Source: Channel NewsAsia Online
Date: 10 August 2015

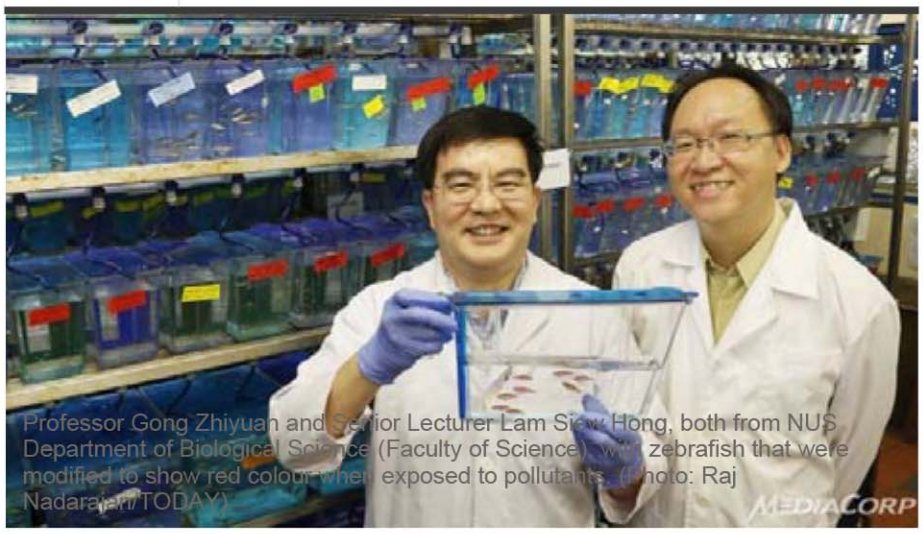
SINGAPORE

Turning to nature to monitor Singapore's waterways

TODAY reports: Researchers are studying fish to monitor water pollution, and mangrove trees to improve desalination methods.

By Lynette Tan, TODAY
POSTED: 10 Aug 2015 10:03

PHOTOS



Professor Gong Zhiyuan and Senior Lecturer Lam Siew Hong, both from NUS Department of Biological Science (Faculty of Science) with zebrafish that were modified to show red colour when exposed to pollutants. (Photo: Raj Nadarajan/TODAY)

CAPTION

SINGAPORE: A common aquarium fish or a mangrove tree might not draw a second glance from most. But when researchers Dr Lam Siew Hong and Dr Gong Zhiyuan look at their aquarium of zebrafish and medaka, they see a chance of better-monitoring Singapore's waterways for pollutants.

And for Associate Professor Loh Chiang Shiong and his team, mangroves are a source of inspiration for coming up with more energy-efficient methods of desalination.

All three are from the National University of Singapore Environmental Research Institute (NERI).

Dr Lam and Dr Gong, who are also part of NUS' Department of Biological Science, are looking at genetically engineering fish to glow in the presence of water contaminants, while Assoc Prof Loh and his colleagues are studying the natural desalination mechanism found in the salt glands of the Avicennia officinalis species of mangrove.

Dr Lam and Dr Gong hit on the idea of using fish to monitor water quality, with water being a fish's natural habitat. Said Dr Lam: "I think what needs to be appreciated is that the genetically modified fish used here ... gives real-time reporting. They are there in direct contact with the pollutants, they glow and it's alive."

They took the gene of the green fluorescent jellyfish and inserted it into a zebrafish embryo, and bred the fish such that it glows only when pollutants are present. Most chemical tests show only the presence of pollutants, but these fish biomonitors allow immediate identification of the contaminant, explained Dr Gong, who is also known for creating Glofish, luminescent zebrafish sold as pets in the US.

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Currently, the fish have been engineered to detect three types of contaminants: Oestrogen, chemicals from heavy metals, and certain man-made chemicals such as those from plastics. Usually imperceptible to the naked eye, the glow is detected by a fluorescent microscope.

The fish can be traditionally bred, as the gene can be passed to offspring upon maturity. Species such as zebrafish and medaka are also easily available in large numbers, and can be maintained at low cost.

While the researchers have developed a set-up for using the fish in Singapore's water bodies to monitor water quality, this is probably some way off, given Singapore's strict laws on genetically modified animals.

Meanwhile, Assoc Prof Loh and his team have turned to studying mangroves to address inefficiencies in current desalination methods, which rely heavily on membranes. This is energy intensive, and membrane-fouling is also an issue.

The Avicennia officinalis, which can be found locally, have water-channel proteins called aquaporins. These have high water-permeability and are highly selective, allowing only water molecules to pass, and would be superior to the chemical-based filtration membranes used in desalination, explained Dr Lin Qingsong, one of the team members.

While the team has made breakthroughs, they continue to face challenges in their research. For example, as very little is known about the genetics of the species, molecular genetic studies are a challenge to perform.

In future, their research findings could inspire novel desalination devices such as salt glands that are used as an individual unit, suggested research fellow Dr Tan Wee Kee, who professes to be a "plant lover since young".

Added Professor Prakash P Kumar, one of the researchers: "It may not be my generation ... but, I'm very positive and will risk the speculation that such new technologies will help us harvest water from the sea in a much more efficient way."

Read the original TODAY report here.

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