J-3 Incorporated ***Report # 81899***

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SUBJECT: Degradation of the Components of SteriChelle Products.

The components of SteriChelle products do not persist in the environment. The time required for degradation is dependent on environmental factors (availability of light, moisture, biological systems, etc.). There are three components which require any discussion of degradation: surfactant, quaternary ammonium salts, and tributyl tin oxide.

Surfactant - The surfactant used in SteriChelle products complies with European regulations for safety and degradation. The rate at which the surfactant is broken down is the same as the rate at which simple sugars such as glucose and fructose are broken down by organisms.

A combination of moisture and sunlight results in environmental cleavage of the carbon to carbon bonds, as well as, the saturation of carbon's valences resulting in low molecular weight, non-toxic intermediaries. These intermediaries are integrated into biological systems and safely utilized as a source of energy.

Quaternary Ammonium Salts - Degradation of the quats are not as rapid as the surfactant. The quats are composed of central nitrogen atoms surrounded by four chains consisting of benzene rings, a carbon chain, and low molecular weight carbon moieties as branches from the carbons. Heat, ultra violet light, temperature, pH, and biological action, all act on the quaternary chains to produce a multitude of short-lived intermediaries.

Methyl, ethyl, propyl, etc. groups are easily cleaved from the aliphatic chains. These low molecular weight carbon compounds react with water, salts and acids or bases to form non-toxic organic acids and salts which can be utilized by both plant and animal life forms.

The benzene rings easily become sugar-like and are also food for microscopic and macroscopic life.

The aliphatic chains are cleaved to produce simple non-saturated long and short chain compounds that can also be utilized by macro and micro life forms.

Tributyl tin oxide - Degradation of tributyl tin oxide can take longer than SteriChelle's other components, depending on the environment.

In soil, TBTO does not leach. It binds tightly to soil particles and does not migrate. It is susceptible to sunlight, ultra violet, oxygen and heat, in the presence of which, degradation occurs rapidly.

Dealkylation and dearylation progresses rapidly when ultra violet is present or when oxygen and heat are present. Demethylations take place concurrently, removing the tin from the organic side chains resulting in inorganic tin. Microbial degradation follows a similar pathway, resulting in the release of tin and the breakdown of the carbon chains.

There are approximately 26 bonds in the butyl chains available for interaction with the environment. Breakdown intermediaries may be from 1 to 3 carbons in length. They may be alkanes, alkenes or even less saturated and may be aldehydes, ethers and other forms of carbons. All of these are readily degraded by light and microbial action.

Degradation in aerobic soil is much faster than in anaerobic soil. Degradation is also dependent on temperature and soil organisms.

All of the breakdown products are even less toxic than the TBTO and the end products of degradation are non-toxic organics and inorganic tin or tin salts.

In water, TBTO will bind to organic material and accumulate in the bottom sediment. The current literature reports half lives in freshwater from 6 to 25 days and in deep seawater up to 34 weeks. The rate of degradation is contingent on oxygen level, pH, light quality and temperature.

Conclusion: None of the components of SteriChelle products persist in the environment long enough to accumulate to levels that could negatively impact the environment.

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