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An Effective Method to Detect Tributyltin by Gas Chromatography-Mass Spectrometry Using Solid-Phase Micro-Extraction**Bandara K.R.V.¹, Chinthaka S.D.M.², Manage P.M.^{1*}**

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Abstract

A consequence of anthropogenic activities poses introduction of toxic chemicals such as organotin compounds and heavy metals into the environment. Organotin compounds and their derivatives are used in many industrial applications, Tributyltin (TBT) is one of the most toxic organotin compounds among them. Major application of organotin is its use as an antifouling agent on ship hulls, boat and ship bayou. TBT has been used since 1960 as paint additive to prevent adhesion of mollusks and algae on fishing boats and tools. TBT is highly persistent in the environment and its half-life is greater than 10 years. Therefore, environmental problems due to presence of TBT has become a serious concern on marine aquatic environment. TBT is highly lipophilic compound and adsorbs easily into the fat tissues in aquatic biota, following bioaccumulation to non-target organisms. TBT also shows androgenic activity that causes disruption of reproductive function in vertebrates as well as invertebrates. In present study, new quantification method for TBT was developed by derivatization, solid phase microextraction (SPME) followed by gas chromatography mass spectrometry (GC-MS) analysis. Medium polar SPME fiber was found to be the most appropriate for extraction and preconcentration. Tributyltin derivatization to tributyltinhydride was carried out by using potassium Borohydride (KBH₄) as hydride donor agent. Conditions such as extraction time, temperature and pH were optimized and best conditions were found to be 10 minutes extraction time, pH 5.4 and ambient (30° C) temperature. The best GC-SPME desorption temperature and desorption time were found to be 270° C and 10 minutes respectively. Pulsed spitless mode of GC injector is found to give better quantification than the split injection mode. The best helium carrier gas flow rate found to be 1 mLmin⁻¹. The minimum quantification level (MQL) was found to be 0.1 ngL⁻¹ and the minimum detection level (MDL) was calculated as 0.03 ngL⁻¹. The application of SPME is highly sensitive and eliminates the use of harmful solvents during sample extraction. Further, derivation with KBH₄ is simpler and largely reduces extraction steps. The developed method is a cost-effective and less time consuming method to access the TBT contamination status and is recorded as first such modified method in Sri Lanka.

Keywords: Tributyltin, Solid Phase Micro Extraction, Hybridisation, Gas Chromatography-Mass Spectrometry.