

Short Communication

Allergic contact dermatitis from unsaturated polyester resin consisting of maleic anhydride, phthalic anhydride, ethylene glycol and dicyclopentadiene

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Case Report

A 58-year-old man who had worked in a fibreglass-reinforced plastics (FRP) factory for over 30 years, reported that dermatitis first appeared on his hands 2 months after he started working in the factory and that the condition has recurred since, especially in summer. A first patch test session included 2 kinds of unsaturated polyester resins UP(a) and UP(b) (1%, 5%, 10% pet.) obtained from the factory, and their bases (1, 5% pet.) provided by a manufacturer, methyl ethyl ketone peroxide (0.5% pet.) and dimethyl aniline (10% o.o), all of which were prepared in the laboratory, together with a plastics (Trolab) and a Japanese standard series. The Finn Chamber® technique with a occlusion time of 2 days was used for patch tests, which were read 1 day after removal according to ICDRG standard. The results showed positive results (+) to cobalt, UP(a) (1%, 5%, 10%) and UP(a) base (1%, 5%).

UP(a) base comprises 4 chemicals: maleic anhydride (MAn), phthalic anhydride (PAn), ethylene glycol and dicyclopentadiene (DCPD) (Fig. 1, Table 1). Purified UP(a) was fractionated by thin-layer chromatography (TLC) and the fractions were scraped and extracted from the TLC plate and patch tested (1). The fraction

giving an allergic reaction was found using gas chromatograph–mass spectrometry (GC–MS) to contain 3 substances subsequently identified as PAn, dicyclopentenyl alcohol (DCPA) (Fig. 2), a derivative of DCPD, and a third substance found to be a derivative of DCPD, similar to DCPA but with a carboxyl moiety. The first two substances patch tested negative (Table 2) and the last one could not be tested because its precise chemical structure could not be determined.

A second patch test session with the components of UP(a) base and some possible allergens showed a strong positive reaction to fumaric acid (FA), which can be produced from MAn in the UP condensation process (Table

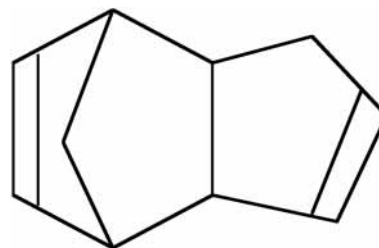


Fig. 1. Dicyclopentadiene (DCPD).

Table 1. Components of unsaturated polyester resin (UP)

	UP (a)	UP (b)
Base resin	phthalic anhydride maleic anhydride ethylene glycol dicyclopentadiene	isophthalic acid maleic anhydride propylene glycol
Cross-linking agent	styrene	styrene
Auxiliary chemicals	cobalt octate copper naphthenate dimethyl aniline silica	cobalt naphthenate silica

Information supplied by the manufacturer.

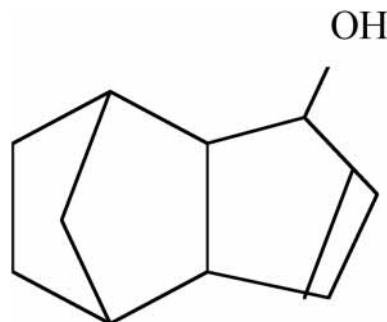


Fig. 2. Dicyclopentenyl alcohol.

Table 2. Second patch test results

	Con.	D3
Maleic anhydride	1% aq.	? +
Phthalic anhydride	1% alc.	–
Ethylene glycol	5% pet.	–
Dicyclopentadiene	2%, 1%, 0.5% pet.	–
Maleic acid	1% alc., aq.	? +
Phthalic acid	1% alc., aq.	–
Fumaric acid	1% alc.	+ +
Dicyclopentenyl alcohol	5%, 1% pet.	–

pet. in petrolatum, alc. in 70% ethanol, aq. in water, o.o. in olive oil.

2). However, the selected ion monitoring method of GC–MS did not show any characteristic fragment FA ion in this sample.

Discussion

Only a few cases of allergy to UP base have been reported (2, 3). Allergy due to UP is mostly from additives, auxiliary agents or catalysts (4). This patient was

positive to UP base, and a substance whose chemical structure could only be identified as a derivative of DCPD is suspected as being the allergen. FA can also be a cause of allergic contact dermatitis from UP(a). However, the current UP base sample did not contain FA and it is therefore likely that this allergy arose from a prior source or sources of UP used in the FRP manufacturing process that contained FA.

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