

## Quantitative assessment of diethylthiourea exposure in two cases of occupational allergic contact dermatitis

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Neoprene is rubber made of polymerized chloroprene (1), chloroprene having been first discovered in 1931 (2–4). In the production of neoprene, thioureas are added as accelerators in the vulcanization process (Fig. 1) (5). Earlier animal studies have classified diethylthiourea as a weak to mild contact allergen (6, 7). A recent large Finnish study showed that contact allergy to the thioureas might be more frequent than previously thought, as 59 of 15 100 (0.39%) patients tested gave a positive patch test result with a thiourea mix (8).

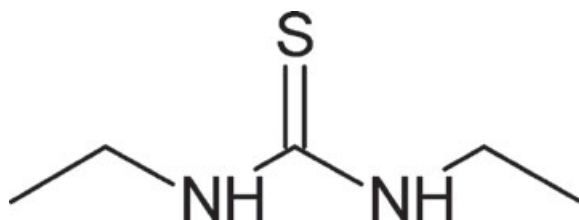


Fig. 1. The chemical structure of diethylthiourea (CAS: 105-55-5).

We have performed quantitative exposure assessments in two recent cases concerning a pair of running shoes and a pair of neoprene gloves.

### Case 1

A 22-year-old male professional soldier, who had earlier been exposed to a neoprene wet suit during diving training, developed severe contact dermatitis on his feet after 1 day of use of a pair of neoprene running shoes (Fig. 2). The dermatitis spread to the hands.

He was patch tested with the European standard series, rubber series, shoe series, and his own running shoes. Patch testing was performed with Finn Chambers® (8 mm; Epitest Ltd, Oy, Finland) on Scanpor® tape (Norgesplaster A/S, Alfarma, Vennesla, Norway). The patch tests were applied to the upper back and were occluded for 2 days. Readings were performed on D2, D3, and D7, according to the recommendations of the International Contact Dermatitis Research Group (9). There were positive reactions to dimethyl fumarate (maximum ++), diethylthiourea (maximum ++), and to



Fig. 2. Acute reaction to diethylthiourea from a pair of neoprene running shoes.

the neoprene part of the shoes (maximum ++). No other positive reactions were seen. The shoes were analysed at the National Environmental Research Institute for dimethyl fumarate and diethylthiourea, with the use of high-performance liquid chromatography, ultraviolet spectroscopy, and–mass spectrometry. Two grams of the rubber part of the shoe was extracted with acetone and treated with ultrasound, and was then evaporated to dryness under N<sub>2</sub> and dissolved in acetonitrile. The probe was filtered before being analysed. The content of diethylthiourea in the shoes was 192–251 ppm. Dimethyl fumarate was not detected, and there was no indication in the patient's history about the source of sensitization to dimethyl fumarate.

### Case 2

A 44-year-old male electrician developed severe contact dermatitis on both hands after approximately 3 days of work where he wore a pair of neoprene gloves because of cold weather. He had previously been exposed to neoprene arm supports when playing hand ball, but did not recall any rash.

He was tested with the European baseline series, an additional rubber series, and his own gloves, and he was also prick tested with natural rubber latex. Patch testing and reading was performed as in case 1. There were positive reactions to diethylthiourea (maximum ++) and to the gloves (maximum +?). No other positive reactions were seen. The gloves were analysed similarly as for case 1. The content of diethylthiourea in the gloves was 76–77 ppm.

### Discussion

In a recent Finnish study, 24 of 59 patients with contact allergy to a thiourea mixture also reacted to diethylthiourea on patch testing (8). In this study, the most common probable sources of sensitization to thioureas were knee braces, footwear, and various items of sports and fishing equipment. Only in 5 cases were positive reactions seen to their own materials. In 1 case, the eczema was occupation-related, being caused by the rubber from the handle of the patient's cleaning trolley. In our 2 cases, we found footwear and gloves used in an occupational context to be the cause of the contact allergic reaction. Over the last year, we have diagnosed 2 further cases of non-occupational diethylthiourea contact allergy. This may mean that neoprene products

containing thioureas have become popular. Monitoring of thiourea contact allergy should be considered. It will also be important to have quantitative information regarding exposure. In our 2 cases, the concentrations of diethylthiourea in the products were 192–251 ppm (running

shoes) and 76–77 ppm (working gloves). These are probably elicitation levels, as the patients reacted after 1 and 4 days of contact with the products. Whether these levels are elicitation concentrations representative of neoprene products will have to be determined in future studies.

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