乐事敬业　创新惟恒

PLEASURE DEDICATION　CONSTANT INNOVATION

河北乐恒节能设备有限公司

HeBei LeHeng Energy Saving Equipment Co.,LTD.

地址：河北省大厂潮白河工业园区工业二路东首

Add : 1st Industial Road East, Chaobai River Industrial Zone,DaChang,Hebei Province

电话TEL :0316-7788168

传真FAX : 0316-7788178

网址Web :www .lhequip.cn

邮箱E-mail: sales@lhequip.cn

邮编P.C : 065300

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

引领节能蒸发系统的崭新未来

LEADING ENERGY-SAVING
EVAPORATION SYSTEM
IN THE NEW FUTURE

公司简介 COMPANY PROFILE

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、安装调试的国家级高新技术企业。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10000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，并联合国内蒸发结晶方面的技术权威，打造了一支优秀的技术团队，为客户提供最优化的系统解决方案。公司将继续发扬锐意进取、努力创新的创业精神，为中国先进装备行业的进步贡献力量。

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, 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 10000 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.

我们的团队 OUR TEAM







乐事敬业、创新惟恒 PLEASURE DEDICATION CONSTANT INNOVATION

售前 Pre-sales

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 During sales

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 sales service

提供及时、全面的设备保养、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,in-spection service and trouble shooting service,Stock spare parts for fast delivery,to satisfy the urgent needs from clients.

MVR—节能设备的首选

PRIME CHOICE OF ENERGY SAVING EQUIPMENT

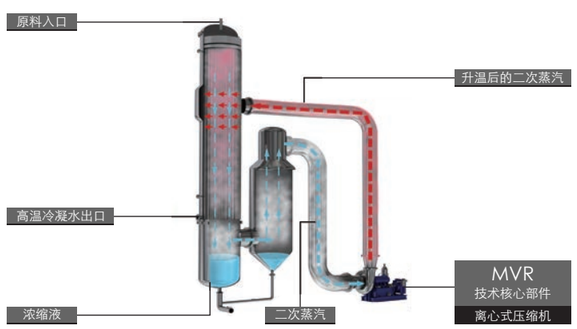
- MVR是机械式蒸汽再压缩技术（mechanical vapor recompression ）的简称，是利用蒸发系统自身产生的二次蒸汽及其能量，将低品位的蒸汽经压缩机的机械做功提升为高品位的蒸汽热源。如此循环向蒸发系统提供热能，从而减少对外界能源需求的一项高效节能技术。

- 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.

◈ 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天然的优势，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



◈ 应用领域 Application Fields

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

海水淡化、真空制盐

Desalination of sea water
and vacuum salt making

饮料工业

The beverage industry

食品、添加剂

Food and additives

制药及保健品行业

Pharmaceutical and
health products industry

医药中间体及高盐化工废水处理行业

High salt chemical
wastewater treatment

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.








◈ 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

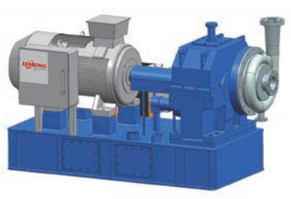
- 高速直驱式压缩机由电机直接驱动，无需增速箱进行增速，不仅具有增速箱式压缩机的特点，而且结构更为简洁、维护更为方便同时使用寿命也大大提高。

- 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.

◈ 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.



▲ 增速箱离心式蒸汽压缩机

▼ 高速直驱离心蒸汽式压缩机

▲ 增速箱离心式蒸汽压缩机

▼ 高速直驱离心蒸汽式压缩机

MVR蒸发浓缩系统类型
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.

◈ 主要特点 Main Features

- 最短的预加热时间，生蒸汽与产品冷凝水无任何交叉接触。
- 蒸发温度低，最低控制在45-55℃，不发泡、不跑料、蒸发效率高。
- 产品浓缩倍数高，最低收膏量可到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，最小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，完全做到无残留、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.

▲ MVR六级降膜浓缩系统

◈ 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 Evaporation capacity：5T/h
物料成分：多品种、多批次中药液 Raw material：Multi variety and batch of Chinese herbal medicine
浓度：1-5% Feeding concentration：1-5%
进料密度：1.01g/L，出料密度：1.15g/L Feeding density：1.01g/L，Discharge density：1.15g/L
沸点升：1℃ Boiling point elevation (BPE)：1℃
压缩机温升：8℃ Centrifugal compressor temperature rise：8℃
蒸发温度：80℃ Evaporation temperature：80℃
系统持液量：0.5-1m³ System holdup：0.5-1m³
压缩机形式：高速直驱式蒸汽压缩机 Compressor type：High speed direct drive compressor
装置布置尺寸：长10米，宽8米，高12米 Evaporator system footprint, L*W*H：10*8*12 meter

能耗分析 Energy Consumption

进料量 T/h Feeding capacity (T/h)	5.2	运行时间 h/y Operation time (h/y)	8000
蒸发量 T/h Evaporation capacity (T/h)	5	电价 元/kW · h Electricity price (CNY/kW · h)	0.8
出料量 T/h Discharge capacity (T/h)	0.2	蒸汽价格 元/T Operation time (h/y)	200
		冷却水费用 元/T Operation time (h/y)	0.1

	双效系统 Double effect evaporator	MVR系统 MVR Evaporator
电耗 kW Electricity consumption(kw)	30	136
鲜蒸汽 T/h Steam consumption (T/h)	2.8	0.15
冷却水 T/h Cooling water consumption (T/h)	200	30
小时费用 /元 Cost per hour(CNY)	604	141.8
蒸发吨水费用 /元 Cost per ton water evaporation (CNY)	120.8	28.36
小时节约费用 /元 Cost saving per hour (CNY)	462.8	
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、不凝气冷却
Remark: MVR evaporator to evaporate one ton water need 28kW electricity, 30kg steam and 6ton cooling water

MVR蒸发浓缩系统类型
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

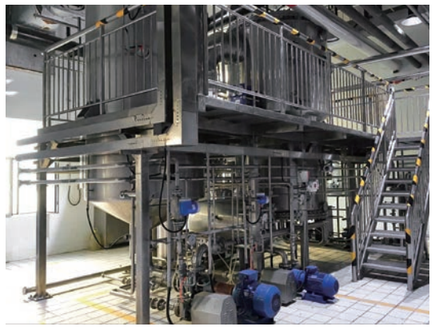
- 料液经预热后由蒸发器底部进入，进入加热管内受热沸腾后迅速汽化，生成的蒸汽在加热管内高速上升。溶液被上升的蒸汽所带动，沿管壁成膜状上升，并在此过程中继续蒸发，汽、液混合物在分离器内分离，完成液在分离器底部排出，二次蒸汽则在顶部导出后进入压缩机压缩。

- 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

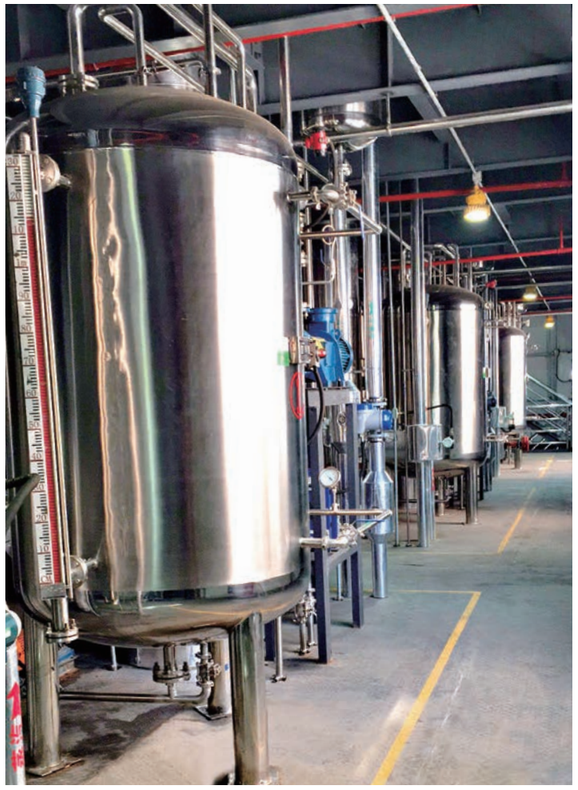
- 换热温差小，可达到温和蒸发，不易结焦，适合高粘度、热敏性物料。
- 可蒸发温度较高、粘度较大(0.05-0.45Pa•s)物料，膜状流动，温差损失小。
- 无需蒸汽冷凝器，结构流程简单，可连续运行，安全可靠。
- 较短的停留时间，特殊的结构设计，可以减少污染和细菌的增长。

- 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

乙醇浓缩系统—配乐恒离心式蒸汽压缩机
Ethanol concentration system–leheng centrifugal steam compressor



参数介绍 Parameters
蒸发量：7T/h Evaporation capacity: 7tons/h
物料成分：30-85%乙醇提取小叶榕溶液 Raw material: 30~85% Extracting solution of Ficus microleaf by ethanol
浓度：1% Concentration: 1%
进料密度：0.85-0.9g/L，出料密度：1.05g/L Feeding density：0.85-0.9g/L，Discharge density：1.05g/L
沸点升：2℃ Boiling point elevation(BPE): 2℃
压缩机温升：10℃ Compressor temperature rise: 10℃
蒸发温度：80℃ Evaporation temperature: 80℃
系统持液量：3~4m³ System holding liquid capacity: 3~4m3
压缩机形式：离心式蒸汽压缩机 Compressor type: Centrifugal steam compressor
装置布置尺寸：长12米，宽8米，高9米 System overall dimension, L*W*H: 12*8*9meter

能耗分析 Energy Consumption

进料量 T/h Feeding capacity (T/h)	7.5	运行时间 h/y Operation time (h/y)	8000
蒸发量 T/h Evaporation capacity (T/h)	7	电价 元/kW · h Electricity price (CNY/kW · h)	0.8
出料量 T/h Discharge capacity (T/h)	0.5	蒸汽价格 元/T Operation time (h/y)	200
		冷却水费用 元/T Operation time (h/y)	0.1
	双效系统 Double effect evaporator		MVR系统 MVR Evaporator
电耗 kW Electricity consumption(kw)	50		193
鲜蒸汽 T/h Steam consumption (T/h)	4		0.1
冷却水 T/h Cooling water consumption (T/h)	350		50
小时费用 /元 Cost per hour(CNY)	875		179.4
蒸发吨水费用 /元 Cost per ton water evaporation (CNY)	125		25.63
小时节约费用 /元 Cost saving per hour (CNY)	695.6		
年节约费用 /万元 Cost saving per year (10000CNY)	556.5		
年节约率 % Saving efficiency (%)	79.5%		

备注：MVR系统蒸发吨水电耗约27.5kW，蒸汽1.5kg，冷却水8T。含蒸汽压缩机油冷却、不凝气冷却
Remark: MVR evaporator to evaporate one ton water need 30kW electricity, 35kg steam and 8ton cooling water

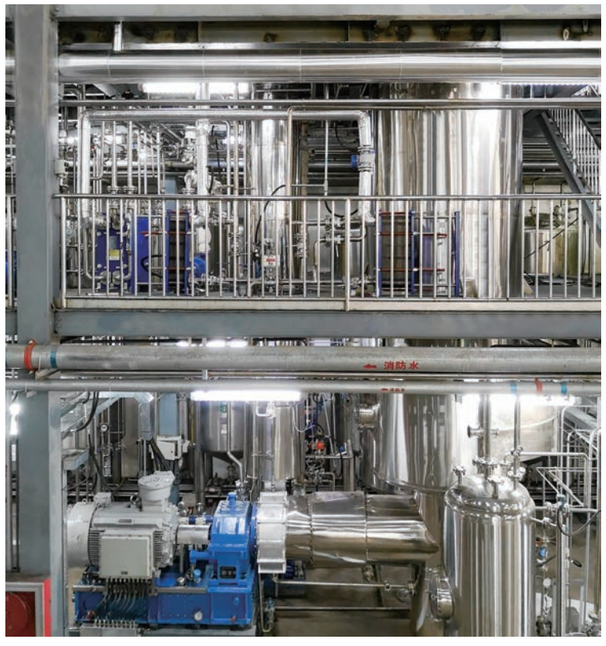
◈ 应用案例 Application Areas

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：适用于乙醇提取液的蒸发浓缩

- System Type: MVR falling film evaporation system
- Application: Ethanol and water dual application



参数介绍 Parameters

蒸发量：7.5T/h Evaporation capacity: 7.5T/h
物料成分：中药提取液 Material composition: Chinese herb medicine
浓度：0.8~2.5% Concentration: 0.8~2.5%
进料密度：0.8~0.9g/L，1.01g/L；出料密度：1.08~1.2g/L Inlet density: 0.8~0.9g/L，1.01g/L；，outlet density: 1.08~1.2g/L
蒸发温度：水提80℃，醇提65℃ Evaporation temperature：80℃ for water medium，65℃ for ethanol
系统持液量：3.5-4.5m³ System liquid holdup：3.5-4.5m³
压缩机形式：乐恒增速箱离心式蒸汽压缩机 Compressor type: Ledheng centrifugal steam compressor
装置布置尺寸：长12米，宽7米，高15米 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	运行时间 h/y Operation time (h/y)	8000
蒸发量 T/h Evaporation capacity (T/h)	7.5	电价 元/kW · h Electricity price (CNY/kW · h)	0.8
出料量 T/h Discharge capacity (T/h)	0.5	蒸汽价格 元/T Operation time (h/y)	200
		冷却水费用 元/T Operation time (h/y)	0.1

	双效系统 Double effect evaporator	MVR系统 MVR Evaporator
电耗 kW Electricity consumption(kw)	50	193
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
冷冻水T/h Chilled water consumption (T/h)	70	47
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 Cost saving per year (10000CNY)	623.4	
年节约率 % Saving efficiency (%)	79.8%	

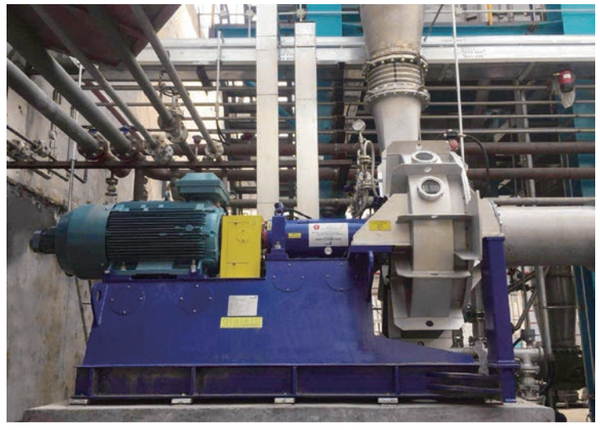
备注：MVR系统蒸发吨水电耗约25.7kW，蒸汽30kg，冷却水4T，冷冻水6.3T。
Remark: MVR evaporator to evaporate one ton water need 25.7kW electricity, 30kg steam, 2ton cooling wafer, and 6.3T chilled water.

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%
进料密度：1.01g/L，出料密度：1.15g/L Inlet density: 1.01g/L，outlet density: 1.15g/L
蒸发温度：≤60℃ Evaporation temperature：≤60℃
系统持液量：5-6m³ System liquid holdup：5-6m³
压缩机形式：HOWDEN 豪顿 涡轮压缩机 Compressor type: HOWDEN turbocompressor
装置布置尺寸：长13米，宽8米，高20米 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	运行时间 h/y Operation time (h/y)	8000
蒸发量 T/h Evaporation capacity (T/h)	18	电价 元/kW · h Electricity price (CNY/kW · h)	0.8
出料量 T/h Discharge capacity (T/h)	3.6	蒸汽价格 元/T Operation time (h/y)	200
		冷却水费用 元/T Operation time (h/y)	0.1

	五效系统 Five effect evaporator	MVR系统 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 Cost saving per year (10000CNY)	548	
年节约率 % Saving efficiency (%)	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、不凝气冷却。
Remark: MVR evaporator to evaporate one ton water need 25.5kW electricity 28kg steam and 2ton cooling water (include the cooling of steam compressor oil and non-condensable gas)

MVR蒸发结晶系统
MVR EVAPORATION CRYSTALLIZATION SYSTEM

- 蒸发结晶被用于清洁分离技术，在一些废水处理中被认为是最通用的技术。
- Evaporation crystallization is used for clean separation technology and is considered as the most suitable technology in some wastewater treatment.

◈ 系统特点　System Features

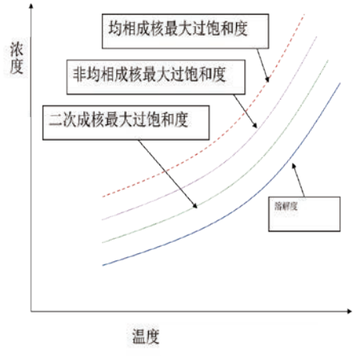
- 应用范围广，传热系数大，易清洗，抗结垢，结晶颗粒大等。
- Wide range of applications, large heat transfer coefficient, easy to clean, anti-scaling, large crystalline particles, and so on.

◈ 适用范围　Application

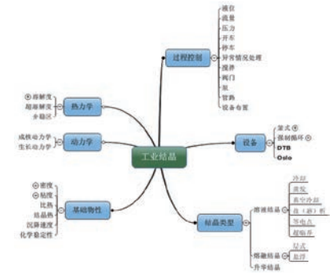
- 真空制盐、井矿盐、盐硝分离等传统制盐行业。
- 适用于化工、化药厂等高盐、高COD、高沸点升等生产废水及医药中间体高盐废水处理。
- 锂电池正极材料及三元前驱体新材料的蒸发结晶锂电池回收提锂及零排放。
- 配套膜反应器、生物处理工艺、化学处理工艺等，实现化工废水、生物污水等的“零排放”和固废的回收利用。
- Vacuum salt production technology, brine well salt making, mineral salt separation of traditional salt industry.
- Suitable for the production wastewater 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

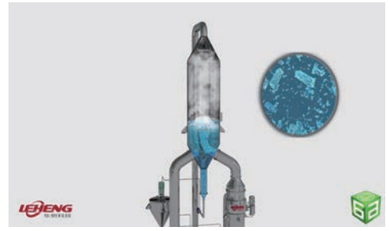
- 蒸发结晶系统在涉及传热和蒸发等单元操作的基础上，还要重点考虑结晶的化工过程。
- On the basis of heat transfer and evaporation, the evaporation crystallization process should also consider chemical process.
- 根据不同水质的物性特点，结合小试检测的基础物性，通过分析结晶过程热力学和动力学与产品粒度之间的理论关系，采用最合适的工艺设计流程和最优的设备选型。
- According to the physical characteristics of different 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.



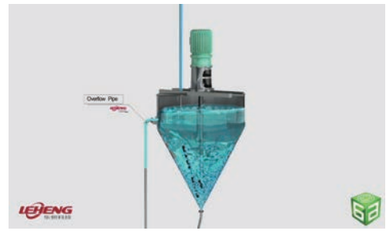
- 根据不同物系各自的溶解度及介稳区数据记录，精确分析结晶操作过程中最佳浓度范围，确定蒸发器结构尺寸及循环泵选型。
- According to the solubility of different materials and the data of the metastable zone, the optimum concentration range of the crystallization process is analyzed, and the structure size of the evaporator and the type selection of the circulating pump are determined.



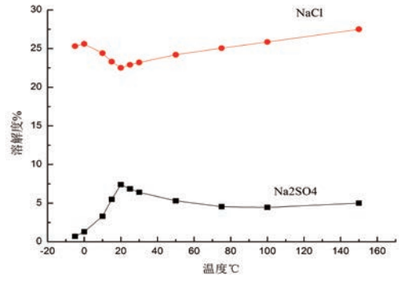
- 在结晶操作过程中，通过结晶热力学和动力学理论衡算，控制晶体成核及生长速率、温度、浓度等工艺参数，控制晶体粒径大小，为结晶器选型提供依据。
- In the process of crystallization operation, through crystallizing thermodynamics and kinetics theory balance, we control crystal processing parameters such as nucleation and growth rate, temperature and concentration, control crystal size and provide basis for mould selection.

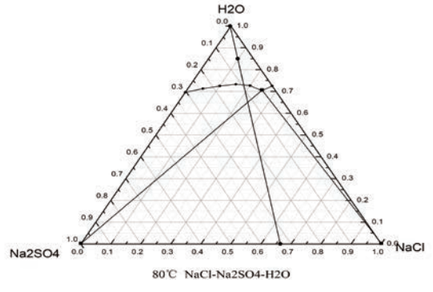


- 可连续蒸发结晶，严格控制晶体粒度，便于离心分离；对于无机盐产品，可做到粒径均匀、产品回收率高。后续配套离心机、干燥、吨装包装等。
- Can achieve continuously evaporation crystallization, strictly control crystal size and facilitate centrifugal separation; for inorganic salt products, the grain size is uniform and the yield of the product is high. Follow up the centrifuge, 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.





MVR蒸发结晶系统
MVR EVAPORATION CRYSTALLIZATION SYSTEM

◈ 应用案例 Application Areas

化工废水处理—配乐恒离心式蒸汽压缩机
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.

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 standard discharge

▲ 硫酸钠废水蒸发结晶系统

▼ 氯化钠废水蒸发结晶系统

参数介绍 Parameters

蒸发量：40T/h Evaporation capacity: 40tons/h
物料成分：染料行业硫酸铵废水 Raw material: Ammonium sulfate wastewater in from dye and dyeing industry
浓度：20-25% Concentration: 20~25%
沸点升：12℃ Boiling point elevation(BPE): 12℃
一效压缩温升：15℃，二效压缩温升20℃ 1st effect compressor temperature rise: 15℃,2nd effect compressor temperature rise: 20℃
蒸发温度：85℃ Evaporation temperature: 85℃
结晶出盐量：14T/h Crystallization salt output: 14tons/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：长25米，宽20米，高30米 System overall dimension, L*W*H: 25*20*30meter

能耗分析 Energy Consumption

进料量 T/h Feeding capacity (T/h)	54	运行时间 h/y Operation time (h/y)	8000
蒸发量 T/h Evaporation capacity (T/h)	40	电价 元/kW · h Electricity price (CNY/kW · h)	0.8
出料量 T/h Discharge capacity (T/h)	14	蒸汽价格 元/T Operation time (h/y)	200
		冷却水费用 元/T Operation time (h/y)	0.1

	三效系统 Three effect evaporator	MVR系统 MVR Evaporator
电耗 kW Electricity consumption(kw)	1200	2100
鲜蒸汽 T/h Steam consumption (T/h)	20	1.6
冷却水 T/h Cooling water consumption (T/h)	1350	100
小时费用 /元 Cost per hour(CNY)	5095	2010
蒸发吨水费用 /元 Cost per ton water evaporation (CNY)	127.4	50.25
小时节约费用 /元 Cost saving per hour (CNY)	3085	
年节约费用 /万元 Cost saving per year (10000CNY)	2468	
年节约率 % Saving efficiency (%)	60.55%	

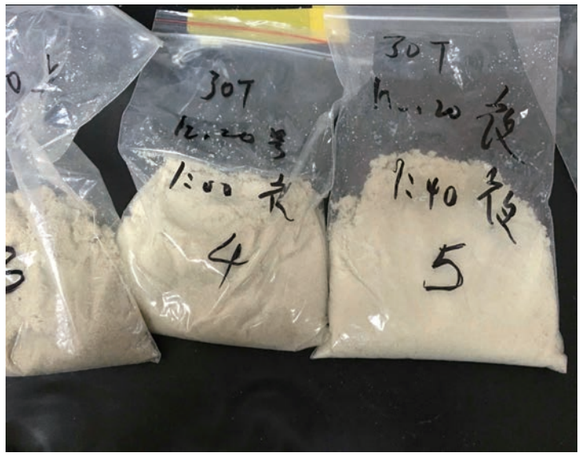
备注：MVR系统蒸发吨水电耗约52.5kW，蒸汽40kg，冷却水2.5T。含蒸汽压缩机油冷却、不凝气冷却
Remark: MVR evaporator to evaporate one ton water need 52.5kW electricity, 40kg steam and 2.5ton cooling water

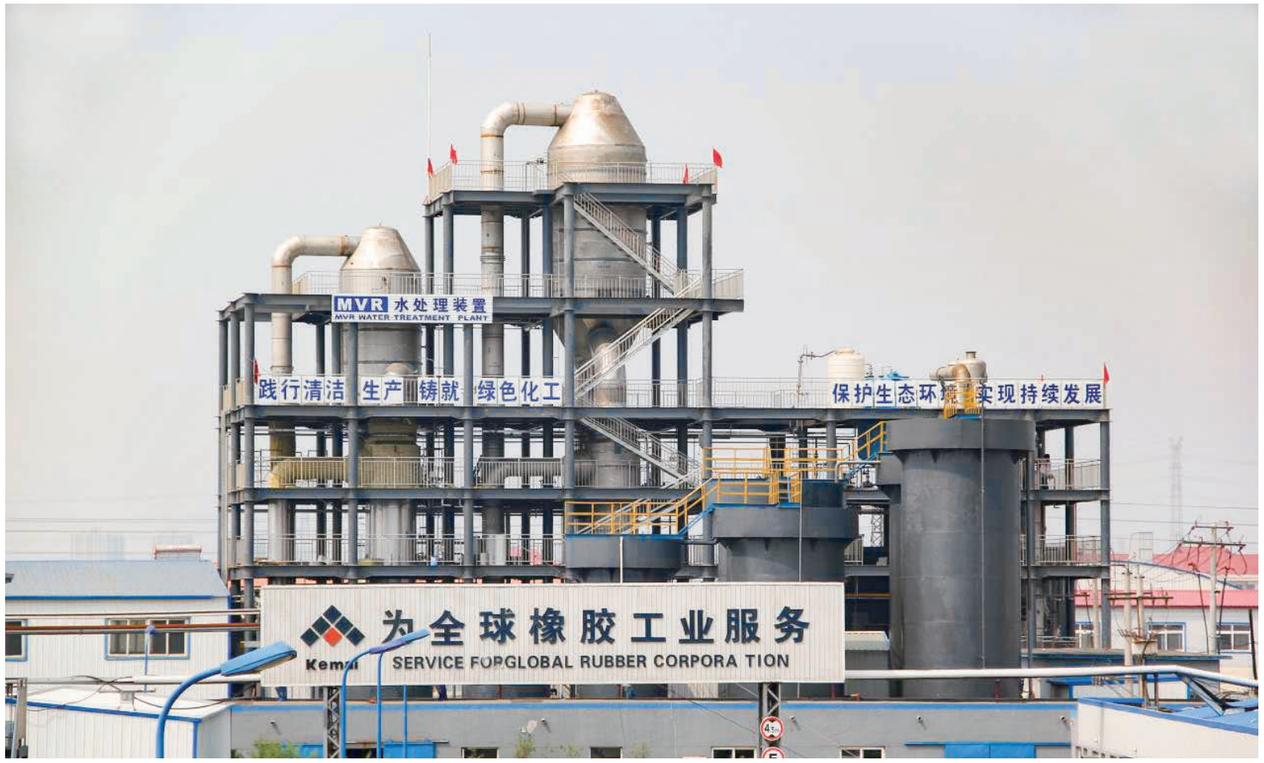
◈ 应用案例 Application Areas

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℃，二效12℃ Boiling point elevation(BPE): 1st effect 7℃, 2nd effect 11℃
一效压缩温升：15℃，二效压缩温升19℃ 1st effect compressor temperature rise: 15℃,2nd effect compressor temperature rise: 19℃
蒸发温度：80℃ Evaporation temperature: 80℃
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：长24米，宽13.5米 System overall dimension, LxW: 24 x 13.5 meter

能耗分析 Energy Consumption

进料量 T/h Feeding capacity (T/h)	35	运行时间 h/y Operation time (h/y)	8000
蒸发量 T/h Evaporation capacity (T/h)	30	电价 元/kW · h Electricity price (CNY/kW · h)	0.8
出料量 T/h Discharge capacity (T/h)	5	蒸汽价格 元/T Operation time (h/y)	200
		冷却水费用 元/T Operation time (h/y)	0.1

	三效系统 Three effect evaporator	MVR系统 MVR Evaporator
电耗 kW Electricity consumption(kw)	450	1600
鲜蒸汽 T/h Steam consumption (T/h)	13.5	0.5
冷却水 T/h Cooling water consumption (T/h)	400	50
小时费用 /元 Cost per hour(CNY)	3100	1385
蒸发吨水费用 /元 Cost per ton water evaporation (CNY)	103.3	46.17
小时节约费用 /元 Cost saving per hour (CNY)	1715	
年节约费用 /万元 Cost saving per year (10000CNY)	1372	
年节约率 % Saving efficiency (%)	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

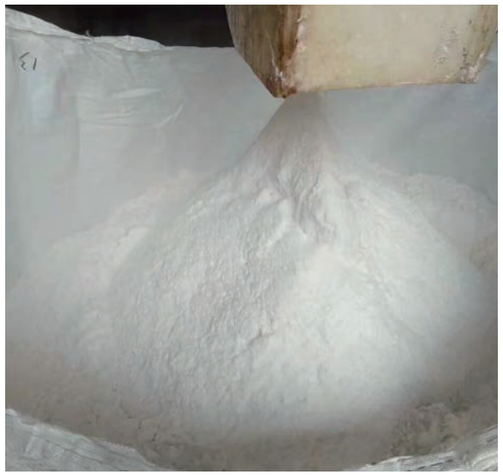
◈ 应用案例 Application Areas

萃取液、碳酸锂、氢氧化锂–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，对锂电池碳酸锂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 lithium carbonate 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
浓度：氯化锂0.9%，氯化钠12.5%
MVR蒸发量：25T/h
沸点升：8℃
压缩温升：16℃
浓度：氯化锂1.8%，氯化钠25%
双效蒸发量20T/h
沸点升：20℃
结晶出盐量：7.5T/h
离心机形式：双级活塞推料离心机
装置布置尺寸：长30米，宽15米，高25米

Raw material: lithium chloride and Sodium chloride mixture solutions
Concentration: LiCl-0.9%; NaCl-12.5%
MVR evaporation capacity: 25T/h
Boiling Point Elevation: 8℃
Compressor temperature rise: 16℃
Concentration: LiCl-1.8%; NaCl-25%
Double effect evaporation capacity: 20T/h
Boiling Point Elevation: 20℃
Salt output: 7.5tons/h
Centrifuge type: Double drum piston pusher centrifuge
System overall dimension, L*W*H: 30*15*25meter

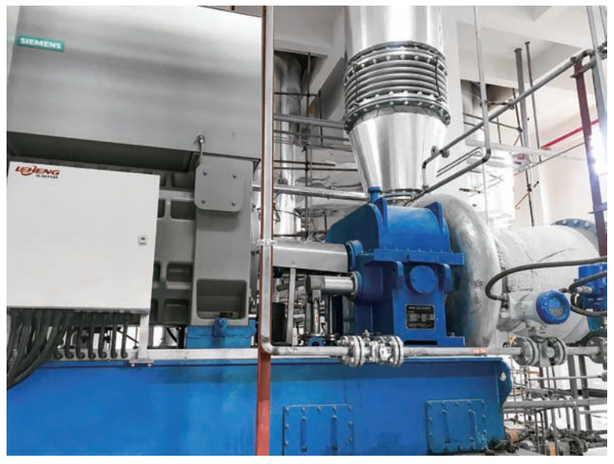
◈ 应用案例 Application Areas

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、材质选型等具有非常成熟的工艺经验，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 Material 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℃ Boiling point rise：12-14℃			
压缩机温升：20℃ Compressor temperature rise：20℃			
蒸发温度：85℃ Evaporation temperature：85℃			
压缩机形式：乐恒增速箱离心式蒸汽压缩机 Compressor type: Ledheng centrifugal steam compressor			
装置布置尺寸：长42米，宽20米，高27米 Unit layout size (L x W x H): 42m x 20m x 27m			

能耗分析 Energy Consumption

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

	三效系统 Triple effect evaporator	MVR系统 MVR Evaporator
电耗 kW Electricity consumption(kw)	500	1430
鲜蒸汽 T/h Steam consumption (T/h)	13.2	2.5
冷却水 T/h Cooling water consumption (T/h)	1400	200
小时费用 /元 Cost per hour(CNY)	3180	1374
蒸发吨水费用 /元 Cost per ton water evaporation (CNY)	96.4	41.6
小时节约费用 /元 Cost saving per hour (CNY)	1806	
年节约费用 /万元 Cost saving per year (10000CNY)	1444	
年节约率 % Saving efficiency (%)	56.79%	

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

新能源电池原材料粗品氢氧化锂蒸发结晶—配乐恒离心式蒸汽压缩机
Crude lithium hydroxide evaporation crystallizer for lithium battery

项目信息 / Project Information

- 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: One of the top three raw material suppliers in the lithium industry
- Location: Australia
- Certification: ASME, API
- Standard: Australia & America

行业经验 / Industry Experience

随着新能源汽车爆发式增长，单水氢氧化锂成为锂电池正极材料高镍电池发展的主流。乐恒对MVR蒸发结晶连续性生产水合氢氧化锂的系统积累了丰富的经验，对设备选型，出盐指标等都有着成熟的工艺，可以确保氢氧化锂晶体颗粒大小（DT50）保证在0.65~0.8mm范围内，结晶颗粒均匀度≥95%，同时可以确保冷凝水中锂含量≤20ppm。

With the explosive growth of new energy vehicles, lithium hydroxide monohydrate has become the mainstream of the development of lithium source as cathode material for lithium batteries. Leheng has accumulated rich experience in MVR evaporative crystallization continuous production system of lithium hydroxide hydrate. It has mature technology in equipment selection and salt output index. It can ensure that the size of lithium hydroxide crystal particles (DT50) is within the range of 0.65-0.8 mm, the uniformity of crystalline particles is more than 95%, and the lithium content in condensate water is less than 20 ppm.

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 solution
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℃ Evaporation temperature：85℃
压缩机形式：乐恒增速箱离心式蒸汽压缩机 Compressor type: Ledheng centrifugal steam compressor
装置布置尺寸 (L x W x H)：13mx12.5mx38m Unit layout size (L x W x H): 13m x 12.5m x 38m

能耗分析 Energy Consumption

进料量 T/h Feeding capacity (T/h)	60	运行时间 h/y Operation time (h/y)	8000
蒸发量 T/h Evaporation capacity (T/h)	25	电价 元/kW · h Electricity price (CNY/kW · h)	0.8
出料量 T/h Discharge capacity (T/h)	35	蒸汽价格 元/T Operation time (h/y)	200
		冷却水费用 元/T Operation time (h/y)	0.1

	三效系统 Thriple effect evaporator	MVR系统 MVR Evaporator
电耗 kW Electricity consumption(kw)	350	1154.4
鲜蒸汽 T/h Steam consumption (T/h)	11.2	2.5
冷却水 T/h Cooling water consumption (T/h)	800	60
小时费用 /元 Cost per hour(CNY)	2600	1429.5
蒸发吨水费用 /元 Cost per ton water evaporation (CNY)	104	57.18
小时节约费用 /元 Cost saving per hour (CNY)	1170.48	
年节约费用 /万元 Cost saving per year (10000CNY)	936.38	
年节约率 % Saving efficiency (%)	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. (include the cooling of steam compressor oil and non-condensable gas)

新能源原材料精品氢氧化锂蒸发结晶—配乐恒离心式蒸汽压缩机
Fine lithium hydroxide evaporation crystallizer for lithium battery

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℃ Evaporation temperature：85℃
压缩机形式：乐恒增速箱离心式蒸汽压缩机 Compressor type: Ledheng centrifugal steam compressor
装置布置尺寸：12.65mx12.5mx35m Unit layout size (L x W x H): 12.65m x 12.5m x 35m

能耗分析 Energy Consumption

进料量 T/h Feeding capacity (T/h)	36	运行时间 h/y Operation time (h/y)	8000
蒸发量 T/h Evaporation capacity (T/h)	15	电价 元/kW · h Electricity price (CNY/kW · h)	0.8
出料量 T/h Discharge capacity (T/h)	21	蒸汽价格 元/T Operation time (h/y)	200
		冷却水费用 元/T Operation time (h/y)	0.1

	三效系统 Thriple effect evaporator	MVR系统 MVR Evaporator
电耗 kW Electricity consumption(kw)	230	781.4
鲜蒸汽 T/h Steam consumption (T/h)	8	0.75
冷却水 T/h Cooling water consumption (T/h)	700	50
小时费用 /元 Cost per hour(CNY)	1854	780.12
蒸发吨水费用 /元 Cost per ton water evaporation (CNY)	123.6	52
小时节约费用 /元 Cost saving per hour (CNY)	1073.9	
年节约费用 /万元 Cost saving per year (10000CNY)	859.1	
年节约率 % Saving efficiency (%)	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, 3.3ton cooling water. (include the cooling of steam compressor oil and non-condensable gas)

应用案例 Application Areas

新能源原材料硫酸钠蒸发结晶—配乐恒离心式蒸汽压缩机
Sodium sulfate evaporation crystallizer for lithium industry

- 描述：随着锂电池行业的发展，三元前驱体行业持续升温在蒸发浓缩硫酸钠方面积累了丰富的经验，对设备选型、材质选型等具有非常成熟的工艺经验。

参数介绍 Parameters

蒸发量：15T/h Evaporation capacity: 15T/h
物料成分：主要成分为硫酸钠，含有氧化钙杂质 Material composition: Sodium sulfate solution
进料浓度：硫酸钠：336g/L Inlet concentration: 336g/L
出料浓度：硫酸钠饱和浓度 Outlet concentration: Saturated concentration of sodium sulfate
蒸发温度：85℃ Evaporation temperature：85℃
压缩机形式：乐恒增速箱离心式蒸汽压缩机 Compressor type: Ledheng centrifugal steam compressor
装置布置尺寸：10.3mx10mx32m Unit layout size (L x W x H): 10.3m x 10m x 32m

能耗分析 Energy Consumption

进料量 T/h Feeding capacity (T/h)	30	运行时间 h/y Operation time (h/y)	8000
蒸发量 T/h Evaporation capacity (T/h)	15	电价 元/kW · h Electricity price (CNY/kW · h)	0.8
出料量 T/h Discharge capacity (T/h)	15	蒸汽价格 元/T Operation time (h/y)	200
		冷却水费用 元/T Operation time (h/y)	0.1

	三效系统 Thriple effect evaporator	MVR系统 MVR Evaporator
电耗 kW Electricity consumption(kw)	230	710
鲜蒸汽 T/h Steam consumption (T/h)	6	1
冷却水 T/h Cooling water consumption (T/h)	300	50
小时费用 /元 Cost per hour(CNY)	1414	773
蒸发吨水费用 /元 Cost per ton water evaporation (CNY)	94.27	51.53
小时节约费用 /元 Cost saving per hour (CNY)	641	
年节约费用 /万元 Cost saving per year (10000CNY)	512.8	
年节约率 % Saving efficiency (%)	45.33%	

备注：MVR系统蒸发吨水电耗约47.3kW，蒸汽66.7kg，冷却水3.33T。
Remark: MVR evaporator to evaporate one ton water need 47.3kW electricity, 66.7kg steam, 3.33ton cooling water.

新能源原材料硫酸锂蒸发结晶—配乐恒离心式蒸汽压缩机
Lithium sulfate evaporation crystallizer for lithium battery industry

- 描述：随着锂电池行业的发展，三元前驱体行业持续升温在蒸发浓缩硫酸锂方面积累了丰富的经验，对设备选型、材质选型等具有非常成熟的工艺经验。

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℃ Evaporation temperature：85℃
压缩机形式：乐恒增速箱离心式蒸汽压缩机 Compressor type: Ledheng centrifugal steam compressor
装置布置尺寸：7.5mx10mx26m 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	运行时间 h/y Operation time (h/y)	8000
蒸发量 T/h Evaporation capacity (T/h)	8	电价 元/kW · h Electricity price (CNY/kW · h)	0.8
出料量 T/h Discharge capacity (T/h)	30	蒸汽价格 元/T Operation time (h/y)	200
		冷却水费用 元/T Operation time (h/y)	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 Cost saving per year (10000CNY)	295.2	
年节约率 % Saving efficiency (%)	45.64%	

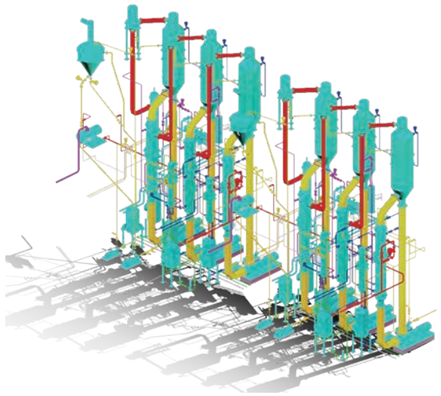
备注：MVR系统蒸发吨水电耗约52.5kW，蒸汽63kg，冷却水2T。含蒸汽压缩机油冷却、不凝器冷却
Remark: MVR evaporator to evaporate one ton water need 52.5kW electricity, 63kg steam, 2ton cooling water.

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	Raw material: Sodium chloride waste water
浓度：氯化钠8-10%	Concentration: 8~10%
三效蒸发量：5T/h	Three effect evaporation capacity: 5tons/h
沸点升：12℃	Boiling point elevation: 12℃
结晶出盐量：0.5T/h	Crystallization salt output: 0.5tons/h
离心机形式：卧式螺旋离心机	Centrifuge type: horizontal screw decanter centrifuge
装置布置尺寸：长26米，宽7米，高18米（2套）	System overall dimensions, L*W*H: 26*7*18 (2sets)

◈ 应用案例 Application Areas

烟草提取液MVR+TVR浓缩系统—配进口离心式蒸汽压缩机

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 Evaporation capacity：MVR 4.5T/h, TVR 0.5T/h
物料成分：烟草提取液 Raw material：Tovacco extract
进料浓度：6.5-15%% Feeding concentration：6.5-15%
出料浓度：40%-55% Output concentration: 40-55%
蒸发温度：MVR 53-58℃; TVR 50-54℃ Evaporation temperature：MVR 53-58℃, TVR 50-54℃
压缩机形式：风机 Compressor type：Centrifugal steam blower
装置布置尺寸：长13.6米，宽13米，高17米 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	运行时间 h/y Operation time (h/y)	8000
蒸发量 T/h Evaporation capacity (T/h)	5	电价 元/kW · h Electricity price (CNY/kW · h)	0.8
出料量 T/h Discharge capacity (T/h)	1.3	蒸汽价格 元/T Operation time (h/y)	200
		冷却水费用 元/T Operation time (h/y)	0.1

	双效系统 Double effect evaporator	MVR系统 MVR Evaporator
电耗 kW Electricity consumption(kw)	40	150
鲜蒸汽 T/h Steam consumption (T/h)	3.2	0.36
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 Cost saving per year (10000CNY)	400.96	
年节约率 % Saving efficiency (%)	71.9%	

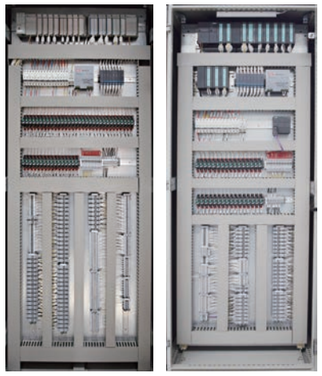
备注：MVR系统蒸发吨水电耗约30kW，蒸汽72kg，冷却水7.8T。
含蒸汽压缩机油冷却、不凝气冷却。

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

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

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最新的一件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.

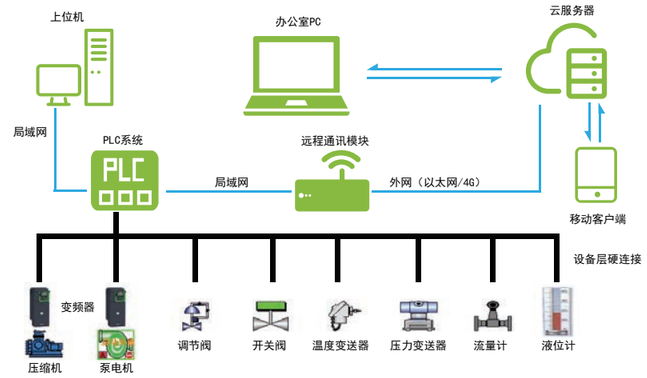


乐恒云服务
LEHENG CLOUD SERVICE

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.

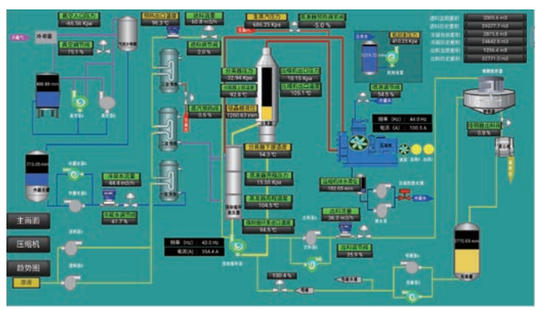
乐恒云服务示意图
LEHENG CLOUD SERVICE DIAGRAM



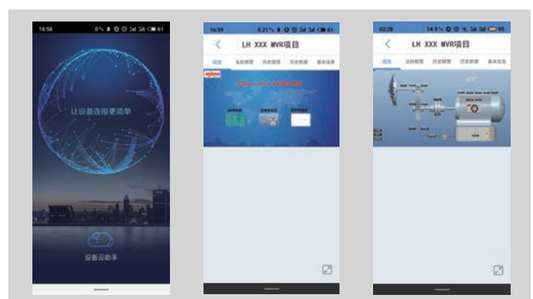
乐恒云服务优点
FEATURES OF LEHENG CLOUD SERVICE

- 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

合作伙伴 COOPERATION PARTNERS

制药行业(中药浓缩)

Production industry
(Chinese medicine concentration)

国际市场

International market

- SLAM SUBMANEE CO.,LTD
- UTC Aerospace Systems
- USTYURT SODIUM SULFATE LLC
- JABIL
- Wood
- LNH Engineering Works
- PT ELANG KURNIASAKTI
- Albemarle Lithium Pty Ltd.
- TOWN IN TOWN GROUP

锂电池回收及生产 / 新能源电池

Recovery and production of Lithium battery material

青海恒信融锂业科技有限公司 Qinghai Hxin Lithium Tech Ltd
格林美
金源 JINYUAN
ALBEMARLE
Hcone 合纵锂业
骆驼股份 CAMEL GROUP
贵州安达科技能源股份有限公司
鑫达新能源
珠海市科立鑫金属材料有限公司 ZHUHAI KELIXIN METAL MATERIALS CO.,LTD
CATL 宁德时代 (宜宾天宜)

医药中间体 / 化工行业

Rhamaceutical intermediates / chemical industry