nyex™
An Arvia Solution

RO Reject Water Treatment to Protect Bio Process

Equipment Capacity/Flow Rate	Compounds of Concern	Influent Concentration	Treatment Targets	Unit Energy Consumption
60m³/h	COD	60 mg/L	<30 mg/L	tbc

Background

Arvia were approached by one of the world's largest petrochemical companies who are involved in the processing, production and sales of petroleum refining and petrochemical products.

The company has a refinery in the East of China and was looking to improve its wastewater treatment process to comply with environmental regulations and reduce operational maintenance of their on-site effluent treatment process.

Water Ten Plan Compliance

Manufacturing facilities in China were under pressure to reduce water pollution and address their water usage as part of the 'Water Pollution Prevention & Control Action Plan', also known as the 'Water Ten Plan'.

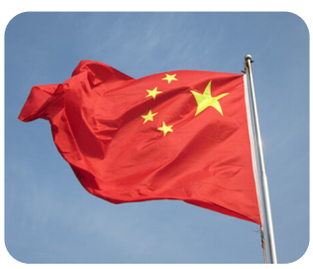
The key objective of the plan was to protect surface and ground water. Heavy polluting industries like the petroleum sector have been the focal point for enforcement. Facilities found to breach specified standards under the new law face significant fines and prison sentences for directors.

The effluent standards for the petroleum refining and petroleum chemistry sectors came into force on 1 July 2015. Specified limits differ depending on the sector and province but were usually between < 50 or < 30 mg/L chemical oxygen demand (COD).

Prior to the enforcement of the Water Ten Plan, some sectors did not have any specified limits for effluent quality. This meant that discharging untreated wastewater into waterways was permitted. This resulted in facility management requiring the installation of complete water treatment processes from scratch.

Since enforcement in 2015, water treatment technologies have been integrated which in many cases were not advanced enough to reach the specified limits. Arvia has been partnering with companies in China since 2016, offering an eco-friendly and low-maintenance wastewater treatment alternative.

The Objective



The petrochemical facility in Nanjing, China wanted to treat the recalcitrant refinery effluent so it could pass safely on to their biological process. This effluent was from a reverse osmosis system (or RO system), which concentrates harmful chemicals into the reverse osmosis reject water, or 'RO reject stream'.

This RO reject stream needed to be fed into a biological process but the chemicals in the effluent would destroy the bacteria which is central to the biological process action.

The purpose of our work in this application was to remove the most persistent organic chemicals to protect the biological treatment step which was further downstream. If the chemicals from the RO stream were to react with the biology, this vital water treatment step would be damaged and would become ineffective.

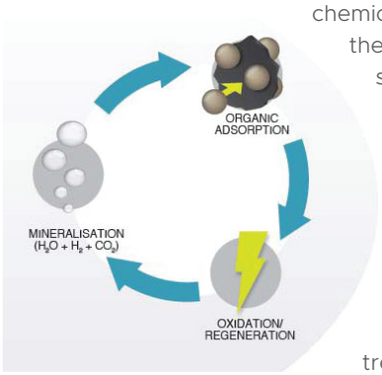
Our client needed to reduce the recalcitrant COD to <30 mg/L. The RO reject stream had a flow rate of 60m³/h and a concentration of 60mg/L COD.

The Solution

An engineering team from Arvia conducted initial treatability trials at the client's facility in Nanjing, China on samples of the refinery effluent from the concentrated RO stream. Following these trials, a Nyex™ water treatment system was installed. It consisted of a set of submergible reactors which, placed inside a large treatment basin, combined adsorption with electrochemical oxidation.

The concentrated RO stream was gravity fed into the treatment basin containing the Nyex™ reactors. Once in the basin, atmospheric pressure was to drive the water into the base of each reactor and up through a bed of carbon-based adsorbent media. Due to the use of gravity and pressure, there was no need to pump the water, which saved the client significant operational expense.

The carbon-based media inside each Nyex™ reactor localised the harmful organic chemicals onto its surface and these pollutants were then simultaneously oxidised using an electrical current.



The treated water was designed to overflow out of the top of the reactors and was directed out of the basin for further water treatment processes.

The Result

Using Nyex™ technologies we achieved a COD reduction down to 12mg/L at a flow rate of 60mg/L. This was better than the target of <30mg/L and was sufficient to protect the downstream biological process.

Due to the flexible nature of the Nyex™ process, it can be installed as described here to support other treatment processes. It can also be installed as a final 'polishing' treatment step to remove any remaining recalcitrant chemicals from effluent prior to this being discharged.

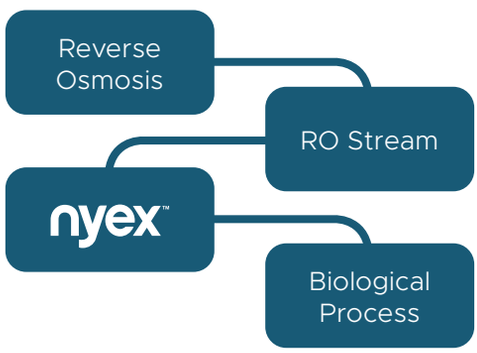


Figure 1: The water treatment process design

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Get in touch to discuss your company's treatment challenges and arrange a treatability trial on your wastewater today.