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Rubber process fumes components — Quantitative test methods

Constituant des fumées de procédé du caoutchouc — Méthodes d'essai quantitatives

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*.

Introduction

Rubber process fumes are emitted during the rubber manufacturing process. These rubber fumes have been the topic of many studies, for example ISO/TR 21275. ISO/TR 21275 gives a bibliographic study of 95 publications describing the compositions of fumes that could be emitted during the processing of rubber. The study also confirms that rubber fumes are a complex and variable mix of chemicals which have a wide range of possible sources and origins, including chemicals generated from the chemical reactions occurring in the rubber compounds during processing and curing. Some of these chemical substances can be hazardous. ISO/TR 21275 demonstrates the need for standardization of test methods to identify and quantify the hazardous chemicals to which the operators of the factories producing rubber articles may be exposed, allowing the identification and mitigation of potential health risks.

ISO/TS 17796 specifies a qualitative method (by thermodesorption – gas chromatography – mass spectrometry) for the identification of volatile components in rubber fumes, and is applicable to the screening of emissions from the processing of rubber compounds in the ambient workplace and storage environment. The document is an efficient tool for identifying hazardous substances contained in rubber process fumes.

If a hazardous component is identified in rubber fumes, then the most efficient way to eliminate risk for the operators is to substitute the substance or the process which generates the hazardous component.

In cases where there is no substitute, then the risk can be reduced by controlling the exposure of the operators to the hazardous component. Test methods are therefore necessary to quantify each hazardous substance.

Table 1 provides an overview of the diverse range of rubber components made from general manufacturing processes and dipped latex technology. The list of components is by no means exhaustive but helps to highlight the diverse areas and products in which rubber is used.

Table 1 — Range of rubber components

Types of products	Examples
Tyres	Passenger cars, trucks, racing vehicles, cycles, off-road tyres, inner tubes, curing bladders
Conveyor /transmission belting	Steel cord conveyor belting, repair material for conveyor belting, scrapers, mining conveyors, V-belts, flat belts, synchronous belts
Industrial hoses	Water hoses, high pressure hoses, welding hoses, hydraulic hoses, spiral hoses, offshore hoses, oil hoses, chemical hoses
Automotive products	Coolant hoses, fuel hoses, seals and gaskets, anti-vibration mounts, hydraulic hoses, fuel injectors, timing belts, window and door channelling, transmission and engine components, wiper blades, exhaust hangers
General mouldings/sheeting	Moulded seals and gaskets, anti-vibration products, floor coverings, sheeting, tube rings, roofing layers, subsoil water sheeting, roller coverings, protection linings, moulded micro-cellular products, composite profiles, rubberized fabric, micro-cellular rubbers/profiles, wire and cable jackets and insulations, glass sealants, pump impellors, roof membranes, pond liners, rail mounts, bridge bearings, military vehicle track pads
Medical/pharmaceutical products	Surgical gloves, medical tubing, MDI valve gaskets, catheters, dialysis products, surgical implants, prostheses, contraceptives, soothers, baby feeding teats and breast caps, blood transfusion tubing and valves, medical and antistatic sheeting and membranes, masks and respirators
Clothing	Boots/footwear, protective suits, household gloves, industrial gloves, footwear/boot heels and soling, cellular rubber soles, wet suits, diving suits, coated fabrics, sports footwear and clothing

Table 1 *(continued)*

Types of products	Examples
Food contact products	Food transportation (e.g. conveyer belts, hoses and tubing), food handling (gloves), pipe and machinery components (seals, gaskets, flexible connectors and diaphragm/ butterfly valves), pumping system components (e.g. progressive cavity pumps stators, diaphragm pumps), plate heat exchanger gaskets, seals/gaskets for cans, bottles and closures
Potable water products	Pipe seals and gaskets, hoses, linings of pumps and valves, tap washers, membranes in pipes and filters, coatings on process plant, tank linings
Miscellaneous products	Adhesives, rubberised asphalt, high vacuum and radiation components, carpet backing, latex thread, sealants and caulking, toys

The rubber material used to make any particular product is not a single entity but is a complex compounded material referred to as a "compound" or "formulation", which can contain a large number of essential chemical ingredients. These ingredients include the base rubber polymer(s), reinforcing and non-reinforcing particulate fillers, process oils, vulcanizing agents, protective agents, process aids, etc. (all of which are available in many types and grades from many suppliers and can be included at different levels). The company or individual that designs a rubber formulation for a specific product has a vast number of ingredients to choose from and many formulations are therefore possible for a specific rubber product.

The processing route by which the majority of rubber components are manufactured includes mixing the ingredients together in a controlled manner to produce a rubber "compound" or "mix", shaping of the mixed compound to give the desired shape or form, then "vulcanizing" (also known as "cross-linking" and "curing") the compound to convert it to a condition where it has permanent properties and shape.

Rubber process fumes components — Quantitative test methods

1 Scope

This document gives guidance on the quantitative test methods to measure chemical components in fumes emitted during the manufacturing process of rubbers (including storage) and considered hazardous.

NOTE Quantification of the level of exposure allows selection of the correct type of protection for the operators and, after implementation of the protection, verification that the risk was eliminated by implementation of the selected protection.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

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rubber process fumes
variety of volatile substances emitted from rubber compounds into a workplace atmosphere as a result of industrial processing, the composition of which depends on the formulation of the compounds concerned, the process technology in use and the associated process parameters

4 General

The list of the hazardous substances which can exist in rubber fumes is established by using the results obtained by ISO/TS 17796 and also by the work done by rubber industries and others, regarding chemical reactions appearing during the process of the rubber. ISO/TR 21275 gives many examples.

NOTE 1 The study given in ISO/TR 21275 compiles and reviews published data with respect to rubber fumes emissions in the workplace. ISO/TS 17796 gives a method for the identification of volatile components in rubber fumes, and is applicable for a screening of emissions from the processing of rubber compounds in the ambient workplace and storage environment.

Many producers of rubber articles use their own techniques to determine the amount of hazardous substances in rubber fumes. Generally, those methods are based on individual internal development and/or on studies published by external laboratories. A standardized technique (including sampling) for the determination of the amount of hazardous substances in various rubber fumes is becoming increasingly important and is the logical complement to ISO/TS 17796.

The process is described in three steps:

a) identification of the hazardous substances which may be present in rubber process fumes;