



Pesticide filter debuts in India

BY KILLUGUDI JAYARAMAN | 20 APRIL 2007

Water purifier uses metal nanoparticles to remove dissolved pesticide residues

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A domestic water filter that uses metal nanoparticles to remove dissolved pesticide residues is about to enter the Indian market. Its developers at the Indian Institute of Technology (IIT) in Chennai (formerly Madras) believe it is the first product of its kind in the world to be commercialised.

Mumbai-based Eureka Forbes Limited, a company that sells water purification systems, is collaborating with IIT and has tested the device in the field for over six months. Jayachandra Reddy, a technical consultant to the company, expects the first 1000 units to be sold door-to-door from late May.

'Our pesticide filter is an offshoot of basic research on the chemistry of nanoparticles,' Thalappil Pradeep who led the team at IIT Chennai told *Chemistry World*. He and his student Sreekumaran Nair discovered in 2003 that halocarbons such as carbon tetrachloride (CCl_4) completely break down into metal halides and amorphous carbon upon reaction with gold and silver nanoparticles¹.

Pradeep said this prompted them to extend their study to include organochlorine and organophosphorous pesticides, whose presence in water is posing a health risk in rural India. In research funded by the Department of Science and Technology in New Delhi, his team found^{2,3} that gold and silver nanoparticles loaded on alumina were indeed able to completely remove endosulfan, malathion and chlorpyrifos - three pesticides that have been found at elevated levels in Indian water supplies.



Source: © Thalappil Pradeep
The pesticide-zapping filter

Use and recycle

The mechanism of removal is 'adsorption followed by catalytic destruction', Pradeep explained. 'The chemistry occurs in a wide concentration range of environmental significance.' He added that tests proved silver particles from the filter are not released into the water. The IIT study found that gold particles perform better in the case of endosulfan. However, for cost reasons, the commercialised filters use only silver particles, which range in size from 60 to 80 nanometres at a concentration (on their alumina support) of 33 parts per million.

'Based on consumption patterns of a typical Indian household, the filter is designed to have enough nanomaterials to provide 6000 litres of pesticide-free water for one year,' Pradeep said. 'After that, the company will recycle the filters to recover the silver.'

Use of nanoparticles for environmental remediation is an emerging area of research worldwide. Nanoscale iron powders had been shown to degrade other pesticides, including DDT and lindane⁴, 'and there are reports about the use of nanomaterials for removing arsenic, heavy metals and fluorides,' said Pradeep. 'But ours is the first product to hit the market,' he said.

World first

Murali Sastry, chief scientist of TATA Chemicals Innovation Centre in Pune - India's first nanotechnology research centre in the private sector - agrees. 'What Pradeep has done is definitely novel,' Sastry told *Chemistry World*. 'I am not aware of any similar product in the market.'

Eureka already markets a water purifier that combines a sedimentation chamber with activated carbon filters and UV irradiation, and costs around Rs8500 (?100). Reddy estimated that adding the 21-centimetre-long nanosilver cartridge (see image) to remove pesticides will increase the price by 15 per cent, but silver recycling (in an environmentally-friendly manner, stressed Pradeep) should help to reduce that cost.

Vijayamohanan Pillai, a nanomaterials expert at the National Chemical Laboratory in Pune, pointed out that it is very rare for an Indian company to exploit a home-grown nanotechnology. 'Most big companies in India look abroad for collaboration,' he said. One problem is that scaling up nanoparticle production is difficult. But Pradeep said his team had taken three years to attack this problem, and 'Eureka Forbes can now make four tonnes of silver nanoparticles a month.'

References

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