Cephalopods tell their secrets

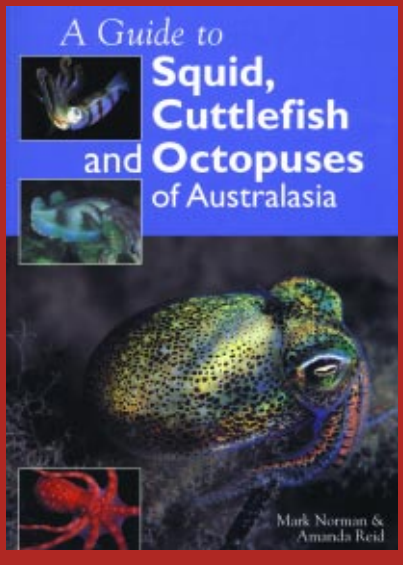
EVEN if you plan never to comb a beach, let alone meet a squid, cuttlefish or octopus, the new book, *A guide to squid, cuttlefish and octopuses of Australasia*, is bound to catch your eye. The book describes in words and pictures the amazing characteristics of these colourful creatures, which are known collectively as cephalopods.

Mimic octopuses, as the name suggests, are expert at mimicking other animals, possibly to deceive potential predators, or lure hapless prey. They can mimic flounders, anemones, sea snakes, mantis shrimps, lionfish and even a stingray – in both shape and behaviour.

Southern bottletail squids have a curious way of mating. They join heads, with the male passing sperm packages into a pouch under the female's mouth. The male uses a ribbed arm to scoop out sperm from any previous suitor.

Such insights into the biology and behaviour of more than 60 Australasian cephalopod species are provided in the guide, which is written by University of Melbourne research fellow Dr Mark Norman, and taxonomist Dr Amanda Reid. Each species has a distribution map and identification notes summarising their main features. There is also a section illustrating cuttlebones.

A guide to squid, cuttlefish and octopuses of Australasia is intended for naturalists, divers, reef-walkers and anglers. It costs $29.95 and is available from CSIRO Publishing (see page 1 for contact details).



Scouring process yields the fertiliser that grew on sheep

Australian and overseas wool mills are set to benefit from a new processing technology that turns wool scouring waste into valuable byproducts.

The 'Sirolan SWIMS' (Scour Waste Integrated Management System) technology, developed by CSIRO Textile and Fibre Technology, removes the dirt, suint (sheep sweat) and 'wool wax' from wool during scouring or cleaning. These contaminants can then be recovered from wastewater and converted to valuable resources, including fertiliser and potting mix.

Dr Jock Christoe, from CSIRO Textile and Fibre Technology, says the major difference between Sirolan SWIMS ('Siro' from CSIRO and 'lanos' meaning wool) and conventional wool scouring operations, is that the wastewater generated is separated into three streams, rather than combined.

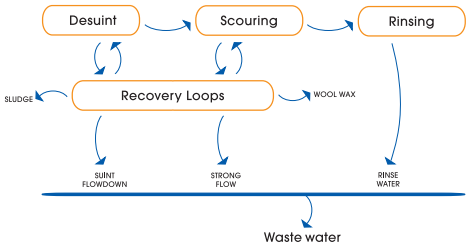
This feature enables wool mills to optimise the removal of scour contaminants from wastewater before its discharge to effluent treatment systems, reducing the environmental impact of the process. Converting these contaminants to byproducts such as fertiliser and potting mix adds value to the process.

'The normal practice for wastewater treatment is to combine all the streams from the scour and discharge to drains, which take it to the sewer or a wastewater treatment plant,' Christoe says. 'But we say it's far better to separate the streams and treat them with the appropriate technology, so you have a smaller, cleaner discharge and waste material that can be converted into a useful byproduct.'

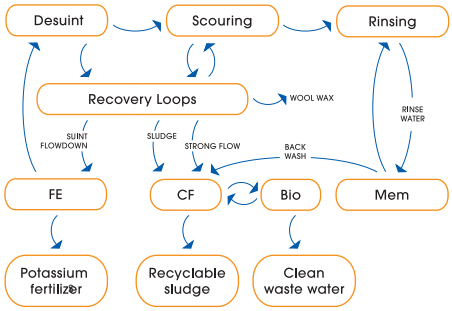
The first wastewater stream comes from a desuint 'bowl' or tank, where the wool is washed in water at room temperature. This process removes dirt and suint, which are recovered using 'recovery loops'.

'When you wash wool, you remove approximately 40% of its weight in dirt, suint and wool wax,' Christoe says. 'So you need recovery loops to prevent large amounts of these contaminants accumulating in the wash bowls.'

The dirt is recovered as a sludge which moves on to the next processing stage, while the suint, which is high in potassium, is recovered from the wastewater using a 'flash evaporator'. The flash evaporator converts the desuint flowdown into a potassium-rich liquid concentrate and clean, hot water, which can be recycled to the hot scouring bowls.



Conventional approach to waste-water treatment

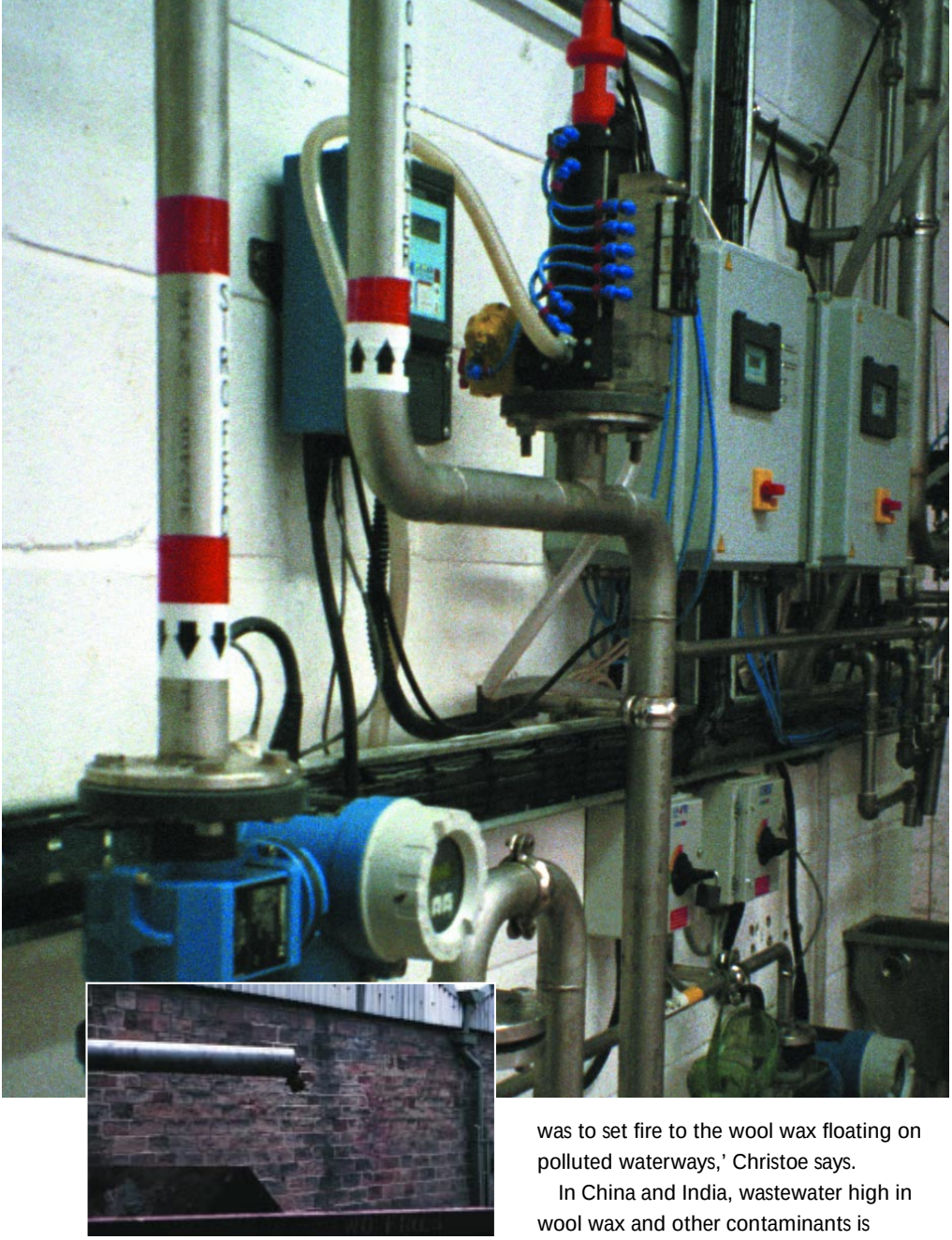


CSIRO Scour Waste Integrated Management System

As sheep remove about 10 000 tonnes of potassium from the land every year, it must be replaced by imported potassium fertiliser (muriate of potash), required for crop and pasture growth and flowering. Field tests conducted by CSIRO and the Victorian Department of Agriculture State Chemical Laboratory, have shown that the potassium concentrate from suint is as good if not better than muriate of potash in improving pasture crop yields

'Farmers may eventually buy this dissolved, organic potassium, which they can dilute and put on their crops,' Christoe says.

In the second stage of the scouring process, the wool passes through a number of hot (60°C) scouring bowls containing detergent. This emulsifies the wool wax, some of which can be recovered from the wastewater using a centrifuge and refined to lanolin at a later stage. Any remaining wool wax and dirt, as well as the sludge from the



The Sirolan SWIMS system separates wastewater into three streams, enabling wool mills to optimise the removal of scour contaminants before discharge to effluent treatment systems. The resulting sludge from dirt and wool wax meets all the requirements for a high grade potting mix or broadacre soil conditioner.

desuint bowl, become part of a 'strong' wastewater flow, which is treated using a novel CSIRO technology called 'Sirolan CF'.

Christoe says Sirolan CF (or, 'chemical flocculation'), is the cornerstone of the SWIMS process because it removes all the dirt and wool wax from the strong flow effluent and turns it into a recyclable sludge. This is important, as wool wax is a difficult material to treat and in the past has caused significant environmental pollution.

'In parts of England in the 19th Century, environmental pollution from scouring mills was so bad that one of the local past-times was to set fire to the wool wax floating on polluted waterways,' Christoe says.

In China and India, wastewater high in wool wax and other contaminants is discharged into rivers. However, a three-year ACIAR funded collaborative project between these countries and Australia, which aims to trial the Sirolan SWIMS and CF technologies, is expected to reduce the problem. 'SWIMS will enable China and India to treat their effluents and meet local discharge regulations,' Christoe says.

The Sirolan CF system works by 'flocculating' or clumping contaminants in the wastewater using a polymeric flocculent. The flocs settle to become a sludge containing about 20% wool wax, 40% dirt and 40% water.

Rather than discarding the sludge, which is costly, Christoe advocates treating it as a resource. In collaboration with EcoRecycle in Victoria, CSIRO has conducted composting trials with the sludge to determine its potential as compost and study the breakdown of wool wax, pesticides (from de-lousing treatment) and detergents during the composting process. Their experiments showed that sludge mixed with other materials, such as green waste, was very 'reactive', producing temperatures over 70°C in a day, enough to kill any pathogens and weed seeds and rapidly break down the sludge contaminants.

'The trials showed the sludge would be a good starter for materials that are difficult to compost,' Christoe says. 'And if you continue to compost it right down, it meets all the requirements for a high grade potting mix or broad acre soil conditioner'.

While the majority of contaminants are removed from the strong flow via Sirolan CF, the resulting sludge-free wastewater contains some dissolved organic material, which can be removed in a bioreactor tank. In this biological 'Sirolan CF-B' process, air is injected into the tank for two days, allowing naturally occurring microbes to break down the organic load. The end result is a biological sludge, which is combined with the CF sludge, and clean wastewater, which can be discharged.

In the final rinsing stage of wool processing, the relatively clean rinse water is recycled using a microfilter membrane, which removes tiny dirt particles. Clean water actually enters Sirolan SWIMS at the rinse stage and moves in a counter-current fashion to the scouring and desuint bowls.

The Sirolan CF process has been evaluated and adopted by a company in England, but the next step is to get the SWIMS technology working for countries such as China and India. Christoe says the technology will not only help these countries meet environmental regulations, it will also ensure sales of Australian wool to China and India are maintained.

'A major benefit to Australia will be the maintenance of or even an increase in wool sales to China and India,' he says. 'China buys about 30% of Australia's wool and India about 5%. This could triple by 2005.'

The Sirolan SWIMS technology was developed with funding from Australian Woolgrowers through the Woolmark company. Eco-Recycle Victoria funded the composting work, and Agriculture Victoria evaluated the composting product. Potting mix studies were conducted by the Burnley College of Horticulture. ACIAR is funding the work in China and India. The process has been licenced to the ADM (ANDAR) group, the world's principal supplier of wool scouring equipment.
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