

BRIEF COMMUNICATION

NITROSAMINES IN RUBBER BANDS USED FOR
ORTHODONTIC PURPOSES

Abstract—Fourteen samples from eight brands of elastic-rubber bands used in orthodontics were tested for their nitrosamine content. The presence of *N*-nitrosodibutylamine and *N*-nitrosopiperidine was confirmed. The potential for nitrosamine formation from accelerating agents used for vulcanization and from other nitrosatable amines, which may be present in rubber exposed to salivary nitrite, justifies further investigations.

Our laboratory is currently studying the formation of *N*-nitrosamines in hams processed with elastic-rubber nettings since previous work by Canadian researchers (Sen *et al.*, 1987 and 1988) has revealed the presence of *N*-nitrosodibutylamine (NDBA), *N*-nitrosodiethylamine (NDEA) and *N*-nitrosodibenzylamine (NDBZA) in netted cured-meat products. One of us (WF) recently observed family members and others wearing rubber bands in connection with dental braces, and wondered whether these bands might also contain nitrosamines. We carried out a limited survey (14 samples) of eight different commercial brands of rubber bands of different sizes (0.5–1.9 cm). They were analysed for volatile nitrosamines (not NDBZA) by a technique commonly used for rubber products, that is (soaking overnight (18 hr) in methylene chloride, filtration, followed by clean-up on silica gel and concentration; Fazio and Sherma, 1987; Harvey and Fazio, 1982). Separation and quantitation of the nitrosamines were done by gas chromatography/Thermal energy analyser (GC/TEA). Solvent and reagent blanks indicated no evidence of nitrosamine contamination, carry-over or formation of artefacts. All 14 samples exceeded the violative level (10 µg/kg) previously set for rubber nipples (Hile, 1984), having detectable levels of NDBA ranging from 11.7 to 166.0 µg/kg; 12 had levels of *N*-nitrosopiperidine (NPIP) ranging from 6.1 to 129.9 µg/kg; one had 5.8 µg NDEA/kg; and three had *N*-nitrosodimethylamine (NDMA) at 2.8 to 3.9 µg/kg. The samples containing NDMA also had the highest levels of NDBA and NPIP. Interestingly, a significant amount of the fluorescent colour was also leached out of

one brand into methylene chloride in addition to the high levels of nitrosamines. NDBA, NPIP, NDMA and NDEA are well known animal carcinogens (Druckrey *et al.*, 1967). Four samples from three brands of elastic-rubber spacers (3 mm diameter), used by orthodontists, were also tested for 10 volatile nitrosamines; none of these nitrosamines was detected (0.2–1.0 µg/kg was the minimum level of detection depending on the nitrosamine). Initial confirmation of both NDBA and NPIP was performed by a UV photolysis technique described by Doerr and Fiddler (1977). Confirmation of the identity of these two nitrosamines was accomplished by mass spectrometry. It is recognized that, by analogy to the situation with baby rubber nipples and pacifiers, preformed nitrosamine contaminants may represent only a small part of the total exposure to nitrosamines from these rubber bands (Castegnaro *et al.*, 1987; Ellen and Sahertian, 1987; Osterdahl and Slorach, 1983; Spiegelhalter and Preussmann, 1982; Thompson *et al.*, 1984; Westin, 1990). The potential for nitrosamine formation from accelerating agents used for vulcanization and from other nitrosatable amines that may be present in rubber exposed to salivary nitrite is therefore of sufficient concern to justify further investigations.

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Abbreviations: GC/TEA = gas chromatography/thermal energy analyser; NDBA = *N*-nitrosodibutylamine; NDBZA = *N*-nitrosodibenzylamine; NDEA = *N*-nitrosodiethylamine; NDMA = *N*-nitrosodimethylamine; NPIP = *N*-nitrosopiperidine.

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