Monitoring toxic chemicals in coastal waters to protect wildlife

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More investment is needed to develop better analytical tests to measure, and therefore help control, the amount of toxic chemicals called organotins that enter the environment, according to a review published in *Trends in Environmental Analytical Chemistry*. The authors of the review found that tough regulations have inspired the development of new technologies to monitor organotins. However, they further work is needed to meet international targets.

Organotins, specifically tributyltin (TBT), were used in anti-fouling paint to kill algae and other organisms on ships' hulls. The paint was very effective - so effective, that when TBT leached into the surrounding water it had a catastrophic effect on marine life, even at low concentrations - just nanograms per liter. It can cause oyster shells to thicken and can result in imposex in sea snails (a condition where female snails grow male sex organs).

What's more, TBT can move up the food chain, accumulate in fish and have toxic effects on the brain and liver of mammals that eat the fish. They also cause obesity and infertility in mammals, and can potentially affect humans..

Because of this, the use of TBT was banned in 2001, under the International Convention on the Control of Harmful Anti-fouling Systems on Ships. There has been a marked reduction in the amount of TBT in the environment, but it is still a problem in places of high shipping activity, such as in docks, ports and in maintenance facilities. In

such places, TBT settles in the sediment and can be remobilised back into the water under certain conditions.

The presence of TBT in the aquatic environment is regulated, and the acceptance limits are very low: the EU Water Framework Directive Environmental Quality Standard (EQS) has set the annual allowable average concentration at 0.2 ng/L and the maximum allowable concentration at 1.5 ng/L. It is challenging to achieve such low concentrations, as it requires dedicated, clean laboratories and high investment in sophisticated instruments

For their review, researchers from the University of Portsmouth and the Centre of Environment, Fisheries and Aquaculture Science (Cefas) looked at the monitoring and analysis techniques available to detect organotin compounds like TBT in the environment. They found that, although the regulatory limits were difficult to meet, this challenge resulted in many innovative technological approaches.

Russell Cole, lead author of the review from the University of Portsmouth, said: "We found that most current methods for monitoring TBT cannot achieve the limits of quantification required to meet the tough demands set by international regulations, with the different environmental quality standards sometimes counterintuitive towards the practical considerations involved in monitoring."

"These low EQS have provided a platform for the development of novel, sensitive analytical instrumentation."

The review contributes to a project that aims to develop a sampling system capable of measuring changes in concentrations of organotins in situ.

By applying a technique previously developed at the University of

Lancaster, called diffusive gradients in thin-films, or DGT, the researchers have been able to measure organotin in sediment pore-water. They now plan to use the device to find out what environmental conditions cause these toxic chemicals to leach back into the water from the sediment phase.

More information: Russell F. Cole et al. Trends in the analysis and monitoring of organotins in the aquatic environment, *Trends in Environmental Analytical Chemistry* (2015). DOI: 10.1016/j.teac.2015.05.001

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