



Organotin Compounds

Other Names: Stannanes Tin organic compounds

CAS Number	Substance
Various	Dibutyltin (DBT)
Various	Diocetyl tin (DOT)
Various	Monobutyltin (MBT)

List continued in "Additional Information"

May Be Found In:

- PVC
- PU coatings
- Polyester
- Plastic trims
- Textiles
- Leather
- Screen prints
- In biocides and pesticides in textiles

Organotin Compounds (Stannanes) are substances composed of tin directly bound to different organic groups. The greatest application of mono-, di-, or tri-substituted organotins is in the apparel and footwear industry.

Uses in the Supply Chain

Organotin compounds are widely applied as pesticides or preservatives for wood, paper, textiles, leather, and glass in heat/light protection of PVC plastics. They are also used in antifouling paints and as catalysts in the production of polymeric materials, such as polyurethane (PU)-coated fabrics, or in plastisol prints, rubber, adhesives etc. They may also be used as biocides or preservatives in textiles, leathers and PU. The most common compounds include tetrabutyltin, tributyltin oxide, triphenyltin acetate, hydroxide, or chloride, azocyclotin, cyhexatin, tetraethyltin, triethyltin, and trimethyltin (TMT) chloride. Silicone-based finishes (e.g. for elastomeric properties and water repellency) may also contain organotins.¹

The most common application of organotins in apparel and footwear supply chains are likely for the production of plastic trims, as preservatives in screen prints, and for the production of PU-coated fabrics.¹ While tetraorganotins are very stable and demonstrate low toxicity, triorganotins are significantly more toxic. Tributyltin (TBT) and triphenyltin (TPhT) are the most common organotins used in the textile and apparel industry, while dibutyltin (DBT) is mainly used as a stabiliser in PVC applications and plastisol prints.

Why Organotin Compounds are Restricted

- Legislation in major markets around the world restricts the presence of organotins in final products.
- Some organotins are classified as very persistent, bioaccumulative, and toxic.
- Certain organotins can be toxic to aquatic life.
- Some organotins such as TMT, TET and TBT may act as immunotoxins.
- Certain organotin compounds are endocrine disruptors and are toxic to reproduction.^{1,2}
- Chemical hazard information for many chemicals can be found in the following external databases:
 - GESTIS Substance Database: [http://gestis-en.itrust.de/nxt/gateway.dll/gestis_en/000000.xml?f=templates\\$fn=default.htm\\$vid=gestiseng:sdbeng\\$3.0](http://gestis-en.itrust.de/nxt/gateway.dll/gestis_en/000000.xml?f=templates$fn=default.htm$vid=gestiseng:sdbeng$3.0)
 - US National Library of Medicine: <https://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB>
 - USA EPA Occupational Chemical Database: <https://www.osha.gov/chemicaldata/index.html>

Sourcing Compliant Materials from Your Suppliers

- Explain that you require materials to be compliant with current AFIRM RSL limits.⁴
- Request suppliers to submit a confirmation of material compliance and/or a test report from a third-party laboratory. When materials are received, consider performing random, risk-based testing to ensure current AFIRM RSL limits are met.
- Share this guidance sheet with your material suppliers. Using the guidance in the next section, instruct them to work with their chemical suppliers to source chemical formulations that comply with these requirements. If needed, highlight the existence of harmful substances in materials via chemical management trainings from the ZDHC Academy, existing guidelines, and laws.
- Pay special attention to:
 - Suppliers of PVC materials. Organotin are often used as stabilisers in PVC production.
 - PU materials, including PU and coatings, may contain organotin that are used as catalysts in PU production.
 - Self-cross-linking silicone or polyester polymers may contain organotin used as catalysts during production.
 - Leather and textiles treated with biocides for protection against mould may also contain organotin.
- Make sure all your suppliers have a solid chemical management system in place.

Sourcing Compliant Formulations from Your Chemical Formulators

- Explain to chemicals suppliers that you require chemical formulations to comply with current ZDHC MRSL limits.³
 - Search for formulations on the ZDHC Gateway Chemical Module. If your preferred formulations are not listed, encourage providers to register their formulations.
 - Ask for a ZDHC ChemCheck report.
- For all formulations, request SDS documentation to ensure none of the CAS Numbers above are listed as ingredients.
- Prior to procuring any formulation, its chemical properties must be reviewed to ensure proper protective equipment, chemical storage facilities, facility engineering controls, and associated treatment/disposal facilities are appropriate for the chemical(s).

Safer Alternatives

The following substances have been identified as examples of safer alternatives and may be suitable for your production needs. In general, any chosen alternative must be ZDHC MRSL compliant whenever applicable.

Calcium-zinc stabilisers may be used in the form of metal carboxylates and provide an alternative to the so-called liquid mixed metals (LMM), especially for flexible applications. These stabilisers are suitable for production of products with a high degree of clarity, good mechanical properties, excellent organoleptic properties, and good weatherability.

Organic-based stabilisers are calcium-zinc stabilisers wherein zinc is nearly or completely replaced with organic co-stabilisers. Benefits of these stabilisers include low migration, low odour, low VOC emissions, good initial colour, and excellent transparency.

Bismuth, titanate nanotubes (TNT) and titanium/zirconium catalysts can be used for PU production.

Titanate catalysts can be used for polyester production (material properties/aesthetics may change).

Additional Information

Impact assessment of potential restrictions on the marketing and use of certain organotin compounds

<http://publications.europa.eu/en/publication-detail/-/publication/424ac720-5954-4382-8f3b-5aff32170484>

Continued list of CAS Numbers and substance names from first page:

CAS Number	Substance
Various	Tributyltin (TBT)
Various	Triphenyltin (TPhT)
Various	All other trisubstituted organotin compounds

References

1 Hohenstein Institute & Textile Exchange. (2017). Chemical Snapshots – Organotin Compounds. Revision 0.2. Retrieved March 17, 2017.

2 European Commission Scientific Committee on Health and Environmental Risks (2006). Revised Assessment of the Risks to Health and the Environment Associated with the Use of the Four Organotin Compounds: TBT, DBT, DOT and TPT. Retrieved August 15, 2017, from http://ec.europa.eu/health/ph_risk/committees/04_scher/docs/scher_o_047.pdf.

3 Apparel and Footwear International RSL Management Group (Ed.). (2018, January 31). Restricted Substances List (Rep.). Retrieved <http://afirm-group.com/afirm-rsl/>.

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