nyex™
An Arvia Solution

Tackling Antimicrobial Resistance (AMR) with Arvia's on-site Nyex™ wastewater treatment system

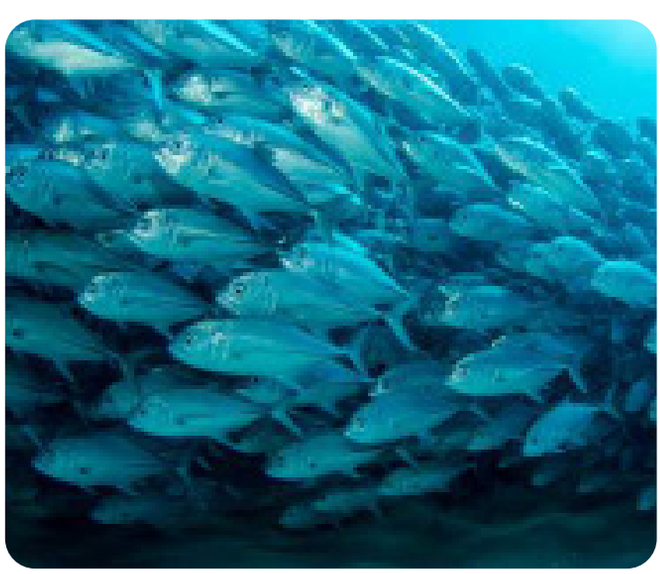
Introduction

Antimicrobial resistance (AMR) is a complex, global issue driven by many interconnected factors. AMR arises when microorganisms (such as bacteria, fungi, viruses, and parasites) mutate, following repeated or prolonged exposure to antimicrobial drugs (such as antibiotics, antifungals, antivirals, antimalarials, and anthelmintics). The global misuse and overuse of antimicrobials is accelerating this process.[1]

As a result, a diminishing pool of antimicrobial medicines are able to treat these 'superbugs' and infections are persisting in the body, increasing the risk of spread to others. In 2016 it was concluded that 700,000 deaths per year could be attributed to AMR. Current assessments estimate that deaths from AMR could reach 10 million by 2050.[2]

Pharmaceuticals in the Environment (PiE) and Antimicrobial Resistance (AMR) are closely interconnected. Increasing levels of pharmaceuticals are being detected in waterways due to irresponsible disposal, run-off from intensive farming and inadequate wastewater treatment. This pollution of surface and ground water impacts water quality, drinking water supply, aquatic life, and also facilitates AMR.[3]

The effluent produced by some pharmaceutical manufacturing facilities has been described as 'a reservoir for the development of AMR'. Research shows that Active Pharmaceutical Ingredients (APIs) and other pharmaceutical residues within the wastewater from these facilities have adverse effects on aquatic life and greatly increase the prevalence of multidrug resistant organisms (MDRO).[3]



The Challenges

The serious consequences of PiE have led to increasing pressure on the pharmaceutical industry to take action. However, the production of a wide array of pharmaceutical products results in wastewater with a complex composition which is difficult to treat to levels in compliance with regulation from industry authorities.

Failure to comply with regulations can result in a loss of permit, operational downtime, limited production volume and severe fines. As traditional municipal wastewater treatment plants are not designed to tackle such varied and persistent compounds, manufacturers are challenged to remove the pharmaceutical residues, including antibiotics, prescription and non-prescription drugs at source.

Arvia's Treatment Solution

Arvia's Nyex™ Treatment Systems offer a unique solution for the reduction of hard-to treat organics, micropollutants and colour from water and wastewater streams.

Each on-site system (figure 1.) is tailored to meet specific water treatment requirements, ensuring environmental and regulatory discharge limits are achieved. Furthermore, Nyex™ Treatment Systems can also be designed and optimised to ensure treated water is suitable for reuse, contributing to the circular economy.

The ability to safely reuse process water does not only reduce utility costs but also builds positive Corporate Social Responsibility through the protection of the environment in water stressed times.

Nyex™ systems provide a chemical free and environmentally sound solution which combines adsorption with electrochemical oxidation in a single, scalable unit. Problematic contaminants are concentrated on the surface of Arvia's proprietary Nyex™ media, which is non-porous with high electrical conductivity. This patented adsorbent media allows for targeted and continuous oxidation.

Unlike granular activated carbon, Nyex™ media is effectively regenerated in-situ and the process can continue without interruption or replacement. Results are achieved without chemical dosing or the generation of sludge, reducing costs in terms of transport of chemicals and specialist waste disposal.

Figure 1: The Nyex™ containerised system

Antibiotic misuse: A real life example

Using antibiotics as growth promoters has been banned in the European Union since 2006, and in

the US was made illegal in 2017. Reports show that Colistin, the 'last hope' antibiotic used to treat patients who are critically ill with infections which have become resistant to nearly all other drugs, is regularly being added to chicken feed in India. The discovery was met with panic in the medical community as this is clearly an example of severe antibiotic misuse which will result in the acceleration of AMR in the environment.

India has been named the epicentre of the global drug resistance crisis. A combination of factors described as a 'perfect storm' have come together to hasten the spread of superbugs - over prescription of antibiotics in humans and animals, poor sanitation and untreated wastewater from pharmaceutical manufacturing

sites creates antibiotic resistant hotspots and fuels the spread of resistant bugs in the environment.

The animal farming industry, pharmaceutical manufacturers, policy makers, waste disposal management and consumers all have a part to play in the prevention of the antibiotic resistance pipeline. See figure 2 for a diagram of how pharmaceuticals enter the environment and sources used for drinking water.

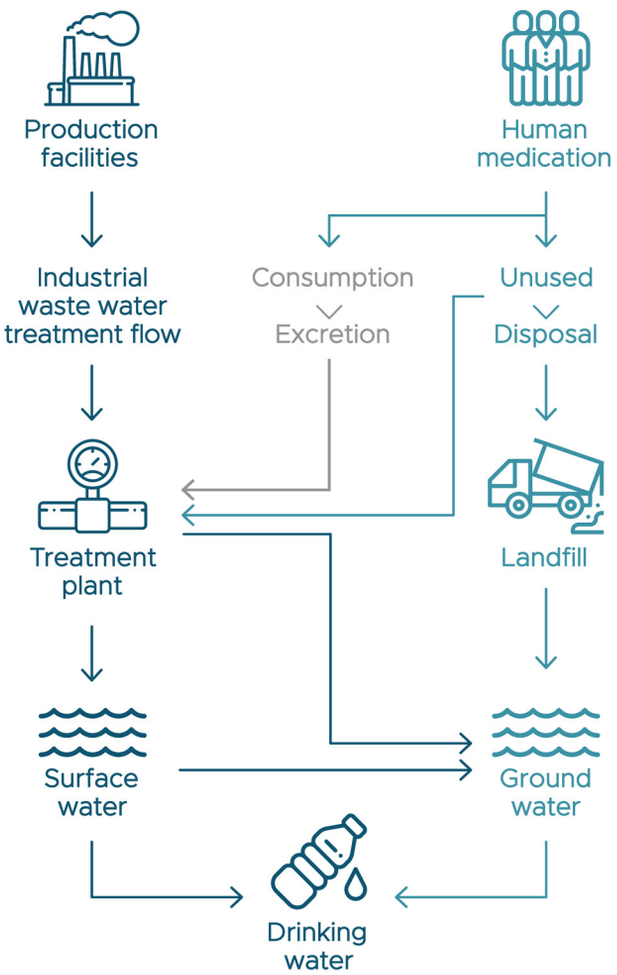


Figure 2. How micropollutants from industrial activity and medication enter our environment

Benefits of Nyex™ water treatment to manufacturers of APIs

Our Nyex™ water treatment systems are used for tertiary wastewater polishing. They are extremely effective at removing APIs, antibiotics, hormones, steroids and EDCs, as well as surfactants, corrosion inhibitors and biocides. This makes them very suitable for use in life sciences companies which manufacture pharmaceuticals or APIs and require removal of hazardous compounds to below the contaminant's Predicted No Effect Concentration (PNEC).

Our Nyex™ water treatment processes have been designed to tackle the wastewater issues faced by the life sciences sectors, with these key benefits:

1. Treatment of APIs

Low energy and targeted treatment of APIs, antibiotics, steroids, hormones and EDCs enabled by Arvia's unique combination of adsorption and electrochemical oxidation.

2. Removes organic chemicals to trace levels

Removes recalcitrant organic chemicals to very low levels enabling safe discharge to sewer or watercourse, with reduced cost and improved traceability.

3. Cost effective

Much more cost effective than inefficient and expensive incineration of wastewater.

4. Eco friendly process

No chemical dosing and no waste products – eco-friendly process.

5. Modular system

Flexible and modular system can be turned on and off according to demand, meeting variable loading over time and accommodates future expansion.

6. Improve existing processes

Improve efficiencies and reliability of existing treatment processes by removing fouling organics and hazardous organic chemicals at key points in the treatment chain.

Speak to one of our application experts today to discuss the targeted removal of API's and Pharmaceutical residues from your wastewater with Nyex™.

1. World Health Organisation: http://www.who.int/en/news-room/fact-sheets/detail/antimicrobial-resistance [Accessed 12th August 2021]
2. World Economic Forum, 2018, Antimicrobial Resistance: http://reports.weforum.org/global-risks-2018/anti-microbial-resistance/ [Accessed 12th August 2021]
3. Joining the Dots. Tackling Pharmaceuticals in the environment and AMR in Europe. European Parliament [Accessed 12th August 2021] https://epha.org/wp-content/uploads/2018/03/AMR-minutes-Joining-the-dots.pdf

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