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LehengMVR

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河北乐恒节能设备有限公司

Hebei Leheng Energy Saving Equipment Co.,LTD.

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LEHENG 乐恒科技

MVR蒸汽压缩机及系统集成供应商

MVR Steam Compressor and System Supplier

Energy-saving evaporation System new future

节能蒸发系统的全新未来

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About us

40000
工厂总占地面积
40000平方米

20000
单层高度15米的大型
总装厂房20000平方米

河北乐恒节能设备有限公司是一家专业致力于MVR（Mechnical Vapor Recompression，机械蒸汽再压缩技术）蒸发结晶系统、叶轮机械及热能回收系统研发设计、制造、安装调试的高新技术企业。

荣获2018年度中国钴锂产业链优质供应商设备十佳企业、河北省高新技术企业、河北省专精特新中小企业、河北省科技型中小企业、廊坊市科学技术奖等荣誉，同时还持有河北省工业企业研发机构证书、廊坊市高效蒸发及热能回收技术研发中心等称号。

工厂总占地面积40000平方米，拥有单层高度15米的大型总装厂房20000平方米，坐落于河北省大厂潮白河开发工业园区，紧邻北京首都机场，交通便利。

乐恒公司自成立以来，始终秉持“乐事敬业、创新惟恒”的乐恒精神，坚持实现以自主研发为核心、技术创新为动力，打造了一支优秀的技术团队，为客户提供合理的系统解决方案。公司将继续发扬锐意进取、努力创新的创业精神，为节能装备行业的进步贡献力量。

售前
Pre-sale

以工艺为先导，技术为保障，深入客户生产过程，针对客户特定的需求进行研发，积极挖掘市场机会。
With the process as the guide, technology as the guarantee, we will do research about the produ-ction process of client; suggest proper solutions according to the customer specific needs.

售中
On sale

提供及时、高质的设备及解决方案。
Provide timely and high quality technical proposals with reasonable equipment configuration.

售后
After sale

提供及时、便利的设备保养、检修、备品备件、故障诊断等服务，提高客户满意度，增加客户粘性。
Provide timely maintenance service,inspection service and trouble shooting service,Stock spare parts for fast delivery,to satisfy the urgent needs from clients.

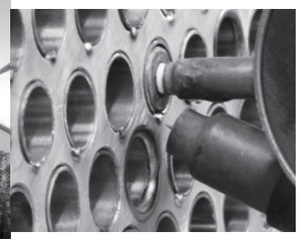
Hebei Leheng Energy Saving Equipment Co.,LTD. The company is committed to research and development, design, manufacturing, installation and commissioning of professional MVR (mechanical vapor recompression technology) evaporation crystallization system, turbo machinery and the heat recovery system.

In 2018, Leheng was honored as one of the top ten high-quality supplier equipment in cobalt and lithium industry chain of China, Hebei high-tech enterprise,specialized and cutting-edge minor enterprises in Hebei Province, science and technology-oriented minor enterprises in Hebei Province, and Langfang Science and Technology Award, and also held industrial enterprises in Hebei Province. R&D institution certificate, Langfang City Efficient Evaporation and Thermal Energy Recovery Technology R&D Center.

The factory covers total area of 40000 square meters, which has a single height of 15 meters large assembly workshop of 20000 square meters. Our company located in Dachang Chaobai River Development Industrial zone, Hebei provice. We are very close to Beijing International airport, very convenient for clients visiting and inspection.

Since company establishment, we always uphold the spirit of "happiness and dedication and innovation." Adhere to the core of independent research and development; adhere to technological innovation as the motive force; combined with the technical authority of evaporation crystallization in China, an excellent technical team has been built to provide the optimal evaporation system solution for the customer. The company will continue to carry forward the spirit of enterprising and innovation, and contribute to the progress of the advanced equipment industry in China.

科研团队
精工质造
RESEARCH TEAM
SEIKO QUALITY
MANUFACTURING



MVR—节能设备的首选 PRIME CHOICE OF ENERGY SAVING EQUIPMENT

MVR是机械式蒸汽再压缩技术（mechanical vapor recompression）的简称，是利用蒸发系统自身产生的二次蒸汽及其能量，将低品位的蒸汽经压缩机的机械做功提升为高品位的蒸汽热源。如此循环向蒸发系统提供热能，从而减少对外界能源需求的一项高效节能技术。

MVR is short for mechanical vapor Recompression technology. Centrifugal steam compressor is the key product to achieve MVR evaporator application. Centrifugal steam compressor will compress the low temperature and low pressure secondary steam to higher temperature and higher pressure, and this can be used again to heat the raw material. Through the centrifugal compressor, the electric energy is converted into mechanical energy, and the mechanical energy is converted into heat energy.

应用领域 Application Fields

食品、添加剂
Food and additives

海水淡化、真空制盐
The beverage industry

医药中间体及高盐化工废水处理行业
High salt chemical wastewater treatment

饮料工业
Desalination of sea water and vacuum salt making

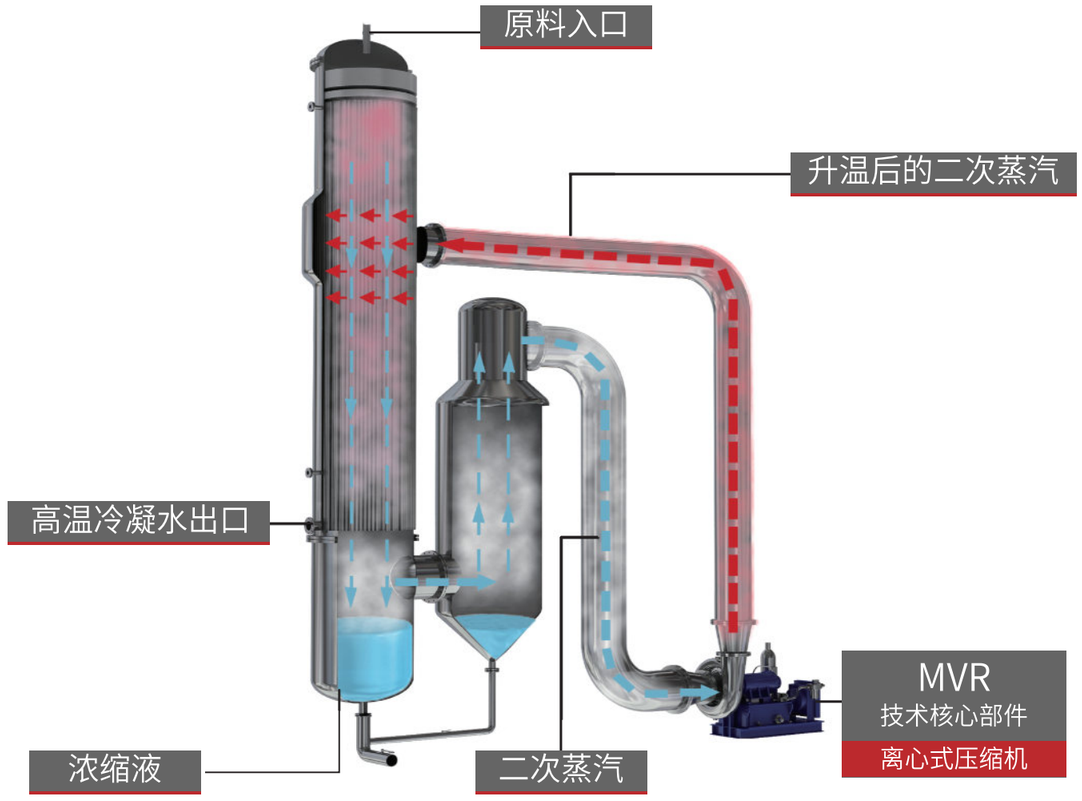
制药及保健品行业
Pharmaceutical and health products industry

锂电池正极材料及三元前驱体新材料、电池回收行业
Lithium battery and three-dimensional precursor materials industry

技术优势 Technical advantage

- 二次蒸汽不断被压缩循环作为加热热源，单位吨耗降低，节能效果明显
- 蒸发温度低，产品停留时间短，被用于热敏性物料性的蒸发浓缩
- 整体占地面积少，自动化程度高，操作成本低
- 工艺简洁，容易检修
- 配套公用工程少，工程投资小
- 对高有机物高盐等化工废水的应用，在处理效果和设备投资上有明显的优势，可以达到废水的“零排放”以及固废的价值回收

- MVR use secondary steam to heat the raw material, reduce the steam consumption of each tons water evaporation; energy saving performance is very good
- Lower evaporation temperature, short residence time of raw material, suitable for evaporation and concentration of heat sensitive materials
- Smaller footprint, higher automation degree and lower operation cost
- Simple process, easy maintenance
- Simple supporting projects and small investment in engineering
- Much suitable for high saline chemical wastewater treatment, can achieve zero liquid discharge (ZLD) and recycle the solids or chemicals inside the wastewater



乐恒离心式蒸汽压缩机 LEHENG CENTRIFUGAL STEAM COMPRESSOR

压缩机是MVR的核心技术部件，本公司采用的离心式蒸汽压缩机，相比于容积式压缩机具有工作范围广、维护方便、噪音低、可靠性更高等优点。

Compressor is the key product for MVR Evaporator system. We adopt centrifugal steam compressor for MVR system. Compared with volumetric compressor, centrifugal compressor have many advantages like wide application, easy maintenance, lower noise and better reliability.

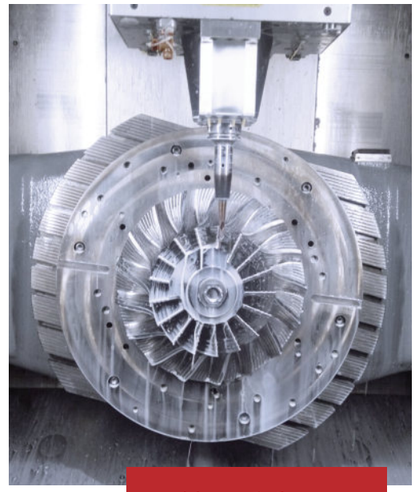
定制化设计的压缩机叶轮 CUSTOMIZED IMPELLER OF STEAM COMPRESSOR

在超过18000转的旋转速度下，叶轮必须具备极高的刚性及强度以满足在高速下的正常运转。通过先进的理论，高强度的材料，精密的加工工艺，严格的检测手段，确保叶轮拥有更长的使用寿命。

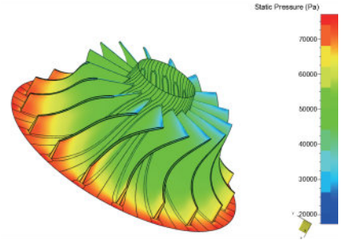
- 根据先进的气动软件和全三元流理论进行设计，强度模拟软件进行校核，确保较高的叶轮运行强度及效率。
- 叶轮材质是由高强度、耐磨、高耐腐蚀的钛合金材料锻造，并通过五轴联动铣床精铣而成。
- 通过不低于G2.5级双面动平衡，同时不低于工作转速的15%进行超速测试以检验其强度。
- 每一个叶轮在加工完成之后都进行了探伤及三坐标等严格的出场检测。

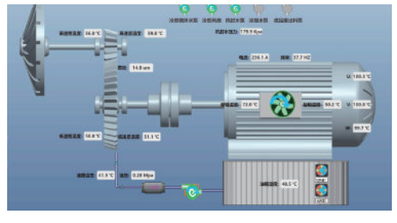
At a speed of more than 18, 000 rpm, the impeller must be extremely rigid and strong to operate normally at high speed. Service life of the impeller is much longer, which is ensured through the most advanced theory, high strength materials, precise process and strict testing method.

- We design the impeller according to the most advanced aerodynasoftware and all three flow theory, and strength is tested by ssoftware, which is to ensure the highest operating strength andthe impeller.
- Material of the impeller is forged by high strength, wearing resistance and high corrosion resistance titanium alloy, and the impeller is made by finish-milling through the five axis linkage milling machine.
- Strength of the impeller is tested by double-sided more than G2.5 dynamic balance of and over 15% of operation speed.
- Each impeller has a strict pre-delivery inspection after production finished, including flaw detection, three coordinate detection and so on.



精工质造
SEIKO QUALITY MANUFACTURING





压缩机检测系统 COMPRESSOR MONITOR SYSTEM

由压力、温度等传感器对压缩机的启动和停机、压缩机的运行及润滑油系统进行全面的监控。确保压缩机的安全运行。如果监控过程中出现了异常数据，会通过报警或者自动紧急停机的方式来保护您的设备。

Compressor' s starting, stopping, running, lubricating oil systemonitored by pressure and temperature sensors to ensure safe opcompressor. If abnormal data occurs, the compressor will protecthrough the ways of alarm or automatic emergency shutdown.

增速箱离心式蒸汽压缩机 GEAR BOX CENTRIFUGAL COMPRESSOR

增速箱式压缩机由电机与增速齿轮箱配合进行驱动。通过精密的叶轮设计可使压缩机工作效率可以达到85%以上。具有供货周期短，结构紧凑，维修快捷等特点。

Gearbox Compressor is driven by motor and gearbox. The efficiency of the compressor can be up to 85% by the precise design of the impeller. It has the features of short supply cycle, compact structure, and fast maintenance and so on.

高速直驱离心式蒸汽压缩机 HIGH SPEED DIRECT DRIVE COMPRESSOR

高速直驱式压缩机由电机直接驱动，无需增速箱进行增速，不仅具有增速箱式压缩机的特点，而且结构更为简洁、维护更为方便同时使用寿命也将提高。

Direct driven compressor is driven by high speed motor directly, without gearbox. It have advantages of gearbox, and other features like simple design, convenient maintenance and longer lifetime.

50T/h增速箱离心式蒸汽压缩机

高速直驱双级离心式蒸汽压缩机 GEAR BOX CENTRIFUGAL COMPRESSOR

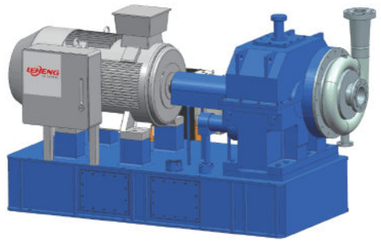
采用高速同步电机直接驱动叶轮，省去了常规电机的传动结构、增速齿轮箱等以及相关附属部件，从而降低了能耗。高速电机使用滚动轴承，转速高、磨损小、配套油站更紧凑。

The compressor adopt high speed synchronous rolling bearing motor dirict drive the impeller, there is no need for the transmission structure, gearbox, and related accessories to reduce the power consumption. The ceramics rolling bearing has the features of high speed, abrasion resistant, and need a smaller oil cooling system.

管道增压离心式蒸汽压缩机 PIPELINE BOOSTER COMPRESSOR

集中供热日益普及，管道增压压缩机可以突破供热气源压力限制。灵活定制所需求的压力，无缝对接热电厂与普通工业用户。

With the increasing popularity of central heating, pipeline booster compressor can overcome the pressure limitation of heating gas source, flexibly customize the pressure needed, and seamlessly connect the thermal power plant to the ordinary industrial user.



高速直驱离心式蒸汽压缩机

高速直驱双级离心式蒸汽压缩机

增速箱式双级离心式蒸汽压缩机

增速箱式双级离心式蒸汽压缩机

MVR蒸发结晶系统 MVR EVAPORATION CRYSTALLIZATION SYSTEM

蒸发结晶被用于清洁分离技术，在化工工艺生产、高盐废水、电池材料生产中被认为是通用的技术。

Evaporation crystallization is used for clean separation technology and is considered as the most suitable technology in chemical production, salinity wastewater, and lithium battery material production.

系统特点 System Features

应用范围广，传热系数大，易清洗，抗结垢，结晶颗粒大等。

Wide range of applications, large heat transfer coefficient, easy to clean, anti-scaling, large crystalline particles, and so on.

适用范围 Application

- 真空制盐、井矿盐、盐硝分离等传统制盐行业。
- 适用于化工、化药厂等高盐、高COD、高沸点升等生产废水及医药中间体高盐废水处理。
- 锂电池正极材料及三元前驱体新材料的蒸发结晶，锂电池回收提锂及“零排放”。
- 配套膜反应器、生物处理工艺、化学处理工艺等，实现化工废水、生物污水等的“零排放”和固废的回收利用。

- Vacuum salt production technology, brine well salt making, mineral salt separation of traditional salt industry.
- Suitable for the production wastewater with high salt, high COD and high boiling point in chemical plant pharmaceitical intermediates wastewater treatment.
- Concentration，crystallization and ZLD of Lithium battery and Three-dimensional precursor materials.
- Supporting membrane reactor, biological treatment and chemical treatment, chemical wastewater, sewage and other biological to achieve "zero liquid discharge" and solid waste recycling.

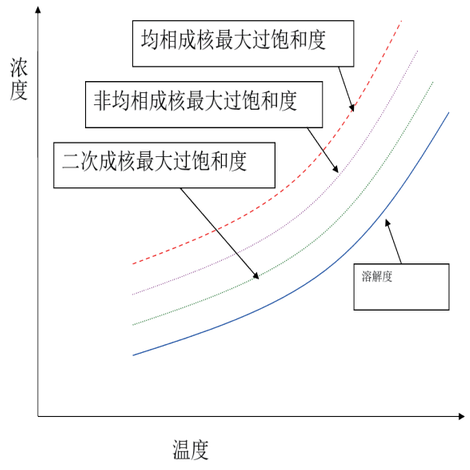
产品优势 Product Advantages

蒸发结晶系统在涉及传热和蒸发等单元操作的基础上，还要重点考虑结晶的化工过程。

根据不同水质的物性特点，结合小试检测的基础物性，通过分析结晶过程热力学和动力学与产品粒度之间的理论关系，采用合适的工艺设计流程和设备选型。

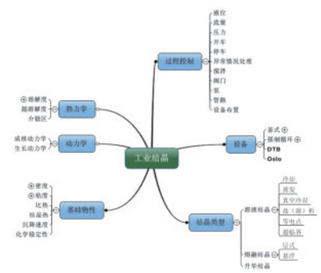
On the basis of heat transfer and evaporation, the evaporation crystallization process should also consider chemical process.

According to the physical characteristics of different water quality, combined with the basic physical properties of the small test, through the analysis of the theoretical relationship between thermodynamics and dynamics of crystallization and the grain size of the product, the most suitable process and equipment selection are adopted.



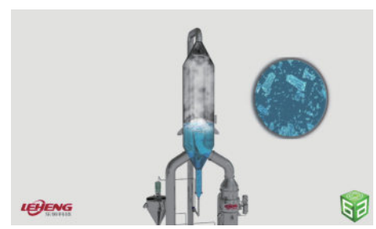
根据不同物系各自的溶解度及介稳区数据记录，精确分析结晶操作过程中的浓度范围，确定蒸发器结构尺寸及循环泵选型。

According to the solubility of different materials and the data of the metastable zone, the optimum concentration range of the crystallization process is analyzed, and the structure size of the evaporator and the type selection of the circulating pump are determined.



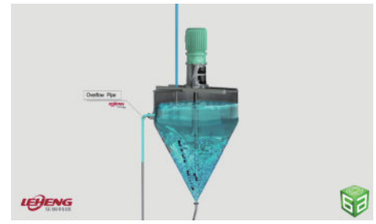
在结晶操作过程中，通过结晶热力学和动力学理论衡算，控制晶体成核及生长速率、温度、浓度等工艺参数，控制晶体粒径大小，为结晶器选型提供依据。

In the process of crystallization operation, through crystallizing thermodynamics and kinetics theory balance, we control crystal processing parameters such as nucleation and growth rate, temperature and concentration, control crystal size and provide basis for mould selection.



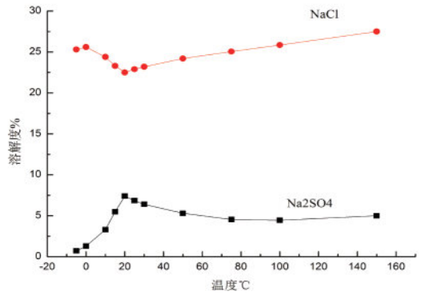
可连续蒸发结晶，严格控制晶体粒度，便于离心分离；对于无机盐产品，可做到粒径均匀、产品回收率高。后续配套离心机、干燥、吨装包装等。

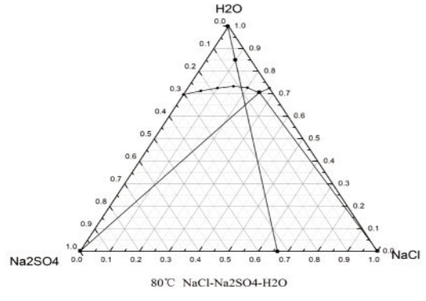
Can achieve continuously evaporation crystallization, strictly control crystal size and facilitate centrifugal separation; for inorganic salt products, the grain size is uniform and the yield of the product is high. Follow up the centrifuge, drying, packing and so on.



对于多种离子成分的废水，考虑固体盐的回收成本，需要分别结晶得到纯度较高的产品，提高其回收价值，降低工艺运行成本。比如，钠盐废水的盐硝分离系统。

Considering the recovery cost of solid salt, it is necessary to crystallize the products with high purity to improve the recovery value and reduce the operation cost of the wastewater with various ionic components. For example, sodium salt separation system of sodium salt wastewater.





应用案例 APPLICATION AREAS

电池回收、硫酸钴、硫酸镍生产过程中萃取液、硫酸钠蒸发结晶处理—配乐恒离心式蒸汽压缩机

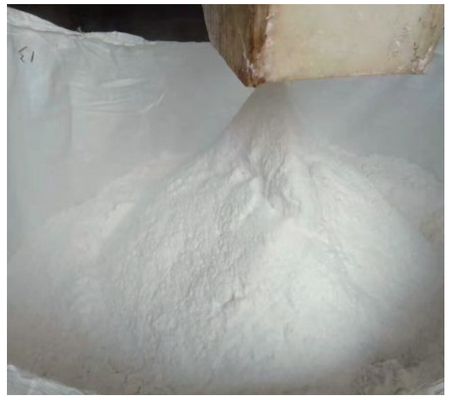
Sodium sulfate evaporation crystallize for lithium carbonate, lithium hydrate production -leheng centrifugal steam compressor

随着锂电池等正极材料行业的持续升温，对锂电池废料提取电池级氢氧化锂及碳酸锂过程中，蒸发结晶（浓缩）氢氧化锂、硫酸钠积累了丰富的工程经验。对设备选型，材质选型，出盐指标，尤其洗盐工序具有非常成熟的工艺经验。达到无机盐夹带锂≤0.02%。

With the continuous warming of the ternary precursor material industry such as lithium batteries, in the process of extracting battery-grade lithium hydroxide and lithium carbonate from lithium battery waste, evaporative crystallization (concentration) of lithium hydroxide and sodium sulfate has accumulated rich engineering experience. . It has very mature process experience in equipment selection, material selection, salt index, and especially salt washing process. Reaching inorganic salt entrained lithium ≤ 0.02%.

参数介绍 Parameters

物料成分：锂钠混合氯化物溶液	Raw material: lithium chloride and Sodium chloride mixture solutions
浓度：氯化锂0.9%，氯化钠12.5%	Concentration:LiCl-0.9%;NaCl-12.5%
MVR蒸发量：25T/h	MVR evaporation capacity: 25T/h
沸点升：8°C	Boiling Point Elevation: 8°C
压缩温升：16°C	Compressor temperature rise: 16°C
浓度：氯化锂1.8%，氯化钠25%	Concentration: LiCl-1.8%; NaCl-25%
双效蒸发量20T/h	Double effect evaporation rater: 20T/h
沸点升：20°C	Boiling Point Elevation: 20°C
结晶出盐量：7.5T/h	Salt output: 7.5tons/h
离心机形式：双级活塞推料离心机	Centrifuge type: Double drum piston pusher centrifuge
装置布置尺寸：30m x 15m x 25m	System overall dimension: L*W*H: 30*15*25meter



年产2万吨氢氧化锂生产线 — 配乐恒离心式蒸汽压缩机

20,000 metric tons of LiOH production - Leheng steam compressor

锂辉石生产氢氧化锂的工艺中包括元明粉、粗品氢氧化锂，精品（电池级）氢氧化锂以及除杂液等几种系统。从芒硝采用连续冷冻结晶，芒硝热溶解至结晶出工业级元明粉；到粗品氢氧化锂蒸发浓缩、冷却结晶、除杂；再到电池级氢氧化锂的返溶、蒸发浓缩，降温结晶得到粒度500μm（可控）的电池级氢氧化锂晶体，我公司对全套工艺具有完善、成熟的设计及施工经验。

The production of lithium hydroxide from spodum ene ore consists of several systems such as sodium sulfate, crude lithium hydroxide, fine (battery grade) lithium hydroxide, and im purity removal. Leheng is experienced in the production process of battery-grade lithium hydroxide,from the continuous freezing crystallization of Glauber's salt, Glauber's salt heat dissolved to crystallize the industrial-grade sodium sulfate; to the crude lithium hydroxide evaporation concentration, cooling crystallization, and impurity removal; to the battery-grade lithium hydroxide redissolution, evaporation concentration, cooling crystallization to obtain the particle size with 500μm (controllable) battery-grade lithium hydroxide crystals.

参数介绍 Parameters

蒸发量：8T/h	Evaporation capacity: 8T/h
物料成分：主要成分为硫酸锂	Material composition: Lithium sulfate solution
进料浓度：以氧化锂计38g/L	Inlet concentration: 38g/L in lithium oxide
出料浓度：以氧化锂计50g/L	Outlet concentration: 50g/L
蒸发温度：85°C	Evaporation temperature：85°C
压缩机形式：乐恒增速箱离心式蒸汽压缩机	Compressor type: Leheng centrifugal steam compressor
装置布置尺寸：7.5m x 10m x 26m	Unit layout size (L x W x H): 7.5m x 10m x 26m

能耗分析 Energy Consumption

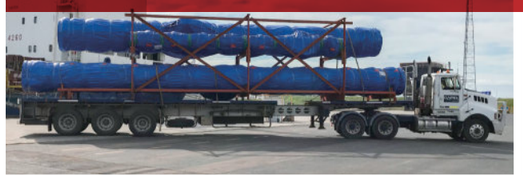
进料量 T/h	Feeding capacity (T/h)	38
蒸发量 T/h	Evaporation capacity (T/h)	8
出料量 T/h	Discharge capacity (T/h)	30
运行时间 h/y	Operation time (h/y)	8000
电价 元/kW·h	Electricity price (CNY/kW·h)	0.8
蒸汽价格 元/T	Steam price (CN Y/t)	200
冷却水费用 元/T	Cooling w ater price (CN Y/t)	0.1

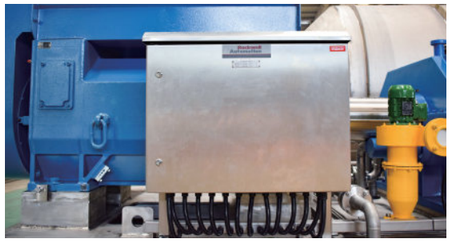
		三效系统 Thriple effect Evaporator	MVR系统 MVR Evaporator
电耗 kW	Electricity consumption(kw)	180	420
鲜蒸汽 T/h	Steam consumption (T/h)	3.2	0.5
冷却水 T/h	Cooling water consumption (T/h)	245	35
小时费用 /元	Cost per hour(CNY)	808.5	439.5
蒸发吨水费用 /元	Cost per ton water evaporation (CNY)	101.1	54.9
小时节约费用 /元	Cost saving per hour (CNY)		369
年节约费用 /万元	Annual cost saving (10000CNY)		295.2
年节约率 %	Annual saving rate		45.64%

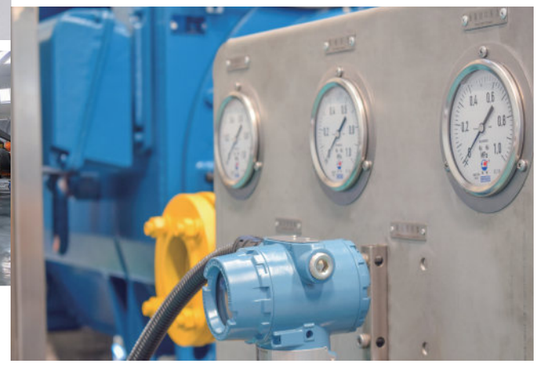
备注：MVR系统蒸发吨水电耗约52.5kW，蒸汽63kg，冷却水2T。含蒸汽压缩机油冷却、不凝器冷却。
Remark: MVR evaporator to evaporate one ton water need 52.5kW electricity, 63kg steam, 2ton cooling water.

应用案例 APPLICATION AREAS

年产4万吨氢氧化锂蒸发结晶（澳洲项目）—配乐恒离心式蒸汽压缩机
Albemarel 40,000 metric tons of LiOH production (in Auatralia)







客户：全球锂电池行业原料供应商巨头（Albemarle）
项目地点：澳大利亚
设备认证：ASME，API
设备标准：澳标、美标

Client: Albemarle
Location: Australia
Certification: ASME, API
Standard: Australia & America

电池级氢氧化锂主要用于锂离子电池正极材料的制备，乐恒公司利用自身的技术优势，选用MVR蒸发结晶工艺，对连续化生产单水氢氧化锂的统具有极其丰富的经验。可以选择控制单水氢氧化锂的晶体粒径大小，在500-800μm范围内的晶体有效选取筛分，晶体颗粒均匀度≥95%可以保证冷凝水出水电导率＜20μs/cm，锂含量＜10ppm。

Battery grade lithium hydroxide is mainly used for the production of cathode materials for lithium batteries. Leheng takes advantage of its own technical advantages and uses the MVR evaporation crystallization process to continuously produce lithium hydroxide monohydrate system. The crystal size of lithium hydroxide monohydrate can be controlled. The crystals in the range of 500-800μM can be selected and screened effectively. The uniformity of crystal particles is more than 95%, the water conductivity of condensate water is less than 20μs/cm, and the lithium content is less than 10ppm.

参数介绍 Parameters

蒸发量：25T/h	Evaporation capacity: 25T/h
物料成分：主要物料是氢氧化锂，含有微量硫酸钠、钙镁等杂质	Material composition: Lithium hydroxide solultion
进料浓度：以氧化锂计48g/L	Inlet concentration: 48g/l
出料浓度：以氧化锂计110g/L	Outlet concentration: 110g/L
蒸发温度：85°C	Evaporation temperature：85°C
压缩机形式：乐恒增速箱离心式蒸汽压缩机	Compressor type: Leheng centrifugal steam compressor
压缩机装置布置尺寸：13m x 12.5m x 38m	Unit layout size (L x W x H): 13m x 12.5m x 38m

能耗分析 Energy Consumption

					三效系统 Thriple effect Evaporator	MVR系统 MVR Evaporator
进料量 T/h	Feeding capacity (T/h)	60	电耗 kW	Electricity consumption(kw)	350	1154.4
蒸发量 T/h	Evaporation capacity (T/h)	25	鲜蒸汽 T/h	Steam consumption (T/h)	11.2	2.5
出料量 T/h	Discharge capacity (T/h)	35	冷却水 T/h	Cooling water consumption (T/h)	800	60
运行时间 h/y	Operation time (h/y)	8000	小时费用 /元	Cost per hour(CNY)	2600	1429.5
电价 元/kW·h	Electricity price (CNY/kW·h)	0.8	蒸发吨水费用 /元	Cost per ton water evaporation (CNY)	104	57.18
蒸汽价格 元/T	Steam price (CNY/t)	200	小时节约费用 /元	Cost saving per hour (CNY)		1170.48
冷却水费用 元/T	Cooling water price (CNY/t)	0.1	年节约费用 /万元	Annual cost saving (10000CNY)		936.38
			年节约率 %	Annual saving rate		45.02%

备注：MVR系统蒸发吨水电耗约46kW，蒸汽100kg，冷却水2.4T。含蒸汽压缩机油冷却、不凝气冷却。

Remark: MVR evaporator to evaporate one ton water need 46kW electricity,100kg steam, 2.4ton cooling water.

参数介绍 Parameters

蒸发量：15T/h	Evaporation capacity: 15T/h
物料成分：主要物料是氢氧化锂，含有微量硫酸钠、钙镁等杂质	Material composition: Lithium hydroxide solution
进料浓度：以氧化锂计65-70g/L	Inlet concentration: 65-70g/L in lithium oxide
出料浓度：以氧化锂计130g/L	Outlet concentration: 130g/L in lithium oxide
蒸发温度：85°C	Evaporation temperature：85°C
压缩机形式：乐恒增速箱离心式蒸汽压缩机	Compressor type: Leheng centrifugal steam compressor
装置布置尺寸：12.65m x 12.5m x 35m	Unit layout size (L x W x H): 12.65m x 12.5m x 35m

能耗分析 Energy Consumption

					三效系统 Thriple effect Evaporator	MVR系统 MVR Evaporator
进料量 T/h	Feeding capacity (T/h)	36	电耗 kW	Electricity consumption(kw)	230	781.4
蒸发量 T/h	Evaporation capacity (T/h)	15	鲜蒸汽 T/h	Steam consumption (T/h)	8	0.75
出料量 T/h	Discharge capacity (T/h)	21	冷却水 T/h	Cooling water consumption (T/h)	700	50
运行时间 h/y	Operation time (h/y)	8000	小时费用 /元	Cost per hour(CNY)	1854	780.12
电价 元/kW·h	Electricity price (CNY/kW·h)	0.8	蒸发吨水费用 /元	Cost per ton water evaporation (CNY)	123.6	52
蒸汽价格 元/T	Steam price (CNY/t)	200	小时节约费用 /元	Cost saving per hour (CNY)		1073.9
冷却水费用 元/T	Cooling water price (CNY/t)	0.1	年节约费用 /万元	Annual cost saving (10000CNY)		859.1
			年节约率 %	Annual saving rate		57.92%

备注：MVR系统蒸发吨水电耗约52kW，蒸汽50kg，冷却水3.3T。含蒸汽压缩机油冷却、不凝气冷却。
Remark: MVR evaporator to evaporate one ton water need 52kW electricity, 50kg steam, 3.3toncooling water.
(include the cooling of steam compressor oil and non-condensable gas)

应用案例 APPLICATION AREAS

用于三元前驱体脱氨后母液处理蒸发结晶系统—配乐恒离心式蒸汽压缩机
Mother liquor evaporation crystallization system used for ternary precursor deamination

三元前驱体脱氨后母液综合循环利用回收过程中，会产生大量的无机盐废水，主要就是硫酸钠，处理这些废水要做到废水“零排放”，即冷凝水达到排放标准，无机盐达到国标二级工业盐的标准，无尾气排放。此废水处理前端要做好除油、除重处理，中间选用MVR蒸发结晶工艺结晶出盐（包括预热、蒸发、脱水、干燥、包装等工序），后端搭配蒸馏水纯化装置。
干燥后无机盐产品纯度可以达到97%以上，重金属Ni≤0.5ppm，Co≤0.5ppm，Mn≤0.5ppm，含水率≤0.5%，冷凝水经纯化后，电导率≤10μs/cm；尾气排放标准粉尘最高浓度可做到低于10mg/m^3。

A large amount of inorganic salt wastewater, mainly sodium sulfate, will be produced in the process of recycling and recovery of mother liquor after deamination of ternary precursor. To treat these wastewater to achieve "zero liquid discharge" of wastewater, that is, condensate should meet the discharge standard, inorganic salt should meet the national industrial salt standard **II**, and there is no tail gas emission. MVR evaporation crystallization process is used to crystallize salt (including preheating, evaporation, dehydration, drying, packaging, and other processes), the pre-treatment includes oil removal, macromolecular substance removal, and the after-treatment include distilled water purification device. After drying, the purity of crystallized salt can reach more than 97%, heavy metals Ni ≤ 0.5ppm, Co ≤ 0.5ppm, Mn ≤ 0.5ppm, moisture content ≤ 0.5%; the conductivity of condensate after purification is lower than 10 μs/cm; the maximum concentration of dust in exhaust emission standard can be less than 10m g/m^3.

参数介绍 Parameters

蒸发量：82T/h	Evaporation capacity: 82T/h
物料成分：主要成分为硫酸钠	Main composition: Sodium Sulphate
浓度：原液浓度10%，母液浓度29%~30%	Concentration: raw material 10%, mother liquor 29%~30%
出料浓度：结晶出盐	Outlet concentration: crystallization
蒸发温度：90°C	Evaporation temperature：90°C
压缩机形式：乐恒增速箱离心式蒸汽压缩机	Compressor type: Leheng Gear-box centrifugal steam ompressor
装置布置尺寸：23m x 31m x 38m	Unit layout size (L x W x H): 23m x 31m x 38m

能耗分析 Energy Consumption

					三效系统 Triple effect Evaporator	MVR系统 MVR Evaporator
进料量 T/h	Feeding capacity (T/h)	92	电耗 kW	Electricity consumption(kw)	600	3058
蒸发量 T/h	Evaporation capacity (T/h)	82	鲜蒸汽 T/h	Steam consumption (T/h)	32.8	2.5
出料量 T/h	Discharge capacity (T/h)	10	冷却水 T/h	Cooling water consumption (T/h)	2800	180
运行时间 h/y	Operation time (h/y)	8000	小时费用 /元	Cost per hour(CNY)	7320	2964.4
电价 元/kW·h	Electricity price (CNY/kW·h)	0.8	蒸发吨水费用 /元	Cost per ton water evaporation (CNY)	89.27	36.15
蒸汽价格 元/T	Steam price (CNY/t)	200	小时节约费用 /元	Cost saving per hour (CNY)		4355.6
冷却水费用 元/T	Cooling water price (CNY/t)	0.1	年节约费用 /万元	Cost saving per year (10000CNY)		3484.48
			年节约率 %	Saving efficiency (%)		59.5%

备注：MVR系统蒸发吨水电耗约43.3kW，蒸汽32kg，冷却水6T
Remark: MVR evaporator to evaporate one ton water need 43.4kW electricity, 32kg steam, 6ton cooling water.

应用案例 APPLICATION AREAS

四氧化三钴（废水）氯化铵蒸发结晶—配乐恒离心式蒸汽压缩机
Ammonium chloride evaporation crystallizer for lithium industry-leheng centrifugal steam compressor

描述 随着正极材料应用行业持续升温，乐恒在生产过程中会产生在蒸发结晶氯化铵方面积累了丰富的经验，对设备选型、材质选型等具有较成熟的工艺经验，本工艺采用降膜+降膜+强制循环结晶+降温结晶。

Description: With the development of lithium battery industry, ternary precursor industry continues to heat up. Leheng has accumulated rich experience in evaporative crystallization of ammonium chloride in the production process, and has very mature process experience in equipment selection and material selection.

参数介绍 Parameters

蒸发量：33T/h	Evaporation capacity: 33T/h
物料成分：主要成分为氯化铵	Main composition: Ammonium chloride
浓度：6%-8%	Concentration: 6%-8%
出料浓度：蒸发结晶	Outlet concentration: evaporative crystallization
沸点升：12-14°C	Boiling point Elevation：12-14°C
压缩机温升：20°C	Compressor temperature rise：20°C
蒸发温度：85°C	Evaporation temperature：85°C
压缩机形式：乐恒增速箱离心式蒸汽压缩机	Compressor type: Leheng Gearbox centrifugal steam compressor
装置布置尺寸：42m x 20m x 27m	Unit layout size (L x W x H): 42m x 20m x 27m

能耗分析 Energy Consumption

					三效系统 Triple effect Evaporator	MVR系统 MVR Evaporator
进料量 T/h	Feeding capacity (T/h)	35.2	电耗 kW	Electricity consumption(kw)	400	1405
蒸发量 T/h	Evaporation capacity (T/h)	33	鲜蒸汽 T/h	Steam consumption (T/h)	14.6	2.5
出料量 T/h	Discharge capacity (T/h)	2.2	冷却水 T/h	Cooling water consumption (T/h)	3500	200
运行时间 h/y	Operation time (h/y)	8000	小时费用 /元	Cost per hour(CNY)	3590	1664
电价 元/kW·h	Electricity price (CNY/kW·h)	0.8	蒸发吨水费用 /元	Cost per ton water evaporation (CNY)	108.78	49.82
蒸汽价格 元/T	Steam price (CNY/t)	200	小时节约费用 /元	Cost saving per hour (CNY)		1946
冷却水费用 元/T	Cooling water price (CNY/t)	0.1	年节约费用 /万元	Cost saving per year (10000CNY)		1556.8
			年节约率 %	Saving efficiency (%)		54%

备注：MVR系统蒸发吨水电耗约43.3kW，蒸汽32kg，冷却水6T。
Remark: MVR evaporator to evaporate one ton water need 43.4kW electricity, 32kg steam, 6ton cooling water.

氯化钴连续蒸发结晶—配乐恒离心式蒸汽压缩机（双级）
Lithium sulfate continuous crystallizer for lithium battery industry - Leheng double-stage compresser

镍盐、钴盐、锰盐是制造三元复合正极材料前驱体产品的原料，钴镍锰主要是以氯化盐、硫酸盐的形式存在，并且都含有结晶水，由于其物理性质中溶解度的特殊性，需要降温结晶析出带结晶水的无机盐。
乐恒公司通过对工业结晶理论的熟练应用，结合ASPEN、CFD等计算模拟软件，选用蒸发+降温+长晶+干燥包装的独有工艺流程，可做到连续化生产氯化钴、硫酸镍、硫酸钴等产品，结晶器选用改良后的OSLO结晶器，有效做到粒度大小均匀，梯度分布明显。结晶出的粒度、颗粒均匀度、色度、纯度等均满足相关的国标要求。

Nickel salt, cobalt salt and manganese salt are raw materials for production precursor products of ternary composite cathode materials. Cobalt, nickel and manganese mainly in the form of chloride and sulfate, which all contain crystal water. Due to the particularity of solubility in its physical properties, need to cool down and crystallize salts with crystal water. Leheng has a great wealth of experience of industrial crystallization application, combined with Aspen, CFD and other calculation simulation software, selected the unique process flow of evaporation + cooling + crystal growth + drying + packaging, so as to achieve continuous production of cobalt chloride, nickel sulfate, cobalt sulfate andother products. The improved Oslo crystallizer was selected to effectively achieve uniform particle size and obvious gradient distribution. The crystallized particle size, particle uniform ity, chroma and purity meet the requirements of relevant national standards.

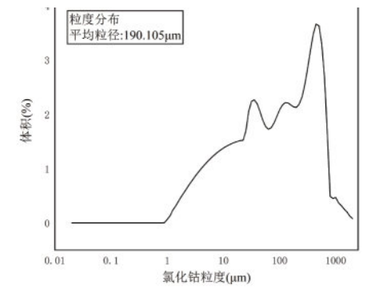
参数介绍 Parameters

蒸发量：3T/h
物料成分：主要成分为氯化钴溶液
浓度：钴150g/L
出料浓度：结晶出盐
蒸发温度：70-75°C
压缩机形式：乐恒增速箱离心式蒸汽压缩机
装置布置尺寸：15m x 11m x 20m

Evaporation capacity: 3T/h
Main composition: cobalt chloride
Concentration: cobat 150g/L
Outlet concentration: Crystallization
Evaporation temperature：70-75°C
Compressor type: Leheng Gear Box centrifugal steam compressor
Unit layout size (L x W x H): 15m x 11m x 20m

能耗分析 Energy Consumption

			MVR蒸发结晶+OSLO连续结晶		
进料量 T/h	Feeding capacity (T/h)	6~10	MVR Evaporative crystallization + OSLO continuous cooling crystallization		
蒸发量 T/h	Evaporation capacity (T/h)	3			
出料量 T/h	Discharge capacity (T/h)	3~7	电耗 kW	Electricity consumption(kw)	383
运行时间 h/y	Operation time (h/y)	7200	鲜蒸汽 T/h	Steam consumption (T/h)	0.5
电价 元/kW·h	Electricityprice (CNY/kW·h)	0.8	冷却水 T/h	Cooling water consumption (T/h)	100
蒸汽价格 元/T	Steam price (CNY/t)	200	小时费用 /元	Cost per hour(CNY)	416.4
冷却水费用 元/T	Cooling water price (CNY/t)	0.1	蒸发吨水费用 /元	Cost per ton water evaporation (CNY)	138.8



应用案例 APPLICATION AREAS

新能源原材料硫酸钴蒸发结晶
Cobatous sulfate evaporation crystallizer for lithium industry

参数介绍 Parameters

物料成分：硫酸钴溶液
浓度：26%
双效蒸发量：1T/h
装置布置尺寸：6m x 9.8m x 11m

Raw material: cobaltous sulfate solution
Concentration: 26%
Double-effect evaporation capacity: 1T/h
Unit Dimension:L*W*H: 6*9.8*11

新能源原材料硫酸镍蒸发结晶
Sodium sulfate evaporation crystallizer for lithium industry

参数介绍 Parameters

物料成分：硫酸镍溶液
浓度：27%
双效蒸发量：1T/h
装置布置尺寸：6m x 9.5m x 11m

Raw material: cobaltous sulfate solution
Concentration: 26%
Double-effect evaporation capacity:1T/h
Unit Dimension: L*W*H: 6*9.5*11

硫酸镍晶体 - 粒径小于0.25mm

硫酸镍晶体 - 粒径0.25-0.38mm

硫酸镍晶体 - 粒径0.38-0.50mm

硫酸镍晶体 - 粒径大于0.50mm

MVR化工废水处理系统 MVR EVAPORATION CRYSTALLIZATION SYSTEM

化工废水处理
Chemical Wastewater Treatment-leheng centrifugal steam compressor

应用工况：采用MVR工艺可有效突破业内高盐、高COD、高沸点升废水处理难的瓶颈，处理后废水可达到直排标准，循环回用利用率达90%以上。

对于高盐、高COD、高沸点升的废水，简单采用某一种废水处理工艺实现凝水、固废的达标排放或生产回用，处理不好还会造成固废的“二次污染”。

Application conditions: MVR technology can effectively solve the bottleneck problem of wastewater treatment with high salinity, high COD and high boiling point. After treatment, the effluent can meet the standard of straight discharge, and the utilization rate of recycling is over 90%.

For wastewater with high salt, high COD, high boiling point rise, simple process with only one method may lead to secondary pollution if not treated well.

MVR废水蒸发预处理 - 亚临界氧化技术SCAO
Chemical Wastewater Treatmentleheng centrifugal steam compressor

亚临界氧化技术（Sub-critical Air Oxidation），在亚临界状态下利用空气使废水中的污染物发生氧化分解反应，反应以羟基自由基为主要氧化剂，氧化电位高有机物反应彻底，可以去除水中各种难降解有机物。亚临界氧化技术具有处理效率高，流程简单，占地面积小等特点，有广泛的工业应用前景。

Subcritical Oxidation, a kind of technology that uses air to oxpose pollutants in wastewater under subcritical state. Hydroxylmain oxidant in the reaction, high oxidation potential, organicreact completely. This technology has a wide application prospect that can be applied to petrochemical, pharmaceutical, printing and dyeing, fiber, rubber and other industries.

化工废水	Chemical wastewater
预处理（fenton反应、活性炭处理等催化氧化技术、超重力精馏床技术）	Pretreatment (Fenton reaction, activated carbon treatment, High gravity distillation bed technology, etc.)
MVR蒸发结晶处理	MVR evaporation crystallization treatment
膜处理（反渗透等）	Membrane treatment (reverse osmosis, etc.)
达标排放	Reaching the Discharge standards

参数介绍 Parameters

蒸发量：40T/h
物料成分：染料行业硫酸铵废水
浓度：20-25%
沸点升：12℃
一效压缩温升：15℃，二效压缩温升20℃
蒸发温度：85℃
结晶出盐量：14T/h
压缩机形式：离心式蒸汽压缩机
离心机形式：双级活塞推料离心机
装置布置尺寸：25m x 20m x 30m

Evaporation capacity: 40tons/h
Raw material: Ammonium sulfate wastewater from dye and dyeing industry
Concentration: 20~25%
Boiling point elevation(BPE): 12°C
1st effect compressor temperature rise: 15°C,2nd effect compressor temperature rise: 20°C
Evaporation temperature: 85°C
Crystallization salt output: 14T/h
Compressor type: Centrifugal steam compressor
Centrifuge type: Double drum piston pusher centrifuge
System overall dimension:L*W*H: 25*20*30meter

能耗分析 Energy Consumption

					三效系统 Three effect evaporator	MVR系统 MVR Evaporator
进料量 T/h	Feeding capacity (T/h)	54	电耗 kW	Electricity consumption(kw)	1200	2100
蒸发量 T/h	Evaporation capacity (T/h)	40	鲜蒸汽 T/h	Steam consumption (T/h)	20	1.6
出料量 T/h	Discharge capacity (T/h)	14	冷却水 T/h	Cooling water consumption (T/h)	1350	100
运行时间 h/y	Operation time (h/y)	8000	小时费用 /元	Cost per hour(CNY)	5095	2010
电价 元/kW·h	Electricity price (rmb/kW.h)	0.8	蒸发吨水费用 /元	Cost per ton water evaporation (CNY)	127.4	50.25
蒸汽价格 元/T	Steam price (rmb/T)	200	小时节约费用 /元	Cost saving per hour (CNY)		3085
冷却水费用 元/T	Cooling water price (rmb/T)	0.1	年节约费用 /万元	Annual cost saving (10000CNY)		2468
			年节约率 %	Annual saving rate		60.55%

备注：MVR系统蒸发吨水电耗约52.5kW，蒸汽40kg，冷却水2.5T。含蒸汽压缩机油冷却、不凝器冷却。
Remark: MVR evaporator to evaporate one ton water need 52.5kW electricity, 40kg steam, 2.5ton cooling water.

应用案例 APPLICATION AREAS

橡胶助剂化工废水处理—配乐恒离心式蒸汽压缩机
Rubber chemicals Wastewater Treatment-leheng centrifugal steam compressor

应用工况：采用MVR新工艺解决了业内高含盐工艺废水处理难的瓶颈，水循环利用率达90%以上；采用光电催化进行废气治理；综合回收利用废渣，实现“三废”达标排放。

Application: Implementation of the MVR technology solved the tough challenge of high salt content wastewater treatment, water cycle utilization rate of more than 90%; Using photoelectric catalysis for waste gas treatment; Comprehensive recycling and utilization of waste residue, the realization of "three wastes" emissions standards.

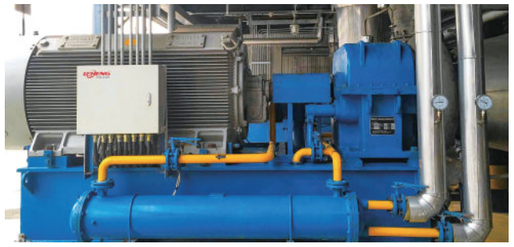
参数介绍 Parameters

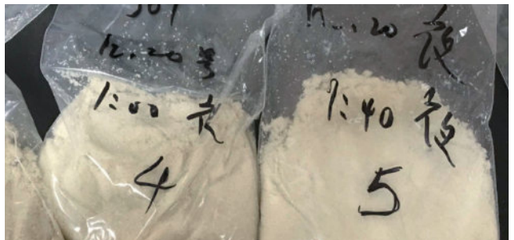
蒸发量：30T/h	Evaporation capacity: 30tons/h
物料成分：橡胶助剂氯化钠、硫酸钠废水	Raw material: Sodium chloride and sodium sulfate wastewater for rubber chemicals
浓度：15%	Concentration: 15%
沸点升：一效7°C，二效12°C	Boiling point elevation(BPE): 1st effect 7°C, 2nd effect 12°C
一效压缩温升：15°C，二效压缩温升19°C	1st effect compressor temperature rise: 15°C, 2nd effect compressor temperature rise: 19°C
蒸发温度：80°C	Evaporation temperature: 80°C
结晶出盐量：5T/h	Crystallization salt output: 5tons/h
压缩机形式：离心式蒸汽压缩机	Compressor type: Centrifugal steam compressor
离心机形式：双级活塞推料离心机	Centrifuge type: Double drum piston pusher centrifuge
装置布置尺寸：24m x 13.5m	System overall dimension: LxW: 24 x 13.5 meter

能耗分析 Energy Consumption

					三效系统 Thriple effect evaporator	MVR系统 MVR Evaporator
进料量 T/h	Feeding capacity (T/h)	35	电耗 kW	Electricity consumption(kw)	450	1600
蒸发量 T/h	Evaporation capacity (T/h)	30	鲜蒸汽 T/h	Steam consumption (T/h)	13.5	0.5
出料量 T/h	Discharge capacity (T/h)	5	冷却水 T/h	Cooling water consumption (T/h)	400	50
运行时间 h/y	Operation time (h/y)	8000	小时费用 /元	Cost per hour(CNY)	3100	1385
电价 元/kW·h	Electricity price (CNY/kW·h)	0.8	蒸发吨水费用 /元	Cost per ton water evaporation (CNY)	103.3	46.17
蒸汽价格 元/T	Steam price (rmb/T)	200	小时节约费用 /元	Cost saving per hour (CNY)		1715
冷却水费用 元/T	Cooling water price (rmb/T)	0.1	年节约费用 /万元	Annual cost saving (10000CNY)		1372
			年节约率 %	Annual saving rate		55.32%

备注：MVR系统蒸发吨水电耗约53.3kW，蒸汽17kg，冷却水2.5T。含蒸汽压缩机油冷却、不凝气冷却
Remark: MVR evaporator to evaporate one ton water need 53.3kW electricity, 17kg steam and 2.5ton cooling water





氯化钠、氯化钾废水蒸发结晶（墨西哥项目）— 配乐恒离心式蒸汽压缩机
Albemarel 40,000 metric tons of LiOH production (in Auatralia)

墨西哥项目主要处理氯化钾-氯化钠的混合无机盐溶液，需要将混盐结晶分离。我们通过ASPEN模拟分析及配比溶液模拟实验分析，通过与原水质实验结果对比，得出契合度达到90%的设计数据。设计同时增加三维配管图纸，有效指导了客户的现场安装工作，这成为了本项目一次开车成功的重要技术支撑。

The Mexico project mainly deals with the mixed inorganic salt solution of potassium chloride and sodium chloride, and the mixed salt crystals need to be separated. Through the ASPEN simulation analysis and the proportioning solution simulation experiment analysis, and the comparison with the original water quality experiment results, we have obtained the design data with a 90% fit. The design also added three-dimensional piping drawings, which effectively guided the customer's on-site installation work, which became an important technical support for the successful start-up of this project.

参数介绍 Parameters

蒸发量：12.8T/h	Evaporation capacity: 12.8T/h
物料成分：主要成分为氯化钠、氯化钾	Material composition: Sodium Chloride, potassium chloride
进料浓度：NaCl 17.4%，KCl 12.6%，KCl固体形式2.3%	Inlet concentration: NaCl 17.4%, KCl 12.6%, solids of KCl 2.3%
出料浓度：结晶出混盐	Outlet concentration: mixed salt crystallized
蒸发温度：80°C	Evaporation temperature：80°C
压缩机形式：乐恒增速箱离心式蒸汽压缩机	Compressor type: Leheng Gear Box centrifugal steam compressor
装置布置尺寸：20m x 9.3m x 32m	Unit layout size (L x W x H): 20m x 9.3m x 32m

能耗分析 Energy Consumption

					三效系统 Thriple effect evaporator	MVR系统 MVR Evaporator
进料量 T/h	Feeding capacity (T/h)	19	电耗 kW	Electricity consumption(kw)	240	896
蒸发量 T/h	Evaporation capacity (T/h)	12.8	鲜蒸汽 T/h	Steam consumption (T/h)	5.8	0.75
出料量 T/h	Discharge capacity (T/h)	6.2	冷却水 T/h	Cooling water consumption (T/h)	600	50
运行时间 h/y	Operation time (h/y)	8000	小时费用 /元	Cost per hour(CNY)	1412	871.8
电价 元/kW·h	Electricity price (CNY/kW·h)	0.8	蒸发吨水费用 /元	Cost per ton water evaporation (CNY)	110.3	68.1
蒸汽价格 元/T	Steam price (rmb/T)	200	小时节约费用 /元	Cost saving per hour (CNY)		533.9
冷却水费用 元/T	Cooling water price (rmb/T)	0.1	年节约费用 /万元	Annual cost saving (10000CNY)		427.12
			年节约率 %	Annual saving rate		38.26%

备注：MVR系统蒸发吨水电耗为70KW，蒸汽60kg，冷却水3.5T。含蒸汽压缩机油冷却、不凝气冷却
Remark: MVR evaporator to evaporate one ton water need 70kW electricity, 60kg steam, 3.5ton cooling water.

MVR蒸发浓缩系统类型 MVR EVAPORATION CONCENTRATION SYSTEM

降膜浓缩系统 Falling Film Evaporation

适用范围 Application

适用于中药、食品、化工、轻工等行业的水或有机溶媒溶液（比如乙醇）等的蒸发浓缩。尤其适合多品种、多批次、低粘度溶液的浓缩。

Suitable for the evaporation and concentration of water or organic solvent solution (eg. ethanol) in the industries of traditional Chinese medicine, food, chemical industry and light industry. It is especially suitable for the concentration of multi-variety, multi-batch and low viscosity solution.

工作流程 Main Process

料液是从蒸发器顶部加入，在重力作用下沿管壁呈膜状流下，在此过程中溶剂不断地被蒸发而使溶质增浓，在换热器底部得到其浓缩液。降膜式蒸发器可以蒸发浓度较高的溶液，对粘度较大的物料也适用。但是液膜厚度在换热管内的分布不易均匀，其传热系数较升膜蒸发器小一些。

Main characteristics: material liquid is feeding from the top of evaporator; under the action of gravity, it flows down along the wall of the pipe. In this process, the solvent is continuously evaporated and the solute is thickened, and the concentrate is obtained at the bottom of the heat exchanger.
The falling film evaporator can vaporize the solution with higher concentration, and it is also suitable for the material with larger viscosity. But the thickness of the liquid film is not easy to be evenly distributed in the heat transfer tube, and the heat transfer coefficient is smaller than that of the rising film evaporator.

MVR六级降膜浓缩系统

主要特点 Main Features

- 较短的预加热时间，生蒸汽与产品冷凝水无任何交叉接触。
- 蒸发温度低，可控制在45-55°C，不发泡、不跑料、蒸发效率高。
- 产品浓缩倍数高，收膏量可到450-600kg（以5T蒸发系统为例），高浓度、高粘度的物料可配备刮板薄膜浓缩器。产品在蒸发器内有更短停留时间，根据产量需要，停留时间可以降低至6-10分钟。
- 全自动CIP清洗，缩短CIP清洗时间和清洗液耗量，设备做工精密，做到无残留、无死角。

- Lower evaporation temperature; the lowest evaporation temperature can be controlled at 45-55 deg C, no foaming, no running material, high evaporation efficiency.
- There is no cross contact between the fresh steam and the condensate at the shortest preheating time.
- Final product with higher concentration and less quantity. Eg. 5ton/h evaporation system can get 450kg~600kg final product. If higher concentration and viscosity product required, scraper thin film evaporator can be adopted.The shorter residence time of the product in the evaporator, the minimum residence time can be reduced to 6-10 minutes according to the production needs.
- Automatic CIP cleaning, shorten CIP cleaning time and cleaning liquid consumption, equipment precision, complete without residue, no dead angle.

应用案例 APPLICATION AREAS

中药配方颗粒—配乐恒离心式蒸汽压缩机
Chinese medicine formula granule-leheng centrifugal steam compressor

参数介绍 Parameters

蒸发量：5T/h
物料成分：多品种、多批次中药液
浓度：1-5%
进料比重：1.01，出料比重：1.15
沸点升：1°C
压缩机温升：8°C
蒸发温度：80°C
系统持液量：0.5-1m³
压缩机形式：高速直驱式蒸汽压缩机
装置布置尺寸：10m x 8m x 12m

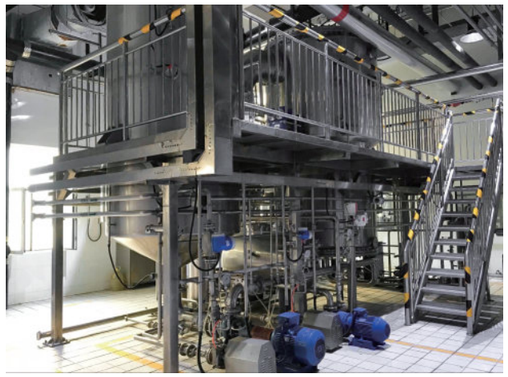
Evaporation capacity：5T/h
Raw material：Multi variety and batch of Chinese herbal medicine
Feeding concentration：1-5%
Feeding relative density：1.01，Discharge relative density：1.15
Boiling point elevation (BPE)：1°C
Centrifugal compressor temperature rise：8°C
Evaporation temperature：80°C
System holdup：0.5-1m³
Compressor type：High speed direct drive compressor
Evaporator system footprint, L*W*H：10*8*12

能耗分析 Energy Consumption

					双效系统 Double effect Evaporator	MVR系统 MVR Evaporator
进料量 T/h	Feeding capacity (T/h)	5.2	电耗 kW	Electricity consumption(kw)	30	136
蒸发量 T/h	Evaporation capacity (T/h)	5	鲜蒸汽 T/h	Steam consumption (T/h)	2.8	0.15
出料量 T/h	Discharge capacity (T/h)	0.2	冷却水 T/h	Cooling water consumption (T/h)	200	30
运行时间 h/y	Operation time (h/y)	8000	小时费用 /元	Cost per hour(CNY)	604	141.8
电价 元/kW·h	Electricity price (CNY/kW·h)	0.8	蒸发吨水费用 /元	Cost per ton water evaporation (CNY)	120.8	28.36
蒸汽价格 元/T	Steam price (CNY/t)	200	小时节约费用 /元	Cost saving per hour (CNY)		462.8
冷却水费用 元/T	Cooling water price (CNY/t)	0.1	年节约费用 /万元	Cost saving per year (10000CNY)		369.8
			年节约率 %	Saving efficiency (%)		76.5%

备注：MVR系统蒸发吨水电耗约28kW，蒸汽30kg，冷却水6T。含蒸汽压缩机油冷却、不凝器冷却。
Remark: MVR evaporator to evaporate one ton water need 28kW electricity, 30kg steam, 6ton cooling water.

MVR蒸发浓缩系统类型 MVR EVAPORATION CONCENTRATION SYSTEM



升膜浓缩系统 Rising Film Evaporation

适用范围 Application

处理蒸发量较大的溶液以及热敏性或易生泡、黏度较大的溶液的蒸发浓缩。对于较浓物料，粘度较大、易结晶或易结垢的物料不适用。系统持液量大，适用于大批量物料的连续处理。

Suitable for processing large amount of evaporation and heat sensitive material or Blister solutions with higher viscosity; The system has large liquid holding capacity and is suitable for continuous treatment of large quantities of materials.

工作流程 Main Process

料液经预热后由蒸发器底部进入，进入加热管内受热沸腾后迅速汽化，生成的蒸汽在加热管内高速上升。溶液被上升的蒸汽所带动，沿管壁成膜状上升，并在此过程中继续蒸发，汽、液混合物在分离器内分离，完成液在分离器底部排出，二次蒸汽则在顶部导出后进入压缩机压缩。

The material feed to evaporator from bottom. After entering the heating pipe, the water is rapidly vaporized and the generated steam rises at a high speed in the heating pipe. The solution is driven by rising steam, rising along the wall of the tube, and evaporating in the process. The mixture of steam and liquid is separated in the separator; the completion liquid is discharged at the bottom of the separator, and the secondary steam flow to the centrifugal compressor.

主要特点 Main Features

- 换热温差小，可达到温和蒸发，不易结焦，适合高粘度、热敏性物料。
- 可蒸发温度较高、粘度较大(0.05-0.45Pa•s)物料，膜状流动，温差损失小。
- 无需蒸汽冷凝器，结构流程简单，可连续运行，安全可靠。
- 较短的停留时间，特殊的结构设计，可以减少污染和细菌的增长。

- Small heat transfer temperature difference, can achieve moderate evaporation, suitable for high
- viscosity and heat sensitive materials.
- Suitable for materials with higher evaporation temperature and higher viscosity (0.05-0.45Pa•s). No need steam condenser, simple structure process; continuous operation, safe and reliable.
- Shorter residence time and special structural design can reduce the growth of pollution and bacteria.

应用案例 APPLICATION AREAS

醇水通用MVR浓缩系统—配乐恒离心式蒸汽压缩机

Ethanol & water dual application MVR concentration system-leheng centrifugal steam compressor

系统类型：MVR降膜浓缩系统
适用范围：适用于乙醇、甲醇提取液的蒸发浓缩

System type: MVR falling film evaporation system
Application: Ethanol, methyl alcohol and water extraction

参数介绍 Parameters

蒸发量：7.5T/h
物料成分：中药提取液
浓度：0.8~2.5%
进料比重：0.8~0.9，1.01；出料比重：1.08~1.2
蒸发温度：水提80°C，醇提65°C
系统持液量：3.5-4.5m^3
压缩机形式：乐恒增速箱离心式蒸汽压缩机
装置布置尺寸：12m x 7m x 15m

Evaporation capacity: 7.5T/h
Material composition: Chinese herb medicine
Concentration: 0.8~2.5%
Inlet relative density: 0.8~0.9, 1.01; Outlet relative density: 1.08~1.2
Evaporation temperature：80°C for water medium，65°C for ethanol
System liquid holdup：3.5-4.5m^3
Compressor type: Leheng centrifugal steam compressor
Unit layout size: L 12m, W 7m, H 15m

能耗分析 Energy Consumption

进料量 T/h	Feeding capacity (T/h)	8
蒸发量 T/h	Evaporation capacity (T/h)	7.5
出料量 T/h	Discharge capacity (T/h)	0.5
运行时间 h/y	Operation time (h/y)	8000
电价 元/kW·h	Electricity price (CNY/kW·h)	0.8
蒸汽价格 元/T	Steam price (CNY/t)	200
冷却水费用 元/T	Cooling water price (CNY/t)	0.1

		三效系统 Thriple effect Evaporator	MVR系统 MVR Evaporator
电耗 kW	Electricity consumption(kw)	50	192
鲜蒸汽 T/h	Steam consumption (T/h)	4.5	0.2
冷却水 T/h	Cooling water consumption (T/h)	367	30
小时费用 /元	Cost per hour(CNY)	976.7	197.4
蒸发吨水费用 /元	Cost per ton water evaporation (CNY)	130.2	26.32
小时节约费用 /元	Cost saving per hour (CNY)		779.3
年节约费用 /万元	Annual cost saving (10000CNY)		623.4
年节约率 %	Annual saving rate		79.8%

备注：MVR系统蒸发吨水电耗约25.7kW，蒸汽30kg，冷却水4T，冷冻水6.3T。
Remark: MVR evaporator to evaporate one ton water need 25.7kW electricity, 30kg steam, 2ton cooling water, and 6.3T chilled water.

低温多级降膜蒸发浓缩系统--配国外压缩机

Low Temperature Multi Stage falling film evaporation concentration system - international compressor brand

适用于单品种、大批量、连续化生产的物料，串级转料，有效降低物料在系统内停留时间，增加产品回收率和产品提炼率。对多糖、二糖类产品，非常适用，系统控温是关键，可有效降低高粘度物料流动性差、易堵管等运行风险。
CIP在线清洗技术可做到对产品清场清洗全自动操作，排污、排凝自动控制。

Suitable for single product, large batch, continuous production, series material transfer, effectively reduce the residence time of materials in the system, which increase product recycling rate and product refining rate. Suitable for polysaccharides and disaccharides product, system temperature control is critical, effectively improve mobility and clog risk for high viscosity material .
The CIP online cleaning technology can achieve automatic operation, automatic control of drainage discharging and condensate discharging.

参数介绍 Parameters

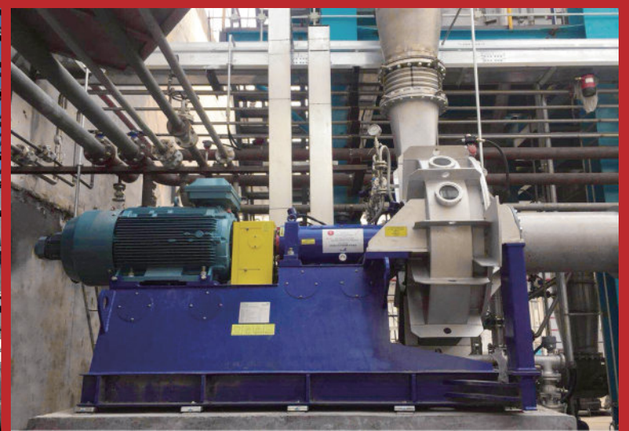
蒸发量：18T/h	Evaporation capacity: 18T/h
物料成分：葵花果胶，含少量硝酸	Material composition: sunflower pectin, with nitric acid
浓度：0.7-1.1%	Concentration: 0.7-1.1%
进料比重：1.01，出料比重：1.15	Inlet relative density: 1.01，outlet relative density: 1.15
蒸发温度：≤60°C	Evaporation temperature：≤60°C
系统持液量：5-6m³	System liquid holdup：5-6m³
压缩机形式：HOWDEN 豪顿离心式压缩机	Compressor type: HOWDEN centrifugal blower
装置布置尺寸：13m x 8m x 20m	Unit layout size: L 13m, W 8m, H 20m

能耗分析 Energy Consumption

进料量 T/h	Feeding capacity (T/h)	21.6
蒸发量 T/h	Evaporation capacity (T/h)	18
出料量 T/h	Discharge capacity (T/h)	3.6
运行时间 h/y	Operation time (h/y)	8000
电价 元/kW·h	Electricity price (CNY/kW·h)	0.8
蒸汽价格 元/T	Steam price (CNY/t)	200
冷却水费用 元/T	Cooling water price (CNY/t)	0.1

		三效系统	MVR系统
		Thriple effect evaporator	MVR Evaporator
电耗 kW	Electricity consumption(kw)	150	460
鲜蒸汽 T/h	Steam consumption (T/h)	5	0.5
冷却水 T/h	Cooling water consumption (T/h)	360	30
小时费用 /元	Cost per hour(CNY)	1156	471
蒸发吨水费用 /元	Cost per ton water evaporation (CNY)	64.22	26.2
小时节约费用 /元	Cost saving per hour (CNY)		685
年节约费用 /万元	Annual cost saving (10000CNY)		548
年节约率 %	Annual saving rate		59.3%

备注：MVR系统蒸发吨水电耗约25.5kW，蒸汽28kg，冷却水2T，含蒸汽压缩机油冷却、不凝器冷却。
Remark: MVR evaporator to evaporate one ton water need 25.5kW electricity, 28kg steam, 2ton cooling water, (include the cooling of steam compressor oil and non-condensable gas)



烟草提取液MVR+TVR浓缩系统—配国外压缩机

MVR + TVR tobacco extract evaporation system - Howden centrifugal steam compressor

参数介绍 Parameters

蒸发量：MVR 4.5T/h; TVR 0.5T/h
物料成分：烟草提取液
进料浓度：6.5-15%
出料浓度：40%-55%
蒸发温度：MVR 53-58°C; TVR 50-54°C
压缩机形式：风机
装置布置尺寸：13.6m x 13m x 17m

Evaporation capacity：MVR 4.5T/h, TVR 0.5T/h
Raw material：Tobacco extract
Feeding concentration：6.5-15%
Output concentration: 40-55%
Evaporation temperature：MVR 53-58°C, TVR 50-54°C
Compressor type：Centrifugal steam blower
Evaporator system footprint (L x W x H)：13.6 x 13 x 17 meter

能耗分析 Energy Consumption

进料量 T/h	Feeding capacity (T/h)	6.3
蒸发量 T/h	Evaporation capacity (T/h)	5
出料量 T/h	Discharge capacity (T/h)	1.3
运行时间 h/y	Operation time (h/y)	8000
电价 元/kW·h	Electricity price (CNY/kW·h)	0.8
蒸汽价格 元/T	Steam price (CNY/t)	200
冷却水费用 元/T	Cooling water price (CNY/t)	0.1

		三效系统	MVR系统
		Thriple effect evaporator	MVR Evaporator
电耗 kW	Electricity consumption(kw)	40	150
鲜蒸汽 T/h	Steam consumption (T/h)	3.2	0.36 （含TVR蒸汽消耗）
冷却水 T/h	Cooling water consumption (T/h)	251	39
小时费用 /元	Cost per hour(CNY)	697.1	195.9
蒸发吨水费用 /元	Cost per ton water evaporation (CNY)	139.42	39.18
小时节约费用 /元	Cost saving per hour (CNY)		501.2
年节约费用 /万元	Annual cost saving (10000CNY)		400.96
年节约率 %	Annual saving rate		71.9%

备注：MVR系统蒸发吨水电耗约30kW，蒸汽72kg，冷却水7.8T。含蒸汽压缩机油冷却、不凝器冷却。

Remark: MVR evaporator to evaporate one ton water need 30kW electricity 72kg steam and 7.8ton cooling water (include the cooling of steam compressor oil and non-condensable gas)

乐恒撬装模块化中药MVR蒸发系统 LEHENG MODULAR DESIGN MVR EVAPORATOR

传统的MVR蒸发系统占地空间大、安装施工工程量大、安装周期长，对于企业扩产需要暂停现有生产线，或是对于现场安装周期以及人工成本比较敏感的企业来说，缩短现场安装施工周期可以显著降低经济成本。

基于此，乐恒从客户角度出发，凭借自身的研发能力，从工艺系统、结构设计、自动化控制等各个方面入手，研发出撬装模块化MVR蒸发系统。

The installation of traditional MVR evaporator need a large footprint, lots of on-site work and long installation period, which means the clients who are sensitive to the on-site installation period and on-site manpower will greatly benifit from the shorter installation period.

Therefor, based on our powerful RD ability, Leheng developed the new modular MVR evaporation sytem.

撬装模块化MVR蒸发系统优点 Features of Modular MVR Evaporator

- 模块化设计，工厂预装，缩短现场安装周期
- 图纸设计标准化，项目工程设计周期大大缩短
- 采购批量化，方便运行维修
- 工艺流程、设备选型进一步优化
- 选用高速同步滚动轴承直驱电机双级蒸汽压缩机，更节能
- 三维建模，实现设计、施工、操作人员可视化

- Modular design, factory pre-installed, shorten the on-site installation cycle
- Standardized design, the project engineering design cycle is greatly shortened
- Procurement in batches, convenient for operation and maintenance
- Process flow and equipment selection are further optimized
- Use high-speed direct drive double-stage steam compressor, more energy saving
- 3D modeling to realize the visualization of design, construction and operation

传统多效蒸发结晶系统 TRADITIONAL MULTI EFFECT EVAPORATION CRYSTALLIZATION SYSTEM

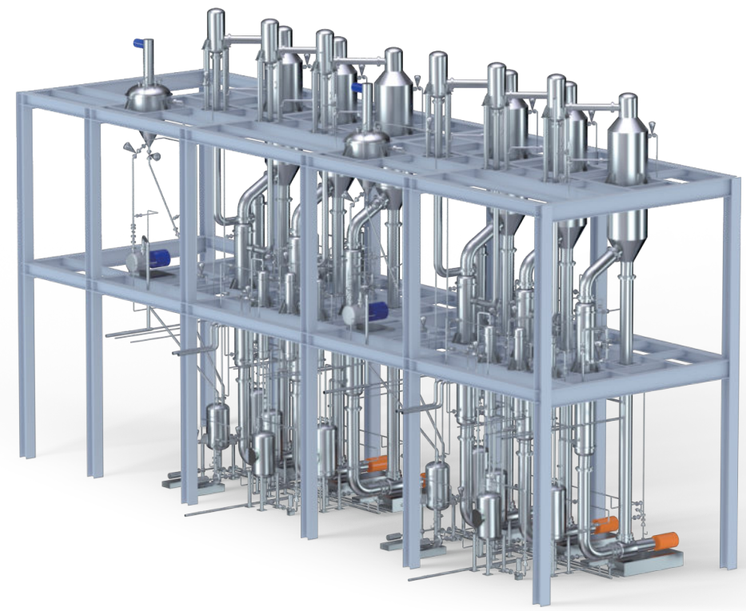
- 适用于蒸汽余热充足且相对价格低廉的客户，配套使用多效系统处理
- 适用于盐水溶液沸点升较高的物料（例如烧碱、CaCl2等）
- 适用于废水种类较多，水质物性差别较大且需要分别处理的物料
- 根据实际情况调整工艺路线，采用不同多效蒸发工艺（顺流、并流、逆流、错流等）

- Suitable for customers with sufficient steam, and the steam with relatively low price;
- Suitable for high salt materials with higher boiling point (such as caustic soda, CaCl2, etc.)
- Suitable for materials with many kinds of waste water and large difference in physical property and need to be treated separately;
- According to the actual conditions, the process route is adjusted, and different multi effect evaporation processes are adopted

参数介绍 Parameters

物料成分：氯化钠废水溶液
浓度：氯化钠8-10%
三效蒸发量：5T/h
沸点升：12°C
结晶出盐量：0.5T/h
离心机形式：卧式螺旋离心机
装置布置尺寸：26m x 7m x 18m
（2套）

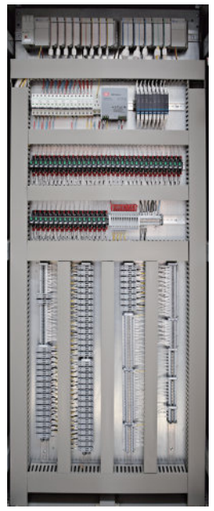
Raw material: Sodium chloride waste water
Concentration: 8~10%
Three effect evaporation capacity: 5tons/h
Boiling point elevation: 12°C
Crystallization salt output: 0.5tons/h
Centrifuge type: horizontal screw decanter centrifuge
System overall dimensions, L*W*H: 26*7*18 (2sets)



自控系统集成化设计 INTEGRATED DESIGN OF AUTOMATIC CONTROL

MVR控制程序选用PLC控制系统，采用西门子S7-1500控制器和罗克韦尔CompactLogix系列控制器，经过多年应用，我们这两种系列控制器的编程和现场调试积累了丰富的经验，具有程序开发周期短，系统稳定性强等优势。与罗克韦尔公司合作开发了新的一健启停全自动无人化控制程序，全面的借鉴了罗克韦尔公司成熟的控制理念，具有更加人性化，更安全，功能更加全面等优势。同时这两种品牌控制器，都配备以太网通讯接口，便于与其他控制系统进行通讯以及数据采集。

MVR control program using PLC control system, adopts SIEMENS S7-1500 controller and Rockwell Compact Logix series controller. After years of application, we have accumulated rich experience in the programming and field debugging of the two series of controllers. It has the advantages of short program development cycle, strong system stability and so on.In collaboration with Rockwell, we have developed the latest start-up and shutdown fully automatic control program, which is fully used for reference by Rockwell's mature control concept, which is more humane, safer and more comprehensive.At the same time, these two brand controller, all equipped with Ethernet communication interface, easy to communicate with other control systems and data acquisition.

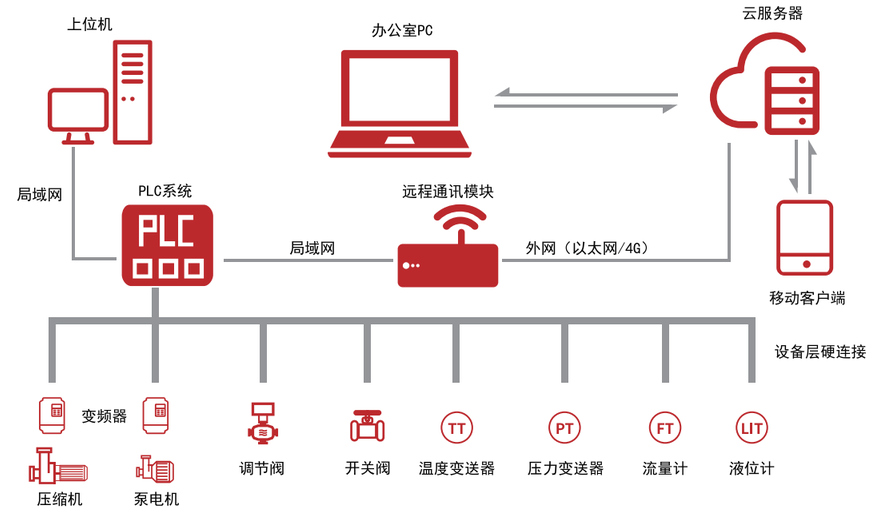


乐恒云服务 Leheng cloud service

MVR蒸发器自控系统采用西门子S7-300/S7-1500PLC，经过长期的经验积累与完善，已经拥有一套自主开发的、适合MVR蒸发器特点的、功能完善的PLC控制程序。程序中通过各种连锁控制及保护机制，保证安全稳定的运行。并且每套MVR控制系统都有远程传输模块，可以将MVR运行数据上传到云服务器。客户可以使用办公室电脑或手机APP随时查看设备运行数据及状态，还可以实现远程程序上下载功能。这样为客户对设备的管理及维护提供很大方便。

The MVR evaporator automatic control system adopts Siemens S7-300/S7-1500PLC. After long-term experience accumulation and improvement, Leheng has a set of self-developed PLC control program suitable for MVR evaporator. The program ensures safe and stable operation through various interlocking control and protection mechanisms. And each MVR control system has a remote transmission module, which can upload MVR operation data to the cloud server. Users can use the office computer or mobile app to view the device's operating data and status at any time, and also enable remote program upload and download. This provides great convenience for the management and maintenance of the system.

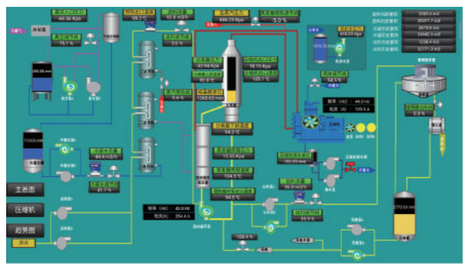
乐恒云服务示意图 Leheng cloud service diagram



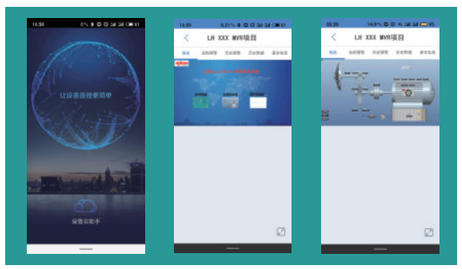
乐恒云服务优点 Features of Leheng cloud service

- 客户不必专门去上位机查看运行数据，可以使用办公室电脑或手机APP随时查看设备运行数据及状态。
- 设备运行过程中有故障且找不到原因所在，乐恒工程师可以通过云服务画面监控的数据快速分析出故障原因。
- 压缩机重要保护有报警功能，做到乐恒工程师及时发现问题，并快速处理问题。
- 实现远程上下载PLC程序功能，乐恒工程师可以根据客户需求及时修改和维护程序，保证其系统长期稳定运行。

- You can access the operation data with PC or mobile phone any where and any time.
- If there is a fault in the operation of the equipment, leheng engineers can quickly analyze the cause of the fault through the data monitored by the cloud service.
- Alarm function: both of the users and Leheng engineers will receive the operation alarm of the compressor.
- By upload and download PLC programs remotely, Leheng engineers can modify and maintain the program according to the requirements of the user to ensure the stable operation of the system.



上位机/PC端远程界面



手机app远程访问云服务

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