Broad application for bioassay techniques

A bioassay test developed to help refine guidelines for new pulp mills in marine environments is also helping to gauge the impact of other resource industries on Australia's coastal waters

The test uses a highly sensitive Australian marine alga (*Nitzschia closterium*) to investigate the toxicity of complex effluents and of particular compounds they may contain.

It was developed by Jenny Stauber from the Lucas Heights laboratories of CSIRO's Centre for Advanced Analytical Chemistry (administered by the Division of Coal and Energy Technology). She has found that *Nitzschia*'s normal rate of growth slows down when the alga is incubated in a dilute solution of toxicants. She measures the growth rate by counting the number of algal cells in solution several times during a three-day incubation at 21°C. The slower the rate, the more toxic the sample.

Nitzschia has already been used to conduct bioassay tests of waste-water for Associated Pulp and Paper Mills Pty Ltd's Shoalhaven plant. These tests have applications outside the pulp and paper industry and look set to have broad commercial as well as government applications. Water authorities have used *Nitzschia* tests to determine the toxicity of power station effluent; CRA, Mt Isa Mines and Queensland Nickel have used them to test the toxicity of ore leachates.

Stauber is also co-ordinating the application of sensitive bioassay techniques using several different animals and plants to help determine toxicity of modern pulp mill effluents. These tests can give an indication of toxic effects in just a few days. Her work is part of a $10 million National Pulp Mills Research Program managed by CSIRO's Institute of Natural Resources and Environment. The program is investigating the application of modern pulping and bleaching technologies to eucalypts and the potential effects on our marine environment of effluents from mills which are using the latest technologies.

Strict guidelines

Australia now has strict guidelines to ensure that effluents from modern mills will not cause any immediate toxic effects, nor any known long-term effects. But most of these guidelines were based on information from the Northern Hemisphere, where the animals and plants that could be affected by mill effluent are different. Also, Northern Hemisphere woods produce effluents of a slightly different compostion than eucalypts.

The Kraft pulping process employs sodium hydroxide and sodium sulfide to break down lignin in eucalypt fibres so they can be processed into pulp. Because the pulp is highly coloured it must then be bleached, producing effluent that may have the potential to affect aquatic organisms in the marine environment into which the effluent is ultimately discharged.

A new mill in Australia will have to use the latest technology designed to keep environmental effects to a minimum. To put new bioassay tests through their paces with the sort of low toxicity effluent expected from a new mill, Stauber has enlisted help from other CSIRO divisions.

Peter Nelson at the Division of Forest Products synthesised some 'modern bleached Kraft effluent' from eucalypt woodchips in his laboratory. Annabelle Duncan at the Division of Chemicals and Polymers treated some of this effluent with the new processes she is developing to remove potentially toxic compounds. Adrian Wallis, also of the Division of Forest Products, chemically characterised these samples using the improved analytical tools he is developing to detect and measure the low levels of chlorophenols and other compounds in modern effluents.

Results of the *Nitzschia* and other bioassay testing of these synthetically-produced and treated effluents will help to develop toxicity and monitoring criteria for the revised and updated environmental guidelines next year.

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The bioassay test developed by Jenny Stauber is already being used by a number of resource industries.

More about bioassays

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