Invasive tropical plant can completely remove metal pollutants from Britain's rivers – new study

August 2 2018, by Parvez Haris

Credit: AI-generated image (disclaimer)

Pollutants in rivers and other water bodies are a serious problem for marine life as well as human health. However, removing them from the water can be a costly process, often requiring energy from fossil fuels, which adds to both operating costs and environmental damage.

Consequently, using plants to remove pollutants – a process known as phytoremediation – has become increasingly attractive around the world.

Not only is phytoremediation more environmentally friendly than conventional methods, it is cheaper too. It involves using photosynthesising organisms to remove pollutants – for example, heavy metals like lead – from water. It is thought that the mechanism of removal involves a combination of adsorption (whereby pollutants stick to the surface of roots) and absorption (whereby they're taken up by the plants' transport system) of metals via the plant roots.

Our research team has recently been investigating how phytoremediation could help clean up rivers in Britain. Though phytoremediation has been used in the country previously, this time we have been specifically using water hyacinth. This tropical plant is not native to the UK, and is actually classed as an invasive species. It has been used for phytoremediation before, but we were the first to use it in a temperate Northern hemisphere river, far removed from its native habitat, originally in South America.

What we found was remarkable. The water hyacinth was able completely to remove highly toxic elements from river water.

Rooting out pollution

We introduced the plant to the Nant-Y-Fendrod stream, a tributary of the River Tawe, in Swansea. This waterway is located in an area which was the heart of global copper production during the 19th and 20th centuries. As a consequence, it has been heavily polluted by millions of tonnes of copper and zinc smelting waste. Despite previous efforts to remediate the land using conventional approaches, such as the removal of contaminated soil, considerable contamination of heavy metals remains, affecting the stream's water quality. In fact, pollution is so bad

that it fails to meet EU water quality standards.

We constructed two purpose-built treatment pods to contain the plants in the river, preventing them from escaping but allowing the water to move in and out of them. We used 25 plants in each pod, covering around one square metre. This equated to approximately 10% of the width of the channel. The content of heavy metals in the river water was determined – using inductively coupled plasma mass spectrometry – prior to plant introduction, within the treatment pods, and downstream on an hourly basis for a period of seven hours.

We found that the water hyacinth was able to remove many different heavy metals – including cadmium, zinc, arsenic, lead, chromium, aluminium, copper, manganese and nickel – from the stream's water. The speed of this metal removal was fast. Our tests demonstrated more than 60% of the aluminium and zinc polluting the water which went into the the pods was removed within just seven hours. Such a high speed of removal is consistent with the reputation of water hyacinth as the fastest growing aquatic plant in the world. In other cases, up to 100% of the metals were removed in just three weeks.

Preparing for climate change

To date, most research work on the water hyacinth plant has originated from developing countries. But given the effects of climate change on the distribution of all kinds of species, researchers from developed countries urgently need to play a greater role in exploring its control, management and effective utilisation.

One particular area of research that still needs to be explored is dealing with the water hyacinth after it has adsorbed/absorbed pollutants. There are several possible solutions, such as recovery of the metals it has adsorped/absorbed for industrial use, and using the plant biomass for

bioenergy production or fertilisers. Another option is to find a way to live with what is the world's most prolific aquatic plant, instead of eradicating it – which has so far been unsuccessful.

The plant has a prolific growth rate and, as climate change affects the range of all kinds of species, it will likely spread into new regions. This means that it may no longer be a problem solely linked with poorer countries in Africa, Asia and South America, where it clogs up rivers, lakes and canals causing huge economic burdens.

Though there are disadvantages to phytoremediation – including that it takes time for the plant to trap the pollutant, and that it must carefully be managed to stop it blocking waterways entirely – our research has shown how nature can help heal the damage caused by industry.

This article was originally published on The Conversation. Read the original article.

Provided by The Conversation

Citation: Invasive tropical plant can completely remove metal pollutants from Britain's rivers – new study (2018, August 2) retrieved 26 June 2024 from https://phys.org/news/2018-08-invasive-tropical-metal-pollutants-britain.html