4 Organotin Compounds

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Organotin compounds, such as tributyltin and triphenyltin, are tributyl or triphenyl derivatives of tetravalent tin. They are colorless solids with low vapor pressures, lipophilic, and are slightly water soluble. The derivatives can either be in the form of hydride, hydroxide, chloride, acetate or oxide as shown in Figure 4.1.

Tributyltin and triphenyltin have been extensively used as algicides and molluscicides in anti-fouling products since the 1960s. In the Philippines and other Southeast Asian countries, triphenyltin (brand names Aquatin, Brestan or Telostan) has long been used as a molluscicide in brackish water earthen ponds to control the population of pond snails Cerithidea cingulata in the culture of milkfish (Coloso et al., 1998). The use of organotins has been restricted in many countries including the Philippines because of their effects on aquatic organisms and persistence in the environment. These chemicals render the soil sterile, are non-biodegradable, bioaccumulate in fish and snails, and are hazardous to humans. They are harmful to various animal species by affecting the immune and reproductive systems, imposex, development of males sex organs in female gastropods, by increasing androgen levels (an endocrine disruptor), hyperplasia in endocrine organs, apoptosis in thymus cells, calcium release in sarcoplasmic reticulum cells, and the eyes. In humans, toxic effects experienced during spraying of triphenyltin formulations include brief loss of consciousness, headache, nausea, vomiting, photophobia, contact dermatitis, and allergic reactions (Sekizawa, 1999). Despite the ban, the clandestine use of triphenyltin in brackish water ponds continues to threaten the aquaculture industry, environment, and humans. High residues of triphenyltin have been found in pond sediments and soil as well as in milkfish tissues (intestine, liver and flesh) (Coloso and Borlongan, 1999).

To control the population of snails in brackish water ponds, the concept of integrated pest management has been proposed (Bagarinao and Lantin-Olaguer, 2000). Ponds should be completely drained, dried, and cracked under the sun to kill adult snails and eggs. Adult snails may be collected and gathered for shellcraft making. Snails remaining in puddles may be killed by alternative treatments such as metaldehyde and nicotine found in tobacco dust (Coloso et al., 1998; Borlongan et al., 1998, Borlongan et al., 1996). In heavily infested ponds, a dose of 120 kg/ha metaldehyde (10% formulation) under both wet and dry conditions is recommended. In moderately infested ponds, a dose of 80 kg/ha metaldehyde (10% formulation) and 120 kg/ha in dry and wet conditions, respectively, are recommended (Coloso et al., 1998). Furthermore, the 72-h LC99 of nicotine in tobacco dust was shown to be about 24 kg/ha nicotine under laboratory conditions. Tobacco dust contains about 2.8% nicotine and its effective application rate depends on the nicotine content (Borlongan et al. 1998). During pond preparation, the remaining snails can be eradicated by treatment with nitrogen fertilizers and lime. The entry of water into the ponds can be done when veliger counts are low.

Organotins have been included among banned pesticides in the Philippines, Brunei, and Singapore, but continue to be allowed in Indonesia, Thailand, and Vietnam (ASEAN Guidelines, in preparation). The illegal importation of triphenyltin into the Philippines has continued precisely because it is allowed and continues to be applied in ponds in neighboring countries. A uniform implementation of the ban in Southeast Asian countries and the ASEAN will be helpful in limiting the use of this chemical in aquaculture. In the Philippines, the ban on triphenyltin usage in milkfish ponds should be strictly implemented to reduce the threat of this pesticide to the environment, natural resources, aquaculture products, and people.

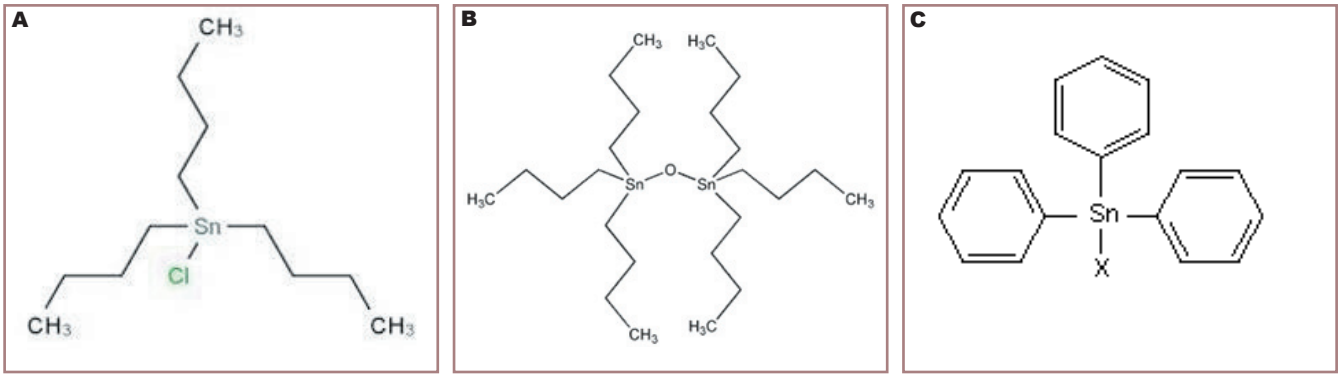

Figure 4.1. (A) Tributyltin chloride, (B) Tributyltin oxide, and C) Triphenyltin

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