，一般均可达 98% 以上；

◎ 一次性投资低，运行费用低，其热回收效率一般均可达 85% 以上；

◎ 整个过程无废水产生，净化过程不产生 NO_x 等二次污染；

◎ RCO 净化设备可与需热车间配套使用，净化后的气体可直接回用到车间利用，达到节能减排的目的。

- ◎ Simple process, compact equipment, reliable operation;

◎ High purification efficiency, generally up to 98%;

◎ Low one-time investment, low operating cost, its heat recovery efficiency can generally reach more than 85%;

◎ There is no waste water in the whole process and NOX secondary pollution in the purification process.

◎ RCO purification equipment can be used with the workshop that needs heat, the purified gas can be directly reused to the workshop, to achieve the purpose of energy saving and emission reduction.

• 应用领域 / Application field

适用于制药工业同一生产线上，因产品不同，废气成分经常发生变化或废气浓度波动较大的场合。

It is suitable for pharmaceutical industry in the same production line, because of different products, in the condition that waste gas components often change or waste gas concentration fluctuates.

• 工艺原理图 / Process diagram

