How Nanotechnology is Leading the Way in Pollution Control

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Scientists at Oxford University have developed a new process based on nanotechnology to simplify and reduce the cost of testing water for chemical pollution and toxicity levels.

Across the EU, including the UK, some common chemicals, such as mercury, nickel, zinc, cadmium, lead, nitrate, phosphates, and polyaromatic hydrocarbons, have degraded water quality at levels that are harmful to health and the environment (European Environment Agency, 2018).

Chemical pollution is understood to be one of the heavy contributors to water pollution, affecting the already limited water supply. The WHO states that approximately 785 million people lack a basic drinking water service worldwide (The World Health Organization, 2019). The improper sanitation service and inefficient wastewater treatment services need immediate attention.

The technology developed by Oxford University shows a promising approach to help protect human health and the environment against chemical pollution. As the spin-out company of the University, Nanolyse Technologies takes the lead to proceed to the next level of development.

Chemical Pollution

The fossil fuels burned by vehicles and industries and the pesticides and fertilizers that contain nitrates and phosphates are the primary cause of chemical pollution. Many toxic chemicals from households and industries leak into the groundwater and mix into lakes or rivers, posing short-term and long-term impacts on human health and the environment.

Emissions from vehicles produce excessive levels of NO2, and the overuse of fertilizers and burning of coal heavily produces sulfur dioxide (SCIENCING, 2017). As the polluted water contains a mixture of different toxic chemicals, the treatment requires state-of-the-art technology to detect them. The newly developed process provides bioavailability-based accurate techniques to distinguish highly toxic ions from less toxic ones in a single step (NTSE, 2021).

Wastewater Treatment Technology

Wastewater treatment technologies treat secondary water before being reused in other divisions or safely disposed of to avoid a heavy burden on the environment. These processes can be categorized into three main types:

Mechanical treatment - this uses natural processes within a constructed environment. The technology utilizes a combination of physical, biological, and chemical processes by using a series of mechanical components, such as tanks, along with pumps, blowers, screens and grinders.

Aquatic treatment - suitable in treating ponds or lakes that have sludge deposits with aerobic and anaerobic layers

Terrestrial treatment - includes slow-rate overland flow, slow-rate subsurface infiltration, and rapid infiltration methods, usually suitable for providing water for groundwater recharge, reforestation, agriculture, and livestock pasturage (OAS, n.d.).

The current options for wastewater treatment are high in cost, complex, less efficient, and time-consuming.

Pollution Control Solutions

Wastewater treatment is a popular process in controlling pollutants from wastewater through

a physical, chemical, or biological process, although the efficiency has to be compromised with the cost and process time. However, before adopting different options for pollution control, it is crucial to understand the origin of the problem. For example, with 25% of human-induced CO2 emissions being absorbed by oceans, air pollution directly and indirectly impacts water degradation (Science on a Sphere, n.d.). In this case, preventing air pollution is a valid option and the urgent need to stop its contribution to water pollution.

The nanoparticle characterization equipment available today

Another major problem of pollution control is the mixture of pollutants that require expensive tailor-fitted treatment for different chemicals and compounds. Nanolyse Technologies' analytical methods for pollution control come with a fitted sensor device and works by selecting and capturing different chemicals and compounds present in water. The prospect of this method will be revolutionary in terms of cost and usability of water analysis.

Nanotechnology Solution

For the last two decades, nanotechnology, defined by the particle size 1-100 nm, has provided prospective solutions to the problems in many fields.

Nanotechnology helps develop better techniques for pollution control on a molecular level that can separate specific elements and molecules from a mixture of atoms and molecules.

A nanofiber catalyst made of manganese oxide is used to speed up chemical reactions and remove volatile organic compounds from industrial smokestacks (UnderstandingNano, 2007).

The University of Queensland experimented with another popular nanomaterial, carbon nanotubes (CNT), to trap greenhouse gas emissions caused by coal mining and power generation (The University of Queensland, 2007). CNT traps gases up to a hundred times faster than other methods, allowing promising integration into the large-scale industry.

The technology offered by Nanolyse Technologies will eliminate the need to transport samples to a laboratory for analysis using complex machines and highly qualified operators.

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