Restricted Substances: HEAVY METALS

Introduction

The term 'heavy metals', is most commonly used to describe metallic elements of higher atomic mass that are toxic at low concentrations. These elements, such as cadmium and mercury, are toxic to the human body as they undergo bioaccumulation. This means that they are absorbed by the body at a faster rate than they can be removed, and, over a period of time, can cause chronic poisoning, even if the levels found in the environment are low. Other heavy metals, such as copper and zinc, are essential to bodily functions, but at higher levels they begin to alter metabolic processes and become toxic. Metals such as chromium only fit into this group when they change oxidation states, in this case when chromium III changes to the hexavalent oxidation state chromium VI, and becomes carcinogenic. The short term effects of heavy metal poisoning can range from skin irritation to vomiting, but high level exposure can cause anything from liver damage to renal failure. Legislation and due diligence ensure that these toxic metals are tested for in certain products, and that these products do not release heavy metals when disposed of, in order to limit their introduction into the environment and the food chain.

Background

Heavy metal analysis serves to identify and quantify the elements that are a potential hazard to the consumer after varying levels of contact. The heavy metals of particular interest (cadmium, Cd; mercury, Hg; lead, Pb; barium, Ba; chromium, Cr; antimony, Sb; selenium, Se and arsenic, As) can be extracted from a sample in a number of solutions, and the level of migrated elements can be detected after extraction using inductively coupled plasma-optical missions spectrometry (ICP-OES). This detection method involves exciting the atoms of the metal using electrons produced by argon plasma. These excited elements emit characteristic wavelengths according to their electron structure, which are then detected. The intensity of the wavelength emitted is directly proportional to the concentration of the element present in the extraction solution, and can be determined using standards of known concentrations.

With the introduction of recent US regulations on lead and other toxic metals there has been renewed interest in the use of hand held XRF instrumentation for assessing the content of heavy metals in consumer products. Whilst XRF is a useful technique for checking for the presence of lead and other heavy/toxic/allergenic metals within a due diligence programme, there can be some problems with its use on certain surfaces generating false positive results. Such anomalies could be related to complications because the component cannot be presented as a flat surface. Also in non- homogenous products, the limited penetration of the x-rays could result in irregular results. Such potential inconsistencies are demonstrated in the following table which describes wet chemistry data and XRF data for metal footwear components. For this reason it is recommended that wet chemistry (to provide a total metal result) is used as part of any safety compliance programme.

Sample	**Description of metal component**	**Wet Chemistry Result (lead ppm)**	**XRF Result (lead ppm)**
1	D ring	105	4100
2	D ring	72	5307
3	Buckle	197	9996
	Buckle barrel	362	10300
	Buckle tongue	306	14800
	Rivet	159	2054
4	Buckle	183	9330
	Buckle barrel	228	10300
	Buckle tongue	264	15900

BLC can provide support on toxic/heavy metals testing to CPSIA and Proposition 65 standards. In addition we can help with extractable metal tests and migratory standards such as EN71-3. BLC can also provide support with testing compliance programmes, diligence testing and testing of a comprehensive range of restricted chemicals. For further information contact Tori.

BLC members can access further information via the Information section of the BLC website - BLC Journal Jan/Feb 2008.

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