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TECH SHEET

Phoslock can help reduce greenhouse gas emissions from freshwaters

METHANE IS THE SECOND MOST IMPORTANT GREENHOUSE GAS (GHG) CONTRIBUTOR TO CLIMATE CHANGE, AND WATERBODIES SUFFERING FROM NUTRIENT POLLUTION ARE SIGNIFICANT EMISSION SOURCES.

Methane gas occurs naturally in the environment and is also the product of human activities. It is an important greenhouse gas, and its atmospheric concentrations are rising due to it being produced faster than it can be removed from the atmosphere. This is due to human population growth, associated activities and climate change.

Methane emissions are the second most important greenhouse gas (GHG) contributor to climate change following carbon dioxide, contributing ~ 20% to the total GHG effect. However, methane has ~ 80% more warming potential than carbon dioxide over a 20-year period, as it is much more efficient at trapping radiation than carbon dioxide in the atmosphere.

Methane produced naturally in the environment comes from - but is not limited to - soils, freshwater bodies, the digestive processes of termites, natural ruminants from ocean floors and volcanoes. Human-associated sources of methane include the extraction, processing and combustion of coal, oil and natural gas, livestock farming, landfills and waste management and these methane emissions due to human-related activities account for ~ 70% of the total global emissions.

Freshwater bodies are a significant source of methane and other GHGs. Natural lakes are reported to contribute to ~ 70% of all freshwater methane emissions (Sanches et al., 2019) contributing to ~43% of total global natural emissions (Rosentreter et al., 2021; Nijman et al., 2019) and shallow, smaller lakes in particular emit more methane than deeper and larger lakes (Deemer & Holgerson, 2021).

Methane production in lakes largely occurs in anoxic (no oxygen) sediments and methane is released from sediments mainly through ebullition (bubbles) and diffusion. Ebullition is the process where methane emissions pass through the sediment reaching the lake surface as bubbles which have been produced by the breakdown of carbon in anoxic conditions by methanogens (microorganisms that produce methane as a by-product in conditions were no oxygen is present). Diffusive methane emissions have to pass through the top layer of sediment where the majority of methane can be oxidised by methanotrophs (microorganisms that use methane as an energy source).

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Lakes suffering from nutrient pollution emit more methane than lakes in good condition, due to the accumulation of organic matter on the sediment surface and 77 % of methane emissions from a particular lake are the result of the breakdown of organic matter in the lake sediments (Emilson et al., 2018). It is concerning that methane emissions are expected to increase from freshwater sources due to ecosystem changes as a result of climate warming and the delivery of excess nutrients entering freshwater systems through changes in climate patterns.

There are several policies in place, some of which are legally binding, to reduce methane emissions in different countries across the globe. In the United Kingdom (UK), these include the Climate Change Act 2008 and the net zero strategy which aims for the UK to reduce GHGs by 100% by 2050 (compared to 1990 levels). Net zero pledges are also in place in other countries including 33 countries in the European Union (EU), with over 100 countries overall including Japan, Canada and New Zealand. The European Green Deal aims for Europe to be the first climate-neutral continent by 2050 and have at least 55% less net GHG emissions by 2030 (compared to 1990 levels). As part of COP26, the EU launched a partnership with the United States, to form the 'methane pledge' which has seen more than 150 countries including Australia, Brazil and Indonesia joining the pledge to reduce methane emissions by 30% by 2030 (compared to 2020 levels). This is a global target and aims to reduce global warming by 0.2 °C by 2050. These policies are more focused towards reducing human-induced methane emissions and although lakes are within the natural classification of methane emissions, human-related activities will increase the methane emissions from freshwater sources.

Phoslock works by controlling the release of phosphorus coming from waterbody sediments. There is evidence that the use of Phoslock can reduce methane by up to 74% in a recent study (Nijman et al., 2022) but it also has the potential to reduce other GHG emissions as well. Phoslock works in this way by reducing the phosphorus concentrations in a waterbody which can reduce the amount of organic material in the sediment, which thereby provides less methane emissions through organic material breakdown.

Lakes suffering from nutrient pollution emit more methane than lakes in good condition.

References

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The use of Phoslock for phosphorus pollution control offers another solution to help reduce methane emissions coming from nutrient-rich lakes which will help towards meeting global and local methane targets.

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