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# Textile contact dermatitis caused by octylisothiazolinone in compression stockings

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doi:10.1111/cod.12959

**Key words:** allergic contact dermatitis; biocides; CAS no. 26530-20-1; case report; compression stockings; octylisothiazolinone; preservative; textile; triclosan.

Textile contact dermatitis is mainly described as being caused by textile dyes and textile finishing resins (1). Here, we report a case of allergic contact dermatitis (ACD) caused by a biocide in compression stockings.

## Case Report

A 38-year-old software engineer with systemic sclerosis for 4 years had been treated for leg ulcers. After using black compression stockings (Jobst® forMen; BSN Medical, Charlotte, NC, USA) for a month, he developed dermatitis confined to the area of the calves and feet covered by the stockings. The dermatitis healed when he stopped using the stockings, and was treated with ordinary compression bandaging. The dermatitis recurred 6 months later when he once more tried to use the same stockings. The dermatitis once again resolved when he stopped using the stockings.

Patch tests were applied on the back with 8-mm Finn Chambers® (Smart Practice, Phoenix, AZ, USA), and fixation with Scanpor® tape (Norgesplaster, Venesla, Norway). Patch test preparations were supplied by Chemotechnique Diagnostics (Vellinge, Sweden). Patch tests [application time of 48 h; readings on day (D) 3 and D7 (2)] with the baseline series used at the department and the textile dye series gave negative results. A patch test with the stocking 'as is' showed a positive reaction (++), as did a patch test with an acetone extract of the stocking (+) on D3. Product information on the stockings stated 'special formula fights odor by inhibiting growth of fungi and bacteria on the socks' (3). This led us to perform an

analysis of the stockings with gas chromatography–mass spectrometry (GS-MS) (4), which indicated the presence of octylisothiazolinone (OIT) (CAS no. 26530-20-1).

Supplementary patch testing with two OIT preparations available at the department at the time of the consultation showed positive reactions to 0.1% OIT in pet. (+++) and 0.05% OIT in eth. (++) on D3. Tests with methylisothiazolinone (MI), methylchlorisothiazolinone (MCI) and benzisothiazolinone (BIT) all gave negative results.

The amount of OIT in the stockings was determined with high-performance liquid chromatography (HPLC). In addition to the used pair of stockings brought in by the patient, we also analysed four different new stockings bought from the same manufacturer: Jobst® forMen, Jobst® forMen Casual, Jobst® forMen Ambition, and Jobst® forMen Explore. Approximately 5 g (120 cm<sup>2</sup>) of each stocking was extracted in 100 ml of 99.5% eth. (Kemetyl, Haninge, Sweden) in an ultrasonic bath for 5 min. The pieces of the stockings were then removed, and the eth. was evaporated by use of a rotary evaporator. The residue was dissolved in 1 ml of a 50:50 (vol/vol) mixture of acetonitrile (VWR International, Fontenay-sous-Bois, France) and aq. The extracts of the different stockings were then filtered and diluted 10–50 times with the same solvent mixture before being injected into the HPLC system.

The HPLC system consisted of a P4000 quaternary pump, a UV6000 diode array detector, and an AS3000 auto injector (ThermoFinnigan, San José, CA, USA). The system was software-controlled with Chromeleon 7 (Fisher Scientific, Gothenburg, Sweden). The column used was a Kromasil C18 (4.6 mm internal diameter × 250 mm, 5 µm, 100 Å Akzo Nobel, Bohus, Sweden). The analysis was performed by gradient elution with mobile phases A [acetonitrile/water 50:50 (vol/vol)] and B (100% acetonitrile). The gradient started at 0% B

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Conflicts of interest: The authors declare no conflict of interests.

(100% A), was then increased to 100% B over a period of 12 min, and was then kept at 100% B for 5 min. The flow rate was 1.0 ml/min, and the injection volume was 20 µl. The detector was operated in the 190–800-nm range, and the chromatograms recorded at 280 nm were used for quantification of OIT. Dilutions of OIT (> 98.0%; Tokyo Chemical Industry Co., Ltd, Tokyo, Japan) in mobile phase A were used as calibration standards. The identity of OIT was determined from the retention time and the ultraviolet (UV) spectrum. The detection limit was 0.01 µg/g of fabric.

The HPLC analysis showed the presence of OIT in both the new and the used samples of Jobst® forMen (350 and 20 µg/g, respectively) and in Jobst® forMen Casual (56 µg/g). No OIT was found in Jobst® forMen Explore or Jobst® forMen Ambition.

GC-MS analysis of eth. extracts of the four new stockings confirmed the presence of OIT in Jobst® forMen and Jobst® forMen Casual. In addition, the analyses also strongly indicated the presence of triclosan in these two stockings. No OIT or triclosan was found in Jobst® forMen Ambition or Jobst® forMen Explore. Supplementary triclosan patch testing of the patient gave negative results.

In parallel with the chemical investigations, the Swedish distributor of Jobst stockings was contacted, and the company confirmed that a biocidal product containing OIT and triclosan had earlier been used in Jobst® forMen. However, this product is no longer used in the production of the stockings, and more recent batches of Jobst® forMen should be free of OIT and triclosan.

## Discussion

Contact allergy to OIT has mainly been attributed to occupational exposure in cutting fluids, water-based paints,

and glues (5, 6). Non-occupational exposure includes OIT in leather products such as shoes and furniture (5–8). Textile-related occupational ACD caused by OIT has been reported in a textile worker (5) and in a sewing machine operator handling mattresses containing OIT (6). Furthermore, ACD caused by OIT in a mattress gel-sheet used for cooling has been reported in a consumer (9). In textiles, biocides are used for protection during manufacture or transport, as well as to inhibit malodour, especially in sports products. Various biocides in textile have been reported, including triclosan, zinc pyrithione, MCI/MI, dichlorooctylisothiazolinone, dimethyl fumarate, and silver particles (10–12). Concomitant test reactions to MI and OIT, or occasionally BIT and OIT, have been described, and the possibility of cross-allergic reactions has been discussed (13–18). In the present case, however, there were no concomitant reactions to either MI, BIT, or MCI. During the first weeks of use, the patient did not experience any dermatitis. Thus, it is likely that he was sensitized by the use of the stockings. In European regulations, OIT is not allowed in cosmetic products, owing to the risk of sensitization. However, the use of stockings involves prolonged skin contact, and is thus comparable to the use of leave-on cosmetic products. In conclusion, aimed testing with isothiazolinone derivatives other than MCI and MI is indicated or should be considered when contact allergy to a textile is found or suspected.

## Acknowledgements

We thank Dr Annika Steinman, Department of Dermatology, Helsingborg for help with supplementary patch testing with triclosan.

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