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New Terminology Required for Short-Term Static Fish Biossays: LC(I)50

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Short-term fish bioassay techniques fall into two main categories: static and continuous-flow. In static tests the solutions in the test containers are renewed daily, or not at all, during the test period. Continuous-flow tests include those where fresh solution is added either at frequent intervals (intermittent flow) or continuously to the test containers, giving a minimum solution volume replacement of 90 per cent in 8 to 12 hours (SPRAGUE 1969).

Because of their simplicity static tests are easy and inexpensive to carry out and are the method of choice for several national regulatory schemes. The object of the test is to define a 24, 48 or 96 hour LC50 for a chemical substance or effluent.

It is widely recognized, however, that in static test procedure the concentration of some test chemicals decreases during the test period. Biodegradation, chemical degradation (hydrolysis and photochemical changes), volatility, adsorption on to test-container surfaces, absorption by the test fish, and reaction with fish excretory products can lead in different degrees to a reduction in the concentration of active toxic substance. For example, the acute toxicity of lindane (gamma isomer of 1,2,3,4,5,6 - hexachlorocyclohexane) to roach (Rutilus rutilus L.) was measured by a static test procedure at this laboratory (TOOBY and DURBIN 1975). Analyses of the test solutions showed that only between 20 and 25 per cent of the initial concentration of lindane was present after 4 hours under the test conditions used.

Such problems can be overcome in most cases by the use of continuous-flow techniques and data from such tests may indicate a greater toxicity for some chemicals than would be obtained from static procedures.

However, it has been argued that where the hazard to fisheries from accidental spillage is being assessed the static test with decreasing test concentration gives the more relevant data, in that the concentration of spilled chemical in a watercourse will also decrease with time because of dilution and the other factors listed above. Furthermore, for evaluating such hazards an approximate indication only of the toxicity of the chemical to fish is required.

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It is becoming apparent that for such static test procedures the expression of the results in terms of LC50 is wrong. The term LC50 has been defined as "the concentration of a poison lethal to one half of a test population of fish" (EIFAC 1975). In the static tests referred to above the LC50 refers to the initial concentration to which the fish were exposed; the mean concentration to which they were exposed in practice is usually lower to an unknown extent. The term LC50 should correctly be used only for static tests if it can be shown by analysis of the test solution at the beginning and at the end of the test period (or before each change of test solution) that the concentration of active toxic substance was not reduced by more than a predetermined amount (for example, 10 per cent). The results of such analyses should be shown in the test report. In exceptional cases there may be chemical and physical data for the test substance which would indicate that the test concentrations would be unlikely to change during the test period.

Where fish bioassay data are submitted for registration there is in some cases, for example, the UK Pesticide Safety Precautions Scheme (MINISTRY OF AGRICULTURE, FISHERIES AND FOOD 1966), a critical examination of the test procedure and an assessment of the likely accuracy of the data obtained. This enables the LC50 data to be seen in their proper context. However, we understand that such a critical assessment is not always an integral part of a registration scheme.

As the generation of bioassay data increases the necessity for summarizing it in an easy retrievable form, either as a published list of chemicals with associated LC50 values or as a computerized data store, becomes more important. In these cases the LC50 values may be separated from the description of the test procedures and the chemical properties of the substance, whereby the validity of these values can be assessed, and in many cases where static test procedures have been used they therefore assume a spurious accuracy. This facilitates their use by the uninitiated to support ill-founded proposals, measures or conclusions. This applies to the storage of all data which have not been subject to a prior critical examination and validation.

We propose therefore as a partial solution to this growing problem that data derived from those static toxicity tests where the concentration of toxic chemical has not been shown to remain within 10 per cent of the initial concentration should be expressed as:

> LC(I)50, where C(I) is derived from the initial concentrations of the test solutions

The adoption of such terminology would go a considerable way towards facilitating the identification of data from static and continuous-flow bioassay techniques respectively and help to clarify discussion on their relative merits. It would also enable a more confident use of correct LC50 data.

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