

INTEGRATED EVAPORATION SOLUTION REDUCES WATER CONSUMPTION AND SLUDGE PRODUCTION AT COSMETICS MANUFACTURING FACILITY

CASE STUDY | Liquid and Cream Cosmetics, Italy



| The client's needs

The cosmetics manufacturing facility encountered significant environmental and operational challenges related to wastewater management and resource consumption. As part of the customer's ambitious environmental targets to reduce water use and raw materials, the facility sought an effective solution to reduce water consumption and sludge production from its existing membrane bioreactor (MBR) biological treatment plant.

The facility's wastewater, generated from liquid and cream cosmetics production, contained extremely high levels of organic contamination with chemical oxygen demand (COD) exceeding 50,000 ppm. The wastewater contained surfactants at concentrations exceeding 30,000 ppm. While essential in cosmetic formulations these compounds create significant treatment challenges. Additional contaminants included silica (70 ppm) and various dissolved solids, with total solids content ranging from 2.0 to 2.5% and conductivity of 2900 $\mu\text{S}/\text{cm}$.

The existing MBR biological plant effectively treated organic loads, generated substantial quantities of biological sludge requiring costly disposal. The continuous 24/6 production schedule meant that wastewater generation was constant, with approximately 30 tons per day (5.5 gpm) requiring treatment.

The facility needed a solution to reduce sludge production and disposal costs. It also sought to enable water reuse to support corporate sustainability goals and reduce freshwater consumption.

The client needed a technology capable of treating highly concentrated cosmetic wastewater, integrating seamlessly with the existing biological treatment infrastructure and delivering rapid return on investment.

| The solution

Veolia designed and implemented an integrated two-stage evaporation system that works in synergy with the existing MBR biological plant. This solution maximizes water recovery and minimizes waste generation. The solution combines advanced evaporation technologies built with UNS S32750 super duplex stainless steel to handle the aggressive cosmetic wastewater composition.



Italy

The client is a multinational cosmetics company with more than 250 manufacturing premises worldwide. In Italy, the production focuses on liquid and cream cosmetics for health care applications. The facility operates continuously with production running 24 hours a day, six days a week, to meet global demand for their health care cosmetics portfolio. As a leader in the personal care industry, the company is committed to sustainable manufacturing, setting ambitious environmental targets for water conservation and raw material reduction.

Key Benefits

Approximately 90% water reuse achieved

Significant sludge reduction from biological plant

Rapid payback period of approximately 10 months

The treatment system consists of two primary components: the RV F 30 FF evaporator with a 14 m² footprint and the AC R 12 FF evaporator-crystallizer with a 14.5 m² footprint. This dual-stage approach enables maximum concentration and water recovery while producing a minimal waste stream suitable for final disposal.

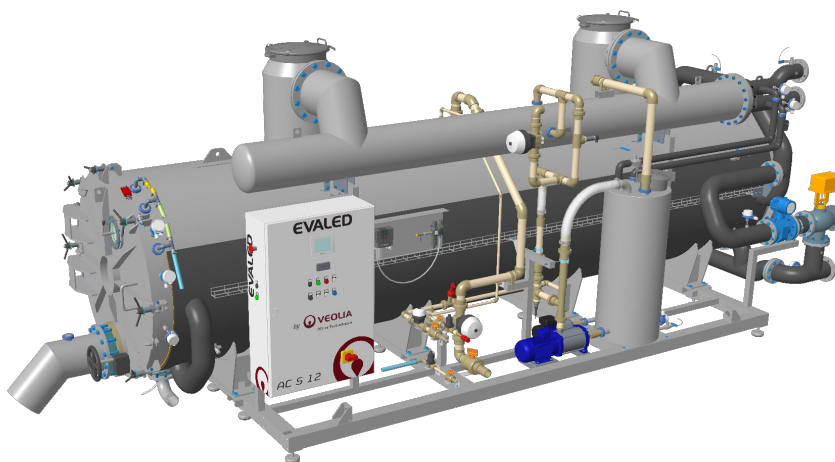
The process flow begins with the incoming wastewater (30 tons per day at 5.5 gpm) entering the RV F 30 FF evaporator. This first-stage evaporation unit separates the bulk of the water from the concentrated cosmetic ingredients, surfactants, and other contaminants. The RV system produces high-quality distillate (32.5 tons per day at 5.2 gpm) with COD reduced to below 3000 ppm, conductivity below 100 µS/cm, and silica content reduced to less than 5 ppm.

This distillate stream is directed to the existing MBR biological plant, where the remaining organic load is further reduced through biological treatment. The MBR effluent, now meeting discharge standards, can be either reused within the facility for non-critical applications or safely discharged, achieving approximately 90% water recovery from the original wastewater stream.

The concentrate from the RV evaporator (6 tons per day at 0.4 gpm) undergoes further treatment in the AC R 12 FF evaporator-crystallizer. This second-stage unit employs more aggressive evaporation and crystallization processes to extract additional water while concentrating the remaining contaminants to very high levels. The AC system produces additional distillate that returns to the process while generating a highly concentrated waste stream (3.5 tons per day at 0.2 gpm) with COD exceeding 200,000 ppm, total solids of 25-30%, and silica content above 1000 ppm.

This final concentrate (6 tons per day at 0.9 gpm when combined with other concentrated waste streams) is suitable for incineration, representing a concentration factor of approximately 10 times compared to the original wastewater volume. The system also includes a high-pressure (HP) system to manage process requirements and optimize energy efficiency.

By pre-concentrating the wastewater before biological treatment, the system dramatically reduces the organic load entering the MBR plant, resulting in significantly less biological sludge production. The UNS S32750 super duplex stainless steel construction ensures long-term durability when handling the corrosive surfactant-rich wastewater while meeting the hygiene standards required in cosmetics manufacturing.



| Results

The integrated Veolia solution achieved exceptional results:

- Water Recovery: ~90% water reuse (32.5 tons/day).
- Waste Reduction: 80% volume reduction (30 tons/day reduced to 6 tons/day concentrate), leading to significant disposal cost savings.
- Sludge Reduction: Pre-treatment dramatically reduced biological sludge from the MBR.
- Distillate Quality: COD reduced from >50,000 ppm to <3000 ppm; conductivity reduced from 2900 µS/cm to <100 µS/cm. Surfactant concentration (>30,000 ppm) is effectively removed.
- Concentrate Quality: COD >200,000 ppm, total solids 25-30%, suitable for incineration/energy recovery.
- Payback Period: Approximately 10 months, demonstrating strong economic benefits from reduced water use and disposal costs.
- Footprint & Durability: Compact 28.5 m² total footprint; UNS S32750 construction ensures reliability.

The solution supports the client's sustainability goals while delivering strong financial returns.

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