Synergism Encyclopedia Article

Synergism

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Synergism

Synergism is a term used by toxicologists to describe the phenomenon in which a combination of **chemicals** has a toxic effect greater than the sum of its parts.

Malathion and Delnav are two **organophosphate** insecticides that were tested separately for the number of fish deaths they would cause at certain concentrations. When the two chemicals were combined, however, their toxicity was significantly greater than the individual tests would have led scientists to expect. The toxicity of the mixture, in such cases, is greater than the total toxicity of the individual chemicals.

In the manufacture of pesticides, toxic chemicals are deliberately combined to produce a synergistic effect, using an additive known as a "potentiator" or "synergist" to enhance the action of the basic active ingredient. Piperonyl butoxide, for example, is added to the insecticide rotenone to promote synergistic effects.

The study of unintended synergistic effects, however, is still in its early stages, and the majority of documented synergistic effects deal with toxicity to insects and fish. Laboratory studies on the effects of **copper** and **cadmium** on fish have established that synergistic interactions between multiple pollutants can have unanticipated effects. Both copper and cadmium are frequently released into the **environment** from a number of sources, without any precautions taken against possible synergistic impacts. Scientists speculate that there may be many similar occurrences of unpredicted and currently unknown synergistic toxicities operating in the environment.

Synergism has been cited as a reason to make environmental standards, such as the standards for **water quality**, more stringent. Current **water quality standards** for metals and organic compounds are derived from toxicological research on their individual effects on aquatic life. But pollutants discharged from a factory could meet all water quality standards and still harm aquatic life or humans because of synergistic interactions between compounds present in the **discharge** or in the receiving body of water. Many scientists have expressed reservations about current standards for individual chemicals and concern about the possible effects of synergism on the environment. But synergistic effects are difficult to isolate and prove under field conditions.

Resources

Books

Connell, D. W., and G. J. Miller. *Chemistry and Ecotoxicology of Pollution*. New York: Wiley, 1984.

Rand, G. M., and S. R. Petrocelli. *Fundamentals of Aquatic Toxicology*. Bristol, PA: Hemisphere Publishing Corporation, 1985.