

Allergic contact dermatitis to dimethyl fumarate in footwear

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Dimethyl fumarate (DMF)–CAS number 624-49-7–has been identified as the responsible allergen for an epidemic contact dermatitis to microfibre

or leather sofas and armchairs manufactured in China. This substance has a wide-spectrum biocide activity and it is contained in paper bags, and progressively it can evaporate and contaminate the leather, textiles, food, cosmetic, etc. It is also used to preserve leather of shoes ‘made in China’, and it can cause an acute bullous dermatitis of the feet, as reported here.

Case Report

A 62-year-old non-atopic woman, Caucasian, retired 3 months prior to the consultation, noticed erythema, desquamation and itching on her ankles and back foot, areas in direct contact with her new boots. After 2 months, the dermatitis relapsed with pruritic bullae on erythematous plaques on the ankles after wearing another new pair of short boots. She was treated with topical steroids and advised to avoid wearing that kind of footwear.

Patch testing was performed with our baseline series, adopted by *Grupo Português de Estudo de Dermite de Contacto* (GPEDC) and footwear series were negative, but patch testing with her own products (small pieces from the boots) and with DMF 0.01% pet was positive. Readings at 2 and 4 days showed positive reactions to DMF and small pieces from the material of the boots (Fig. 1 and Table 1).

The red boots are less closed than the black ones what might have resulted in the loss of DMF from those boots and consequently justify the weaker reaction in those boots.

DMF Determination

Briefly, after extraction, DMF was determined by gas chromatography–mass spectrometry (GC/MS) using a PTV injector on splitless mode, and a DB35, 30 m, 0.25- μ m fd, 0.25-mm ID column. The column program was as follows: 50°C for 1 min; 12°C/min to 130°C for 0 min;

Table 1. Results of dimethyl fumarate (DMF) determination (values expressed in ppm) in the patient’s footwear samples

Tested sample	DMF test results in ppm
Sample 1: insole from black boot	120
Sample 2: tissue lining leather of black boot	640
Sample 3: insole from red boot	11
Sample 4: tissue lining leather of red boot	1.3

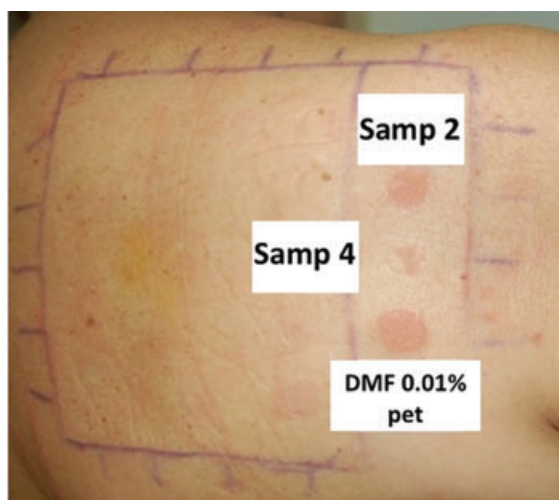


Fig. 1. Patch test reactions at D4 with tissue lining leather of black boot (sample 2), tissue lining leather of red boot (sample 4) and dimethyl fumarate (DMF) 0.01% pet.

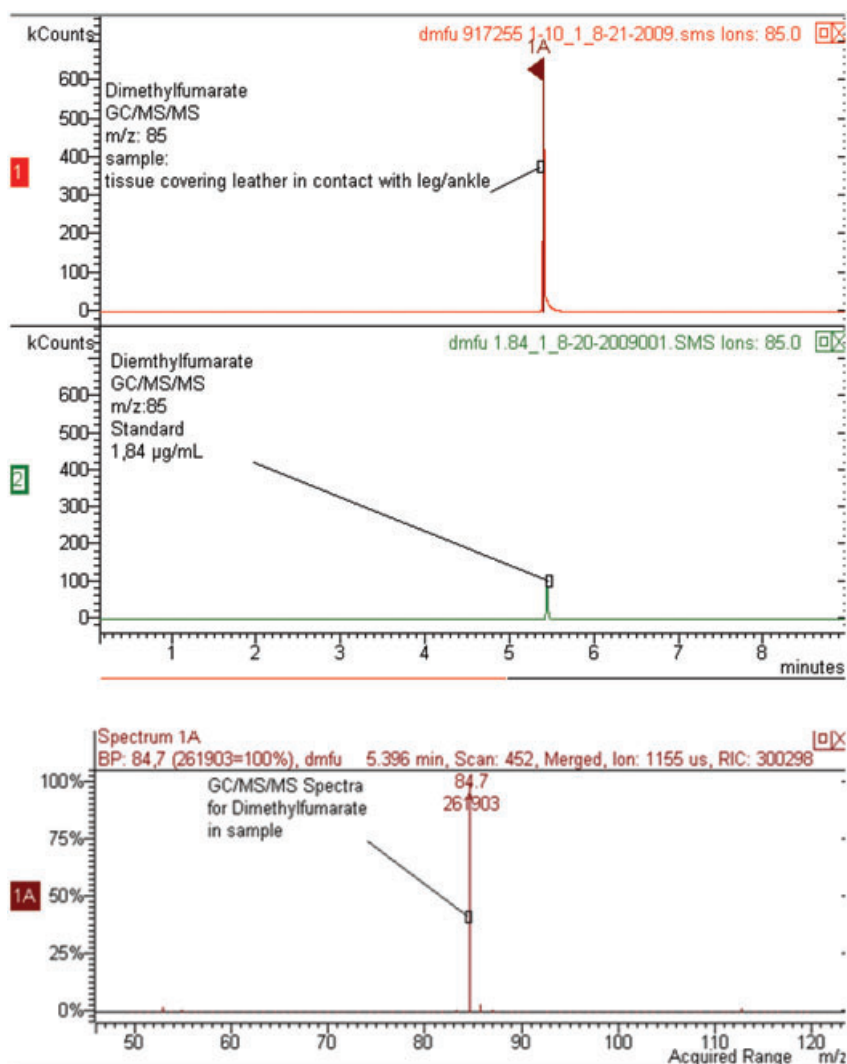


Fig. 2. The presence of dimethyl fumarate (DMF) shown in chromatograms was investigated by GC/MS/MS: 1, analysis of sample 2 (tissue lining leather of black boot); 2, analysis of a standard solution of DMF; and 1A, mass spectrum of DMF in sample 2.

and 35°C/min to 310°C for 1 min. The detection limit was 0.1 ppm (Fig. 2).

Discussion

DMF has been used as an antimicrobial agent contained in small dehumidifying paper bags by Chinese furniture manufacturers (1, 2) and it was responsible for an epidemic allergic contact dermatitis (1) in patients who were exposed to certain domestic armchairs or sofas from China. Similar cases were also identified when patients were exposed to items such as footwear (1–4).

Compared with the reaction to the lining of the black boots (the first to cause ACD), a more modest reaction was observed when the patient was exposed to the lining of the red boots. This led us to suspect that there might have been a loss of the product resulting from the fact that red boots were of a more open style. It can be stated that the contamination has resulted from the footwear, through dehumidifying sachets that contained DMF.

Although since May 2009, the European Commission has prohibited any trade with products containing DMF concentration higher than 0.1 µg/g (5, 6), footwear containing DMF 'made in China' from international brands is still being traded. As a result, we should remain alert to the potential consequences of using this product taking into account its origins and possible effects.

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