

Occupational allergic contact dermatitis to 4,4-methylenebis(cyclohexylisocyanate)

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Isocyanates have widespread industrial use as coatings, adhesives, paints and polyurethanes¹. Isocyanates include a wide range of low-molecular-weight potent allergens¹. We present a case of a young industrial worker who developed allergic contact dermatitis after short-term exposure to 4,4-methylenebis(cyclohexylisocyanate) (DMDI).

CASE REPORT

A 19-year old female worker developed itching, vesicular eczematous lesions localised to the forehead, cheeks and arms within a few months after commencing work at a plant, producing armour plates in composites. She had no family history of atopic dermatitis and was otherwise healthy. It was her first occupational employment. The main work task was gluing ceramic tiles to a plastic surface with a glue: Biresin U1419 part A produced by Sika. The glue was applied with a handheld syringe which from time to time was filled from a large dispenser. Before gluing, the tiles were wiped with a liquid Betawipe VP04604 produced by Dow Chemicals.

Ten co-workers at the plant had the same task; among them, three reputedly reported skin symptoms. The patient wore textile Neotouch microflex gloves with a rubber coating of the palms and a short sleeved T-shirt. When gluing, she most of the time wore rubber gloves on the outside of the Neotouch glove. She reported occasional exposure of arms and face with Betawipe and Biresin U1419 part A. All tasks and procedures were observed and safety data sheets provided by the workplace were reviewed. According to the safety data sheets the following ingredients were identified: Biresin U1419 part A containing 4,4-methylenebis(cyclohexylisocyanate) (DMDI), CAS Registry no. 5124-30-1 in a 10-20% concentration classified as a skin sensitizer. Betawipe VP 04604 containing propan-2-ol (concentration 90-100%), CAS Registry no. 67-63-0, 3-(trimethoxysilyl)-1-propanethiol, CAS Registry no. 4420-74-0 (concentration 1-2.5%) and N-(3-Trimethoxysilyl)-propyl-1,2-ethanediamine, CAS Registry no. 1760-24-3 (concentration 1-2.5%).

Patch testing was performed according to the ICDRG guidelines using Finn Chambers on Scanpor® tape (SmartPractice, Calgary, Canada, Norges plaster A/S, Vennesla, Norway) with readings on day (D) 3 and D7. The patient was patch tested with an extended European baseline series (TRUE Test® 36, SmartPractice, Navamedic, Smørum, Denmark) supplemented with Thiuram-, Mercapto- and Carbamix-series, selected allergens from rubber-, plastic and glue-, isocyanate-series and additional allergens according to ingredient label in soap and

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emollients (Chemotechnique® Diagnostics, Vellinge, Sweden, SmartPractice, Calgary, Canada), and Neotouch gloves. DMDI (Sigma-Aldrich, Steinheim, Germany), kindly provided by the Department of Occupational and Environmental Dermatology, Malmö, was tested at 1.0% in petrolatum (Table 1). The patch test showed +1 for DMDI 1% at D3 and D7. The patient was diagnosed with allergic contact dermatitis due to DMDI exposure and stopped working at the plant. She was notified to Labour Market Insurance Authority. No medical treatment was needed as the lesions healed spontaneously after the exposure ceased. The company was offered patch-testing of all workers potentially exposed to DMDI but declined. Preventive initiatives were taken at the plant including use of disposable sleeves for skin protection of the arms.

Discussion

The patient developed allergic contact dermatitis in areas exposed to DMDI. DMDI is an aliphatic diisocyanate, and is less commonly used compared to diphenylmethane-4,4'-diisocyanate (MDI), toluene diisocyanate (TDI), and 1,6-hexamethylene diisocyanate (HDI) that account for >95% of global isocyanate production². The aliphatic characteristics makes DMDI resistant to abrasion and oxidative discoloration. Single cases of allergic contact dermatitis after only few days of DMDI exposure have been reported ³⁻⁵ indicating DMDI as a strong skin sensitizer. We found no indication of previously reported cross-reactivity between DMDI and MDI⁶.

In conclusion this case report adds to the knowledge of DMDI as a strong skin sensitizer. Necessary precautions when handling DMDI should be taken, and one could consider including DMDI in isocyanates patch-test series.

No conflict of interest.

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Table 1 Patch test results according to allergens and readings

Allergen	CAS number	Reading D3/D7
Toluene-2,4-diisocyanate TDI 2%	584-84-9	
Diphenylmethane-4,4-diisocyanate MDI 1%	101-68-8	
Isophorone diisocyanate IPDI 0,5%	4098-71-9	
Hexamethylene diisocyanate, 1,6 HDI 0,1%	822-06-0	
Polymeric diphenylmethane diisocyanate PMDI 2%		
4,4-methylenebis(cyclohexylisocyanate) DMDI 1%	5124-30-1	+ / +