

Allergic contact dermatitis caused by the preservative 4,5-dichloro-2-n-octyl-4-isothiazolin-3-one in black trousers

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Approximately 60 000 pairs of Chinese wholesale trousers were imported and sold by one of the biggest supermarket stores in Japan from February to June 2015. The sale of the trousers was stopped because of multiple claims of dermatitis. We had a chance to examine one such patient, and we identified the causative chemical. An irritating and sensitizing preservative chemical,



Fig. 1. The patient suffered from oedematous reddish erythema on the abdominal region and lower limbs, except for the area covered by underwear.

4,5-dichloro-2-n-octyl-4-isothiazolin-3-one (DCOIT) (CAS no. 64359-81-5), was detected in the trousers.

Case Report

A 42-year-old woman was referred for evaluation of an eruption on the lower abdomen and legs. She had worn a new pair of black trousers for 2 days. One week later, itchy edematous erythema appeared on the lower abdominal region and the lower limbs, avoiding the area covered by underwear (Fig. 1). Peripheral eosinophils were elevated to 22% (normal range: 0.2–6.8%). The eruptions were successfully treated with oral administration of prednisolone (15 mg/day), and topical application of a steroid ointment, leaving post-inflammatory hyperpigmentation. A skin biopsy revealed spongiosis and superficial perivascular dermatitis with an inflammatory cell infiltrate of lymphocytes and neutrophils. Product patch tests showed a positive reaction to the black trousers. Gas chromatography–mass spectrometry (GC/MS) (performed with JMS-700 MStation; JEOL Ltd, Tokyo, Japan) of the eluent solution of the trousers showed two chemicals, DCOIT and 5-chloro-2-(2,4-dichlorophenoxy)phenol (Triclosan).

Table 1. The patient's test results: D2 and D3 readings (ICDRG criteria)

Test substance	Concentration and vehicle	D2	D3
DCOIT	0.1% pet.	+	++
DCOIT	0.05% pet.	+	+
DCOIT	0.01% pet.	–	–
DCOIT	0.001% pet.	–	–
Triclosan	0.5% pet.	–	–
Triclosan	0.05% pet.	–	–
OIT	0.1% pet.	+	+
MI	0.2% aq.	–	–
MCI	0.01% aq.	–	–
Mixture 3:1 MCI/MI	0.01% aq.	–	–
Disperse Blue 124	1.0% pet.	–	–
Disperse blue 124	0.5% pet.	–	–
Disperse Blue 106	1.0% pet.	–	–
Disperse Blue 106	0.5% pet.	–	–
PPD	1% pet.	–	–
Petrolatum	'as is'	–	–

DCOIT, 4,5-dichloro-2-n-octyl-4-isothiazolin-3-one, CAS no. 64359-81-5, 98.0% [gas chromatography (GC)], Tokyo Chemical Industry Co., Ltd, Tokyo, Japan; MCI, 5-chloro-2-methyl-4-isothiazolin-3-one, CAS no. 26172-55-4, the product of ProClin 200 (MI 0.39%, MCI 1.20%), Sigma-Aldrich, MO, USA, purified by high-performance liquid chromatography; MI, 2-methyl-4-isothiazolin-3-one, CAS no. 2682-20-4, analytical standard 98.0% (GC), Sigma-Aldrich, St. Louis, MO, USA; OIT, 2-octyl-isothiazol-3-one, CAS no. 26530-20-1, 98.0% (GC), Tokyo Chemical Industry, Tokyo Japan; Triclosan, 5-chloro-2-(2,4-dichlorophenoxy)phenol; PPD, *p*-phenylenediamine.

Patch testing was performed with Finn Chambers® (diameter 8 mm) (Epitest Oy, Tuusula Finland) covered with Scanpor® tape (Norgesplaster, Vennesla, Norway). Readings were performed on day (D)2 and D3, according to ICDRG criteria (Table 1). Positive reactions (++) were observed to DCOIT 0.1%, with weak positive reactions (+) to DCOIT 0.05% and 2-octyl-isothiazol-3-one (OIT) 0.1% on D3. As the trousers contained 0.1% DCOIT, the maximum patch test concentration of the DCOIT was set at 0.1%.

Discussion

To our knowledge, this is the first report of allergic dermatitis caused by DCOIT in clothing. DCOIT is strongly irritating to the skin, and should not be used in products intended for skin contact (1). Furthermore, DCOIT is a sensitizing material, according to animal experiments (2). Occupational contact dermatitis caused by DCOIT in a Japanese textile finishing factory was reported in 1993

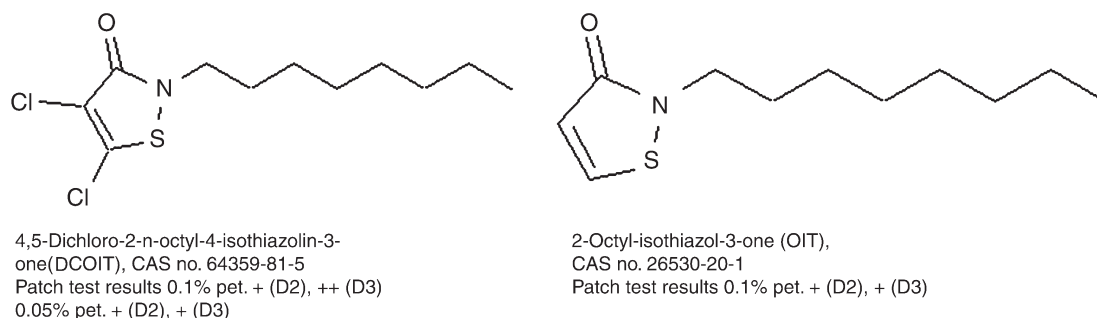


Fig. 2. Molecular formula of DCOIT and OIT, respectively.

(3). The patient in our case had a cross-reaction between DCOIT and OIT, and not to 2-methyl-4-isothiazolin-3-one (MI) or 5-chloro-2-methyl-4-isothiazolin-3-one (MCI) (Fig. 2). According to the manufacturer's information, the trousers were treated with Triclosan, MI, MCI, and OIT, but not with DCOIT. We did not detect MI or MCI in GC/MS analysis. As MI and MCI are water-soluble, these might have dissolved during the washing process.

Chemically, OIT does not change into DCOIT during the production process. Therefore, the outbreak of dermatitis may be attributable to the mistaken labelling of OIT instead of DCOIT, or simply erroneous handling, if the manufacturer had not intentionally used DCOIT. Dermatologists should be aware of the potential presence of allergenic preservatives in clothing.

References

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