The 'colour' of pollution

Each week, Dr Rangnath Kulkarni of the CSIRO Division of Atmospheric Physics has been taking water samples from Mordialloc, Carrum, Frankston, and other beaches of Melbourne's Port Phillip Bay. He is evaluating an optical test that gauges the 'colour' of a water sample as seen by ultraviolet rays.

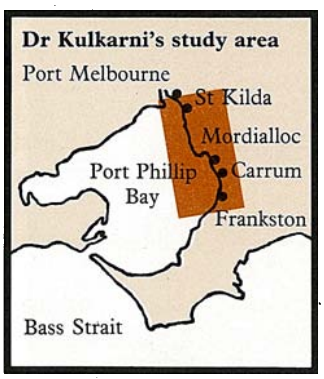
If proved reliable, the test may become a routine method for monitoring the total dissolved organic matter in the Bay. It is quick, avoiding long involved chemical techniques. A sample is simply filtered and placed in the beam of a spectrophotometer. The instrument measures the sample's absorption of ultraviolet light, which indicates the quantity of dissolved organic matter present (his Bay samples usually had less than 100 parts per million).

Anyone can roughly gauge the organic content of water by its colour: rating crystal-clear water highly and discoloured water poorly. In a similar way, the spectrophotometer can determine how transparent water is to ultraviolet light. The ultraviolet portion of the spectrum was chosen because it is strongly absorbed by dissolved organic material.

The idea that ultraviolet-absorption measurements will give a good guide to the presence of organic pollution in the sea originated with Japanese researchers in the late 1960s. It has also been used with some success in Norway and England.

Sea-water samples collected within the study area (see the map) showed a great variation in their ultraviolet absorption.

Beaches at Carrum, Frankston, and Port Melbourne were the most 'off-colour', a finding that ties in with results published by the Victorian Environment Protection Authority. Watercourses flow into the Bay at all these beaches; and land drainage seems to be the most important source of pollution. The clearest water came from areas between Mordialloc and St Kilda.



Samples were taken in Port Phillip Bay, both off-shore and close to the beach.

That the pollution comes mostly from surface water run-off is reinforced by the observation of seasonal variation in readings at Carrum. In winter, when more rain fell, absorption readings were also higher.

In all cases, as one might expect, Dr Kulkarni found peak absorption near the shore, the water becoming twice as clear within one kilometre out to sea. He took samples at various depths and found that his high readings seemed confined to a layer only about half a metre thick on the surface.

Dr Kulkarni speculates that, in the same way that dye shows water movement, the method may allow the movement of large masses of water to be traced. Perhaps turbulence, upwellings, and ocean currents could be located and their progression — vertically and horizontally — could be mapped.

However, at the moment Dr Kulkarni is concerned mainly with working out what the organic chemicals being detected really are, as this could explain some puzzling readings. For example, tap water at Aspendale has given readings as bad as the worst in the Bay. Yet the water in the reservoir it came from gave satisfactory readings. Perhaps an organic chemical — such as a synthetic hydrocarbon — entering the water somewhere in the reticulation system caused the high ultraviolet absorption.

In water taken from the Bay, Dr Kulkarni has found that nitrates and bromides contribute about half of the total absorption. But the remainder — a range of hydrocarbons — still need to be identified. Once that is done, he will know what the ultraviolet readings really show, and spurious readings produced by man-made contaminants can be pinpointed.

Ultraviolet absorption method applied to organic matter in sea water. R. N. Kulkarni. *Water, Air and Soil Pollution*, 1975, **5**, 231–7.