

# ECOTOXICITY TESTING SERVICES

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**E**cotoxicity refers to the toxic effect of a chemical on the living environment, which includes animals and water organisms. The ecotoxicity values of a compound become significant when the compound is degraded very slowly or incompletely or is used in large quantities. Ecotoxicological data have to be known, in addition to an in-depth understanding of biodegradability for chemicals, which may reach surface waters (Guhl *et al.*, 1989).

Since most of the pollutants are found in water, and also for practical reasons such as ease of testing, aquatic organisms are used as a first indication of environmental effects of chemicals. The presence or absence of biological activity is a good indication of the ecotoxicological effect of pollutants released into the aquatic environment, and organisms such as bacteria, algae and fish are used in tests to determine biological activity (Davies, 1995).

Ecotoxicity testing is aimed at finding indications of the nature of the effects (qualitative screening) and at obtaining a first estimate of the concentration ranges within which these effects occur. Mortality, reproduction, assimilation and growth are the parameters, which can be measured reliably and routinely in currently available tests and which can be interpreted.

## THE IMPORTANCE OF ENVIRONMENTAL EVALUATION

The evaluation of the environmental compatibility of organic compounds is generally based on two crucial criteria, namely biodegradation and ecotoxicity. Nowadays, a product with an excellent performance and good economic prospect will no longer be sufficient if the ecological requirements are not fulfilled simultaneously.

Toxicity tests are necessary in evaluating water pollution, as chemical and physical tests alone are not sufficient to assess potential effects on aquatic biota. In European countries, acute toxicity testing using freshwater invertebrates is required to support (Bitton *et al.*, 1995):

- the registration of pesticide products intended for outdoor applications;
- the monitoring of effluents;
- the establishment of water quality criteria; and
- aquatic safety assessment for chemicals.

The ecotoxicity data can also be used in the preparation of material safety datasheet, registration of products, improving production process, *etc.*

## ACUTE TOXICITY TEST METHOD

The toxic effect of a substance to aquatic organisms can be divided into acute and chronic. Only the acute toxic effect will be measured in this laboratory.

Acute toxicity is usually defined as short-term lethal or other effect occurring within four days for fish and shorter times for smaller organisms (APHA, 1980). Acute effects are caused by a single exposure of the toxin and result in an immediate health effect, such as shock, unconsciousness, severe damage and even sudden death (Sax, 1984; Cunningham *et al.*, 1990).

The acute toxicity test is a test that is most commonly conducted to identify the effects of potentially toxic materials to aquatic organisms during short-term exposure. The objective of such test is to obtain an indication of the concentration of the substance that is likely to be hazardous to aquatic organisms. Fish is selected as the test organism in this testing because fish has been used more widely for toxicity tests than any other group of aquatic organisms (Gilbert *et al.*, 1984).

The test is carried in two stages (*Figure 1*). The first stage, the *range-finding test*, is conducted to enable the choice of the appropriate concentration range. It involves a wide range of concentrations of substance in logarithmic series. It is a short-term test that took about 24 hr to complete. The number of fish used for testing is also smaller than in the definitive test (5 fish/concentration). The concentration of substance that kills all the fish and the concentration that kills very few or no fish is used as the upper and lower concentration limits in the definitive test.

The test substance is then subjected to the *definitive test* (second stage) that uses at least five concentrations in a geometric series. The test takes 96 hr to complete and uses 10 fish for every concentration tested. Mortalities are recorded at 24, 48, 72 and 96 hr, and the concentrations that kill 50% of the fish ( $LC_{50}$ ) are determined.





Figure 1. Test chambers for ecotoxicity testing.

The LC<sub>50</sub> values may be a useful measure but they do not represent concentrations that are safe or harmless to aquatic habitats (APHA, 1980). They represent only a small fraction of long-term toxicity. For comparisons of the toxicities of different chemicals, the LC<sub>50</sub> values are used as a yardstick (Sax, 1984).

### ECOTOXICITY TESTING SERVICES

The laboratory to study the ecotoxicity of products (mainly palm-based products) has been set-up in AOTC, MPOB (Figure 2). The laboratory is well equipped to carry out routine ecotoxicity studies or testing and has been in operation since 1997. The tests employed in this laboratory are based on the OECD Guidelines for Testing of Chemicals (1992), i.e. the *OECD 203 Fish, Acute Toxicity Test*. Fishes commonly found in many rivers in Malaysia, *Tilapia nilotica* and *Common carp*, are used for the test.

The most important requirement for this test is the solubility of the test substance. The standard methods for testing and evaluation of ecotoxicity require that the test substance be soluble in water at the test concentration (OECD, 1992). This is important since only in this case the transfer of test results to practical environmental situations is possible.

The cost of the test is as indicated in *Table 1*.

The time required to perform the test and to prepare the final report in English is about 1.5 - 2 months after receipt



Figure 2. Laboratory for ecotoxicity testing.

TABLE 1. COST OF THE ECOTOXICITY TEST

| Test     | Description               | Cost/test |
|----------|---------------------------|-----------|
| OECD 203 | Fish, Acute Toxicity Test | RM 385    |

of sample. In order to perform the test, the safety data sheet (if any) and approximately 50 g of the substance are required.

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