Dais Analytic Corporation
11552 Prosperous Drive
Odessa, FL 33556

NanoClear™水处理技术

Frequently Asked Questions

常见问题解答

April 2018

What are the key benefits of NanoClear?
使用 NanoClear 的核心优势是什么？

NanoClear 技术

- Cleans water to "parts per billion" level of quality, which is 100 times cleaner than the US EPA drinking water standard
  将水净化至"十亿分之几"洁净水平，超出美国环保署（EPA）饮用水标准 100 倍
- Salts and metals do not pass through the membrane
  盐和金属不能通过膜，有效分离
- Thrives in harsh environments that tend to be beyond the capabilities of RO systems and other conventional technologies
  RO 系统和其他传统技术处理不了的恶劣水质和情况下仍能处理
- Can achieve recovery rates up to 99%, significantly reducing the amount of concentrated effluent
  回收率可达 99%，大幅降低浓水排量
- Handles highly concentrated wastewater without significant increase in energy consumption
  在不显著增加能量消耗的前提下能处理高浓度废水
- Operates at low pressures with corrosion resistant plastic hardware instead of the high pressure stainless steel required by RO, which reduces capital expenditures
  系统设备使用耐腐蚀塑料，无需 RO 系统中的耐高压不锈钢设备，降低部分投资成本
- Requires simple pretreatment (TSS filtration to 20 µm and pH adjustment for maximum output)
  只需简单的预处理（TSS 经过 20 µm 级别的过滤以及调节 PH 值使系统产出最大化）
- Has relatively low maintenance requirements, which reduces operating costs
  维护需求相对较低，降低运行成本

What is the highest total dissolved solids (TDS) and chemical oxygen demand (COD) concentration that NanoClear can reliably treat?
NanoClear 能够的 TDS 和 COD 最高浓度是多少？

NanoClear can handle salt water with concentrations up to 250,000 mg/L. The highest COD concentration that we have tackled is about 50,000 mg/L, but we see no reason why that value cannot be pushed higher.

NanoClear 可处理浓度高达 250000 mg/L 的盐水。能处理的 COD 最高浓度为 50000 毫克/升，且可承受 COD 极限浓度预计能更高。

What happens to the contaminants in the wastewater as it is processed?
在系统运行的时候，污水中的污染物发生了什么？

Salt and other contaminants do not pass through the membrane and are discharged from the system as part of the concentrated effluent. Depending on the recovery rate, the volume of the concentrated effluent is significantly smaller than the initial wastewater volume. It can either be dumped or sent to a post-processing step, such as a crystallizer or an evaporation pond.

盐类和其他污染物无法穿过膜材料，将与浓缩后的浓水一起排出系统。取决于回收率，浓水体积大幅小于初始废水量。它可以被既有方式处理或进入到后续处理工序，如结晶器或蒸发池。

How does NanoClear treat chemical oxygen demand (COD)?
NanoClear 如何处理化学需氧量（COD）？

NanoClear works by evaporating water molecules through the Aqualyte membrane to be condensed into ultra-clean product water, while contaminants are concentrated in the water that remains behind. Most of the chemicals that contribute to COD do not pass through the membrane and are concentrated as the water volume decreases. However, some organic molecules that are similar to water in size, polarity, and volatility may transfer through the membrane at a measurable rate, producing a nonzero COD in the product water. For more information on COD, please refer to the external document titled “Chemical Oxygen Demand FAQ”.

NanoClear 技术的工作原理是通过 Aqualyte 膜来蒸发水分子，将其冷凝成超洁净的产水，而污染物则集中在浓水中。 大部分有助于化学需氧量的化学物质不会通过膜，而是随着水体积减少而浓缩。 但是，一些与水分子大小，极性和挥发性类似的有机分子可能会以可测量的速率通过膜而转移，从而产水为非零 COD。 有关 COD 的更多信息，请参阅标题为《化学需氧量常见问题解答》文件。

What are the pretreatment and maintenance requirements?
预处理和维护有哪些要求？

NanoClear requires that the incoming wastewater be filtered to remove any solids larger than 20 µm. If the pH of the wastewater is too acidic or too alkaline, then it should be adjusted to be between 2-11 for optimal performance.

If the performance begins to degrade over time, Dais recommends performing a one-hour citric acid flush to remove any contaminants from the evaporator and rejuvenate the performance. If citric acid is unavailable, please contact Dais for alternatives.

NanoClear 要求先过滤废水去除>20µm 的固体。如果废水的 pH 值太酸或过于碱性，则应将其调整至 2-11 之间以获得最佳性能。

如果性能随着时间的推移开始下降，Dais 建议进行时长一小时的柠檬酸冲洗以去除膜蒸发器中的任何污染物并恢复其性能。 如果柠檬酸不可用，请联系 Dais 寻求其他替代品。

How does NanoClear resist fouling and bio-fouling?
NanoClear 是如何耐结垢和生物污染的？

Dais's patented Aqualyte membrane has a surface structure and internal chemistry that is specially engineered to help resist fouling. The membrane itself is non-porous, so there are no pores for contaminants to get stuck and/or become permanently lodged. The hydrophobic nature of the membrane creates an exclusion zone at the surface, which helps to prevent the material from fouling. Any foulants that do make it to the surface find it difficult to attach to the membrane and are easily swept away in cross-flow. The smooth surface and acidic environment make it difficult for bio-organisms to grow on the membrane, thereby making it resistant to biofouling.

Dais 公司的专利 Aqualyte 高分子纳米膜具有表面结构和内部化学特性，此独特的设计用于防止结垢。 膜本身是无孔的，所以不存在污染物堵塞和/或永久滞留。 膜的疏水特性在表面形成了一个排除区，这有助于防止材料结垢。任何使其到达表面的污染物难以附着到膜上，并且容易在横向流动中被冲走。光滑的表面和酸性环境使得生物有机体难以在膜上生长，从而使其不易生物污损。

What is the target market for NanoClear?
NanoClear 的目标市场是哪些？

NanoClear can handle a wide variety of wastewater types, including very high concentrations of salt water and extremely dirty industrial wastewater. Ideally, we would target a project where a source of waste heat is readily available to minimize the cost of heating the wastewater. Because NanoClear can push the boundary of existing concentration limits, we are targeting facilities that are looking to further increase their recovery rate and reduce the volume of concentrated effluent. Companies that are looking to reduce their wastewater treatment costs and simplify their processes should consider NanoClear, as it can often replace multi-stage filtration processes with a single process.

NanoClear 可以处理各种类型的废水，如高浓度盐水和极脏的工业废水。 理想情况下，最契合的应用是可以容易获得废热的项目，以最小化加热废水的热源成本。由于 NanoClear 可以提高现有浓度限制的极限，我们的目标是希望进一步提高其回收率并减少浓水，减量化。希望降低废水处理成本并简化工艺的公司可以考虑使用 NanoClear，因为它通常可以用一个工艺代替多级膜过滤工艺。

What conventional technologies can NanoClear replace?
NanoClear 可以替代哪些常规技术？

NanoClear can significantly simplify existing industrial wastewater treatment processes by replacing a multiple stage process with a single process. For example, a plant that uses two UF stages and two RO stages to process highly concentrated brine can be replaced by NanoClear, which can reduce the maintenance costs and improve the recovery rate.

NanoClear 可以通过用单一工艺代替多级膜工艺来显著地简化现有的工业废水处理。 例如，使用两级超滤和 RO 双膜法处理高浓度盐水的工厂就可以用 NanoClear 技术来替代，一步到位，可以降低维护成本并提高回收率。

How does NanoClear compare to reverse osmosis (RO) and ultrafiltration (UF) in terms of cost and efficacy?
相比于 RO 和超滤系统，NanoClear 的表现如何？

NanoClear produces water whose Total Dissolved Solids (TDS) level typically measures < 10 mg/L and can often reach 1 mg/L or better with a single pass through the system, even when the input water exceeds seawater salinity. Single-pass seawater reverse osmosis (SWRO) systems typically produce water whose TDS is in the 100 – 400 mg/L range, one to two orders of magnitude higher than NanoClear. Ultrafiltration membranes are not capable of reducing the TDS of their feed-water; instead, they reduce the Total Suspended Solids (TSS) levels.

即使污水侧的盐分高于海水，NanoClear 也可以仅利用一道工序将产出水的 TDS 控制在< 10 mg/L, 而更多的时候甚至可以处理到 1 mg/L 或更低的水平。单工序海水反渗透系统（SWRO）一般的产出水水质的 TDS 在 100 – 400 mg/L, 比 NanoClear 高出一到两个数量级。超滤膜无法降低给水中的 TDS，只能降低 TSS。

NanoClear and RO systems cannot be compared on a component-by-component basis due to differences in the modules and pre-treatment requirements.
鉴于 NanoClear 和 RO 系统在模块和预处理需求中的不同点，我们无法将两个工艺一个组件一个组件的对比。

How does NanoClear compare to Mechanical Vapor Recompression (MVR) in terms of cost and efficacy?
NanoClear 与机械蒸汽再压缩（MVR）在成本和功效方面的比较如何？

Mechanical Vapor Recompression uses a vapor compressor to superheat the vapor and then transfers that heat through a heat exchanger to boil the incoming wastewater. It efficiently reuses the heat of vaporization so that it doesn't require a constant external source of heat. MVR does not use membranes of any type, so fouling management requires careful maintenance of a wastewater film covering the heat transfer surfaces to avoid local "dry" spots where the solids concentration is higher than the rest of the solution.

MVR has an electrical energy consumption of 30 – 50 kWh/m^3 of distillate and can typically produce water with TDS less than 50 mg/L. Compared to NanoClear, MVR uses significantly more electrical energy (up to 10x), but the thermal energy component is incorporated into its electrical usage. If waste heat is available, then NanoClear will ultimately have a lower energy consumption than MVR.

MVR 使用蒸汽压缩机过热蒸汽，然后通过热交换器将热量转移至沸腾废水。它有效地重复使用汽化热，因此不需要恒定的外部热源。 MVR 不使用任何类型的膜，因此结垢管理需要仔细的维护覆盖传热表面的废水膜，以避免固体浓度高于溶液其余部分的局部“干”点。MVR 的电能消耗为 30-50 千瓦时/立方米的馏分，通常其产水的 TDS<小于 50mg/L。与 NanoClear 相比，MVR 需要明显更多的电能（高达 10 倍），但热能组件被纳入其电气使用。如果有余热，那么 NanoClear 最终的能耗将低于 MVR。

What is the average list price per ton of NanoClear at the module and system level?
在模块和系统级别下 NanoClear 平均每吨产出水的标价是多少？

The NanoClear Membrane Evaporator modules are available in modular form, with different capacities offered for the customer to select, and the pricing per ton varies with the different module capacities. The list price of a module varies from $27,178 - $30,000 for 1 ton/hr (6,341 gal/day) of evaporator capacity, with the lower cost being more representative of what would be expected in a larger application.

NanoClear 是以模块为单位，根据不同处理量进行选择， 且每吨水的价格随着模块处理量的不同而彼岸花。蒸发量为 1 ton/hr 的模块价格从$27,178 - $30,000 不等，我们预计在更大型的应用中，更低的价格将更具代表性。

The cost of the entire system is not something we can currently estimate in a format reasonable for a FAQ section. The type of system (e.g. air-cooled vs. water-cooled condenser, other choices) has a large impact on the costs, as do the size of the installation and the type of water being treated.

当下我们还没有办法将一整个系统的造价作为一个合适的样板来放在 FAQ 的文件当中。系统的种类（例如风冷和水冷的冷凝器，或者其他选择）将对造价有很大的影响，安装尺寸和需处理的水样种类也是如此。

What is the average energy used by NanoClear per cubic meter of water produced, and how does this compare to reverse osmosis?
NanoClear 处理每方产水的平均能耗为多少，相对于 RO 表现如何？

NanoClear uses approximately 4 - 5 kWh/m^3 of electrical energy and approximately 670 - 700 kWh/m^3 of thermal energy, typically from waste heat sources. Reverse osmosis claims 3 – 8 kWh/m^3 of electrical usage.

NanoClear 需要约 4-5 kWh/m³ 电能和从废热来的约 670 - 700 kWh/m³ 的热能，RO 一般称其需要 3 – 8 kWh/m³ 的电能需求。

Are there any NanoClear pilot projects?
有没有试点项目？

Dais currently has 15 pilot units in the U.S. and throughout China that are being used to treat wastewater from various markets.

The Dais East pilot site is located in Florida and has been operating since June 2013. It is currently used to treat municipal wastewater.

The Shanghai wastewater treatment device was commissioned in December 2017 and has been used to demonstrate the NanoClear technology to prospective customers. Some of the wastewater samples that it has treated include salt production brine, coal chemical waste, lithium battery waste, petrochemical wastewater, and desulphurization wastewater.

Dais 目前在美国和中国有 15 个试点应用，处理来自不同行业工业废水。
Dais East 试点位于美国佛罗里达，自 2013 年 6 月起投入运营。目前它用于处理城市污水。上海污水测试设备于 2017 年 12 月投入使用，并可用于向潜在客户展示 NanoClear 技术。 其已经处理和测试废水包括：制盐卤水，煤化工废水，锂电池废液，石化废水和脱硫废水等。

What are the typical operating temperature ranges for NanoClear?
NanoClear 的工作温度区间是多少？

The flux rate in the NanoClear system increases with temperature for the wastewater stream. Standard operating temperatures for the wastewater stream range from 50°C to 70°C.

在 NanoClear 系统中，污水侧的温度升高会使通量增加。推荐的污水侧额定温度区间在 50°C 到 70°C.

The flux rate in the NanoClear system increases with decreasing temperature for the condensation system. Standard operating temperatures for the condensation system range from 4°C to 23°C.

NanoClear 系统的通量会随着冷凝系统温度的降低而升高。推荐的冷凝系统工作温度区间在 4°C to 23°C.

While the temperatures affect the rate at which water is produced for a given amount of membrane, they do not significantly change the total energy required to produce a given amount of water.

因为在膜材料一定的条件下，温度是决定产水量的因素，所以出产一定量的水，总的能耗不会很大程度上改变。

How much waste heat is required to allow NanoClear to operate at peak efficiency?
峰值情况下，使用 NanoClear 工艺需要的废热得要多少？

The amount of waste heat required is based on the heat of evaporation that must be supplied to the wastewater to replace the heat carried away from the membrane with vapor. That same amount of heat must be removed from the condenser to return the vapor to a liquid state. The "M3 Customer Estimator" software tool is available to customers and will provide the exact amount of heat required for a project. On average, NanoClear requires approximately 670 – 700 kWh of thermal energy for every cubic meter of water produced. For more details on wastewater heating, please refer to the external document titled "Wastewater Heating Summary".

所需废热是基于蒸发热量，蒸发热量带动废水以取代膜蒸发带走的热量。冷凝器带走对等的热量，将水汽冷凝到液体状态。通过《M3 膜组模拟测算软件》计算，客户能计算出实际项目所需的废热耗量。NanoClear 平均每方产水需要约 670-700kWh 的热能。有关废水能耗的更多详情，请参阅标题为《废水加热能耗》文件。

What size should the condenser be?
冷凝器的选型？

The condenser should be sized based on the cooling required by the vapor as it becomes liquid. Dais will provide an estimator program that calculates this cooling requirement in kilowatts (kW). If this program is not available to the user, Dais or its authorized sales reps can provide the estimate to the customer. Specific details of how the condenser operates, how it is sized, and the materials used are the responsibility of the customer, specifically the engineer responsible for design of the balance of plant. The saturation temperature of the vapor inside the condenser should be communicated to Dais so that all sizing calculations are based on the correct design point.

冷凝器的选型取决于将蒸汽冷凝成液体所需的冷量。Dais 将会提供一个计算程序来计算所需的冷量，以 KW 计。如果这个程序不提供给用户使用，则 Dais 或其授权的经销商会提供这些计算结果给客户。至于冷凝器运行的具体细节，面积多大，用什么材料，则取决于客户，特别是取决于负责设计调节平衡系统的工程师。冷凝器中蒸汽的饱和温度需要和 Dais 进行沟通，来保证所有的型号计算基于正确的设计点。

What vacuum pump is recommended? 推荐那种真空泵？

The exact vacuum pump specifications are the responsibility of the customer and the system design engineer. Dais recommends the following capabilities for the vacuum pump:
具体的真空泵选型取决于客户和系统设计工程师，Dais 推荐一下特性：

- Ultimate vacuum should be < 1 kPa (7.5 Torr) absolute for best operation of the condenser.

为保证冷凝器的最佳运行状态极限真空度应< 1 kPa (7.5 Torr)

- For an ME305 evaporator, a minimum pumping speed of 15 m^3/hr (8.8 CFM) measured at 2 kPa (15 Torr) is recommended.
  对于一个 ME305 来说，推荐在 2 kPa (15 Torr) 最小泵速在 15 m^3/hr (8.8 CFM)

- If multiple evaporators are evacuated by the same vacuum pump, the recommended pumping speed is additive. Three ME305 modules would imply a pump with greater than 45 m^3/hr (26.4 CFM) pumping speed.
  如果多个膜蒸发器共用一个真空泵，那么真空泵的泵速应该是递增的，三个 ME305 模块所需的泵速则需要> 45 m^3/hr (26.4 CFM).

- The pump should be capable of handling water vapor in the exhaust, which typically requires a gas ballast valve to prevent condensation.
  真空泵应该能够处理排出的水蒸气，所以一般情况下需要一个气镇装置来防止冷凝。

How much membrane is available in a single evaporator?
单个膜蒸发器中的有效膜面积是多少？

Each ME305 membrane evaporator exposes 33.75 m^2 (363.3 ft^2) of membrane surface for transfer.
每个 ME305 膜蒸发器中的有效传递面积为 33.75 m^2 (363.3 ft^2)。

What are the connections to the membrane evaporator?
膜蒸发器连接管道？

The connections to the membrane evaporator are female threads that can be specified as either English or metric threads. The English connections are 3/8'' and 1'' NPT. The metric connections are DN10 and DN25 BSPT.

与薄膜蒸发器的连接是内螺纹，可以用英制或公制螺纹。 英制管道连接是 3/8 英寸和 1 英寸 NPT。 公制连接是 DN10 和 DN25 BSPT。

What is the warranty offered for NanoClear media?
NanoClear 的保质期？

NanoClear modules come with a one-year warranty against defects in materials and workmanship and a limited two-year performance warranty.
NanoClear 模块在材料和工艺缺陷方面有一年的保质期，运行保证期限为两年。

Dais Analytic Corporation
11552 Prosperous Drive
Odessa, FL 33556

What kind of technical support can Dais provide?
Dais 可以提供哪些技术支持？

Upon purchase of a membrane evaporator, Dais will provide an instruction manual that details the unpackaging, installation, operation parameters and instructions, shutdown procedures, maintenance instructions, and troubleshooting steps.

Dais also provides a complimentary version of the "M3 Customer Estimator", which is an Excel-based program that allows the user to enter various inputs regarding their system and it calculates how many evaporators are required for that project. It also sizes the equipment for the balance of plant (BOP), which includes heat exchangers, condensers, and vacuum pumps, and it will determine how much thermal heat is needed to maintain the wastewater temperature during operation.

For a one-time fee, Dais will also provide a professional tech-support design package. This package includes a BOP design guide to help size and select the various components needed for a complete system, and an installation guide with BOP plumbing recommendations to get the most out of your NanoClear system.

采购膜蒸发器后，Dais 将提供详细的《拆包安装操作使用说明》以及《运行关机维护和排障手册》。

Dais 还将提供免费版本的《M3 模拟测算软件》，这是一个基于 Excel 的程序，允许用户输入其项目或系统有关的各项数据，并计算该项目需要多少蒸发器。以及包括热交换器，冷凝器和真空泵在内的配套系统（BOP）所需要的设备选型，和明确在运行期间需要多少热量来维持废水温度。

对于一次性费用，Dais 还将提供专业的《技术支持设计包》。该软件包含 BOP 设计指南，可帮助您选择完整系统所需的各项配件，并提供 BOP 管道安装指南，方便组装运行系统。