



Evaporation, an efficient and sustainable technology for the treatment of APIs

WATER TECHNOLOGIES



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Every year, more than 100,000 tons of pharmaceuticals are consumed worldwide, and a quarter of this amount is consumed in Europe. Despite being essential today, active pharmaceutical ingredients (APIs), both during their production and subsequent use and disposal, are at the root of a growing environmental problem that is beginning to concern companies and public bodies. These compounds, along with other chemical ingredients, are released into the environment, creating a problem that must be addressed during the manufacturing process through the use of effective wastewater treatment technology such as evaporation.

Although the main reason for APIs to be released into the environment in the European Union is the use of products containing them, the second most common reason is residues from their production cycle. For this reason, a comprehensive approach is essential when undertaking an effective reduction of this type of environmental discharge at all stages of production and use..

In this sense, companies are increasingly aware of the need to follow a sustainable environmental policy and are seeking solutions that not only minimize the volume of waste produced, but also improve the efficiency of its disposal.

One of the most critical steps in the environmental management of pharmaceutical companies is wastewater treatment. At this stage, conventional treatments are not always able to eliminate all residues of active pharmaceutical ingredients, as municipal wastewater treatment plants (WWTPs) do not always have the appropriate technology for this purpose.

To address this problem, many companies turn to an outsourcing solution, entrusting the management of their wastewater to specialized companies. This outsourcing involves incineration of the waste or complex chemical treatment, resulting in high disposal costs, as most of these substances are hormonally active and/or antibiotic-active.

A more environmentally sustainable and cost-effective solution is evaporation, a proven technology that can be used long-term for wastewater treatment. Technological advances made in recent years to reduce the operating costs of this technology, considered the best available technique (BAT) for treating industrial wastewater, have made this solution increasingly attractive, while also addressing growing pressure to avoid discharging polluting water into nature.

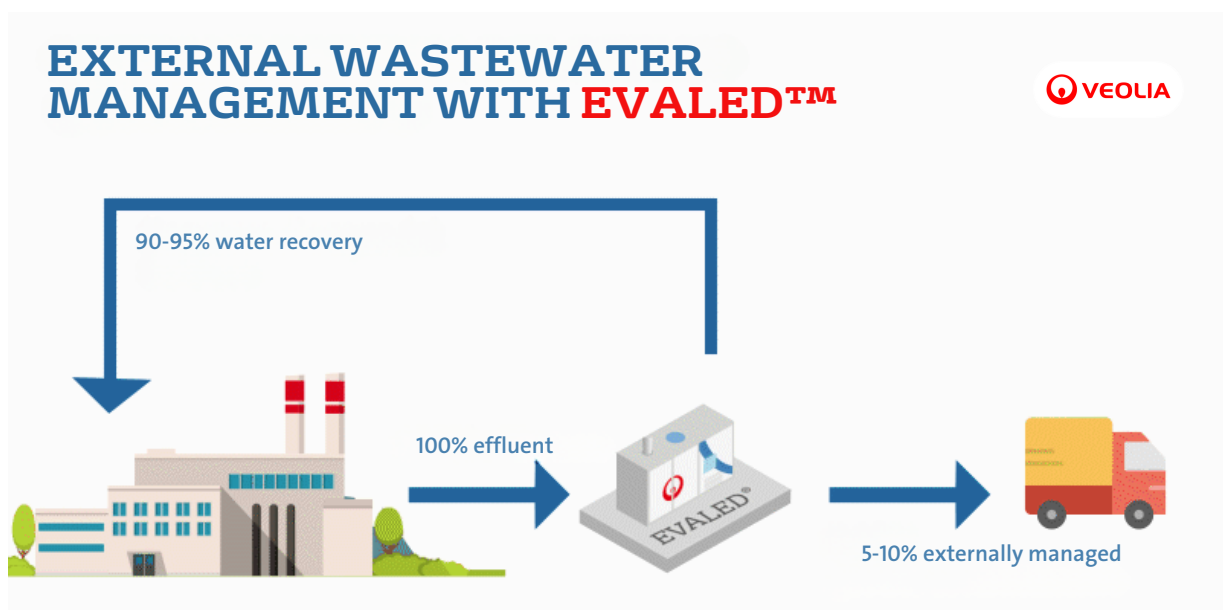
In this sense, the European Union is proving increasingly active in seeking efficient solutions, as demonstrated by the 2017 publication of the Strategic Approach to Pharmaceuticals in the Environment, a roadmap that called on the industry to implement sustainable solutions.

Evaporation: an effective technological solution to concentrate and remove APIs

In short, water evaporation involves converting water into steam using heat. The steam is then condensed, producing two streams: the distillate and the concentrate. This concentrate represents only 5-10% of the original treated volume. For its part, the distillate, which represents up to 95%, is of the highest quality and can be reused for ancillary services within the plant itself.

Therefore, with this technology, savings of up to 80% can be achieved compared to external waste management, since only 5-10% of the original volume is sent to final disposal. In addition to the obvious economic benefit, it allows the company to develop more sustainable management practices, reducing CO2 emissions from transportation to waste disposal facilities.

The effectiveness of evaporators in reducing wastewater volumes and producing high-quality distillate, combined with lower disposal costs, have made this solution ideal for various application sectors: pharmaceuticals, cosmetics, chemicals, and more generally, in all sectors producing wastewater that is difficult to manage with traditional treatment technologies.



Evaporation is also a recommended technique for flow separation, since in some cases it is more economically attractive to separate the streams and send them to an existing treatment plant, thus reducing costs in the short/medium term, as well as being able to recover and reuse the distillate.

In addition to reducing costs, evaporation technology can also be used to recover substances used in the production process, such as raw materials, disinfectants, proteins, or glycols.



Vacuum evaporation occurs at low temperatures, allowing, among other advantages, the treatment of thermolabile products. Some of these substances may be valuable as byproducts, and their recovery without degradation is important.

Therefore, the economic benefits of evaporation technology are both direct, due to the reduction of management and disposal costs, and indirect, deriving from the reuse of water and the recovery of by-products of the production process.

EVALED™: leading evaporation technology since 1978

EVALED™, a company belonging to the Veolia Water Technologies group, has been a leader in the evaporation sector for over forty years and is a point of reference in Europe and worldwide with over 3,000 installations.

Continuous commitment to innovation and development has enabled the company to configure a range of evaporation equipment with production capacities from 0.1 to 120 tons per day per unit, which can be integrated with each other to achieve greater production capacity or higher degrees of separation, adapting to different customer needs.

The company has developed its own range of equipment using the 3 most common evaporation techniques:

Hot water vacuum evaporation:

These evaporators have a forced-circulation hot/cold water supply and a shell-and-tube heat exchanger outside the chamber. The heat required to boil the water to be treated comes from the hot water circulating through the heat exchanger, while steam condensation is achieved by the cold water circulating through the heat exchanger located above the boiling chamber.

Vacuum evaporation with mechanical vapor recompression:

It recovers the latent heat of condensation from the distillate as a source of heating for the liquid to be evaporated. The temperature of the vapor generated during evaporation is increased by compressing the vapor itself. In this way, the superheated vapor can be recycled through an exchanger, achieving a dual objective:

- Save energy for the evaporation process
- Avoid using a refrigerant for condensation (cooling towers, etc.)
- Evaporation with mechanical vapor compression is the most energy-efficient evaporation method.

Vacuum evaporation via heat pump:

It uses the Freon gas refrigeration cycle, through the action of gas compression, which condenses and releases heat to the liquid to be evaporated through heat exchange. The gas is then expanded via a thermostatic valve and the action of a condenser, which cools the evaporated liquid and extracts the distillate. The Freon flows in a closed, hermetic circuit. Being under vacuum, the boiling chamber allows evaporation at temperatures above 40°C, so no other heat or cooling source is required, making it a highly attractive process from an economic and management standpoint.

This low-temperature evaporation system allows for a wide variety of applications related to the treatment of highly fouling, encrusting, and highly corrosive liquids.

Conclusion

Evaporation is a technology that offers both economic and environmental sustainability advantages, such as reduced external management costs, recovery of by-products where possible, and a reduced water footprint thanks to water reuse and often ZLD (zero liquid discharge), thus representing a valid solution even for small installations in the pharmaceutical and cosmetics industries.



Resourcing the world

Veolia Water Technologies UK
2 Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire SL8 5XF
sales.watertech@veolia.com
www.veoliawatertechnologies.co.uk