First edition
2003-07-15

Environmental tobacco smoke — Determination of vapour phase nicotine and 3-ethenylpyridine in air — Gas-chromatographic method

Fumée de tabac ambiante — Dosage de la nicotine et de la 3-éthénylpyridine en phase vapeur dans l'air — Méthode par chromatographie en phase gazeuse

Reference number
ISO 18145:2003(E)

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Published in Switzerland

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Foreword

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ISO 18145 was prepared by Technical Committee ISO/TC 126, *Tobacco and tobacco products*.

Introduction

Nicotine and 3-ethenylpyridine (3-EP) are commonly used tracers for environmental tobacco smoke (ETS). Nicotine and 3-EP are highly selective for tobacco smoke and both have been used as markers of ETS in indoor air. Among the attributes of an ideal ETS tracer is the need to be unique or highly specific to tobacco smoke in sufficient concentrations in air to be measured easily at realistic smoking rates, and in constant proportion to the other components of ETS for a variety of tobacco blends and environmental conditions (see [1]). While nicotine is the more commonly used marker, it is not an ideal marker for several reasons, most notable of which are its adsorptive tendencies and unpredictable decay rate. A measure of the nicotine concentrations may underestimate ETS during smoke generation, due to the ability of nicotine to be adsorbed on building materials and room furnishings, therefore being depleted from the ETS at a rate faster than most other components. On the other hand, an overestimation of ETS may result from the slow desorption of nicotine over time. Nicotine concentration measurements are a strong indication that smoking has occurred. However, nicotine concentrations do not necessarily indicate the presence or concentration of any other ETS components. In contrast, 3-EP has been shown to track the vapour phase of ETS as measured by CO and FID (flame ionization detector) response exactly (see [2]). Due to this correlation, 3-EP may be a better tracer for ETS (see [3], [4], [5], [6], [7]).

High concentrations of ETS have become a concern for potential health effects due to the annoyance and irritation experienced by individuals. Therefore, a need to establish reliable estimation methods of ETS levels is a priority. Although not related to ETS, a workplace threshold limit value (TLV) for nicotine has been set by the National Institute for Occupational Safety and Health (NIOSH) in the United States at 0,5 mg/m^3. For various indoor environments, observed nicotine concentrations can range from not detected (ND) to about 70 $\mu g/m^3$, with values usually at the lower end of this range (see [8], [9]). Due to the low concentrations typically found for nicotine, more sophisticated analytical procedures and equipment are often required for quantification in indoor air. Other methods have also been reported for the determination of nicotine in indoor air (see [10], [11], [12], [13], [14]).

Approximately 95 % of ETS nicotine is found in the vapour phase of the aerosol and it can be efficiently collected by air sampling using sorbent tubes. Early studies indicate that not all of freshly generated ETS particulate phase is trapped on sorbent resin (see [11], [15]). The trapping of particulate matter by sorbent beds has been suggested by another report to be nearly quantitative (see [16]). 3-Ethenylpyridine concentrations in real-world environments are usually one-third that of nicotine and are found exclusively in the vapour phase (see [10], [17]). This method has been used in a variety of real-world ETS studies (see [9], [18], [19]).