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

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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 impellers, 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.

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