products and pasteurized foodstuffs, and commercializes its research and development products, such as plant protectors used in agriculture and gold and silver nanogels used in medicine.

VINAGAMMA also carries out research and development and provides training in the field of radiation technology. It works with international partners to find ways of further improving irradiation technology.

—By Estelle Marais

IAEA develops new method for tracking sources of water pollution

Excessive nitrate in lakes, seas and rivers can increase algae growth that can lead to toxic blue-green blooms. The IAEA, in collaboration with the University of Massachusetts Dartmouth, has developed an innovative method for tracing the origin of nitrate pollution in water.

(Photo: L. Wassenaar, IAEA)

The IAEA, in collaboration with the University of Massachusetts, has developed an innovative method for tracing the origin of nitrogen pollution in lakes, seas and rivers. The nuclear-derived analytical tool provides a cheaper, safer and faster way to determine whether excessive nitrogen compounds in water stem from agriculture, sewage systems or industry, helping prevention and remediation efforts.Nitrogen, an essential and abundant element on earth, is an important fertilizer that has been widely used in agriculture since the mid-1900s. "One of the major global problems in terms of water quality is that we have been overfertilizing our landscapes for decades, either with manure or synthetic fertilizers," said Leonard Wassenaar, head of the Isotope Hydrology Section at the IAEA. "All of these nutrients, particularly nitrogen forms such as nitrates, are seeping into groundwater and eventually into rivers, lakes and streams."

Excessive nitrate levels increase algae growth that can lead to toxic blooms on the surface of lakes. These can also sink to the bottom of lakes, feeding bacteria and creating what is known as dead zones. "We now see more fish kills, where thousands of fish float to the surface because the bottom of the lake — their usual habitat — is depleted of oxygen owing to this rain of organic material," Wassenaar said.

Removing nitrates from water is very difficult and expensive, so tools are needed to understand nitrogen sources and pathways in order to better inform water protection and remediation efforts.

The new method, published in the journal Rapid Communications in Mass Spectrometry, measures the amount and proportion of nitrate stable isotopes in water. Nitrogen has two stable isotopes, or variations of its atoms, with different weights. Since the weight difference is not the same in human waste or fertilizers, for example, the isotopes can be used to identify the source.

"Isotope tools are very powerful for measuring nutrients in water," said Wassenaar, "but their use has historically been very difficult, hampered by cost and accessibility. The new technique allows scientists to run more samples, and much more cheaply, for large-scale studies. I think it is a game changer."

The new method uses a form of titanium chloride — a salt — to convert nitrate in a water sample into nitrous oxide gas. From this gas, the isotopes can be analysed with equipment such as a mass spectrometer or laser. Current methods use genetically modified bacteria or the highly toxic metal cadmium for the nitrous oxide conversion, making them laborious and costly and their use limited to a few very specialized laboratories.

"It's a relatively simple method for what used to be a very complex and expensive process," said collaborator Mark Altabet, Professor of Estuarine and Ocean Sciences at the University of Massachusetts Dartmouth's School for Marine Science and Technology. Sample analysis costs five to ten times less than in the past, and it takes only minutes to prepare samples.

Altabet plans to use the method to study the impact of measures to control pollution in Long Island Sound, an estuary on the eastern coast of the United States, which was heavily impacted by excessive nitrate in the past.

The IAEA promotes the application of nuclear and isotopic techniques to determine water source, age, quality and sustainability, in order to help countries better manage this vital resource.

—By Luciana Viegas