

BIODEGRADATION AND DETERGENT SURFACTANTS

Biodegradation is the process whereby organic (i.e. carbon-containing) matter is decomposed by the action of micro-organisms present in the environment. The micro-organisms treat the organic substances as food; which is mainly (50-90%) utilised to provide the energy necessary to sustain life. The balance of the carbon content is used as building material for the microbial cell constituents like proteins, fats etc. Typically, the final products of the microbial degradation of organic substances are mineralisation products like carbon dioxide, water and mineral salts and newly formed biomass. The mineralisation of organic materials is associated with the consumption of oxygen. In the longer term, the microbial biomass will end up as mineralisation products, i.e. carbon dioxide, water and mineral salts.

Standard laboratory tests have been developed to assess how easily organic materials will biodegrade. These methods are internationally recognised and are used by environmental scientists and regulators world-wide. In such tests, the test substance is the sole source of organic carbon for the micro-organisms; which are generally obtained from a municipal waste-water treatment plant and which are used in very small quantity in the test procedure. The standard test methods incorporated into the new Draft EU Detergents Regulation belong to the group of "ready biodegradability tests" and evaluate the mineralisation of chemicals by the measurement of oxygen consumption or carbon dioxide production. Because of the limited test duration such tests do not allow measurement of the biodegraded moiety of the test substance which has been transformed to microbial biomass.

For the test methods proposed in the Detergents Regulation, there is international recognition that achievement of a threshold level of 60% of the theoretical oxygen consumption or carbon dioxide production in a 28-day period is indicative of a very high level of ultimate biodegradation, i.e. mineralisation and biomass production. For detergent surfactants, achievement of this 60% mineralisation pass level may be considered equivalent to an ultimate biodegradation extent in the region of 90%. It should be appreciated that the extent of primary biodegradation of such surfactants, measured as the removal of the parent chemical, is far above the 90% pass level stipulated in the existing Detergents Directives. Consequently, the 60% mineralisation requirement proposed in the Draft Regulation is far more demanding than the current 90% primary biodegradation requirement and, thus, provides a much enhanced level of environmental protection.

It is broadly recognised that the test conditions in these laboratory "ready biodegradability" tests are far more stringent than those found in waste-water treatment works. The typical half-life of a detergent surfactant in waste-water treatment works is a few hours and monitoring studies by Industry in conjunction with the Netherlands Government have shown surfactant removal to exceed 99% in practice.