

Contact allergy from metalworking fluid traced to tall oil fatty acids monoethanolamide

Kristiina Aalto-Korte¹, Maria Pesonen¹, Outi Kuuliala¹ and Katri Suuronen²

¹Finnish Institute of Occupational Health (FIOH), Control of Hypersensitivity Diseases, FI-00250 Helsinki, Finland and ²Occupational Medicine, FI-00250, Helsinki, Finland

doi:10.1111/cod.12107

Key words: CAS no. 68440-25-5; CAS no. 111-58-0; CAS no. 68171-52-8; linolamide MEA; machinist; ethanolamine derivative of tall oil fatty acids; oleamide MEA

Case Report

A 61-year-old male machinist developed work-related hand dermatitis in 2010. Patch tests in a local hospital gave negative results in 2011. At the Finnish Institute of Occupational Health in 2012, the patient's own metalworking fluid provoked extremely strong allergic reactions (++++) at concentrations of 10%, 3.2% and

1% pet. and at a concentration of 5% aqua. Baseline, antimicrobial, ethanolamine, oil and cutting fluid series gave negative results. In the second patch test session, eight ingredients of the metalworking fluid were tested, and the patient reacted positively to one of them: 10%+++, 3.2% +++, 1% ++, 0.32% ++, 0.1% ++, 0.032% ++, 0.01% ++, 0.0032% ++, 0.001% +, 0.0003% ?+, and 0.0001% – (all in pet.). Results with the other seven ingredients were negative.

In the third patch test session, nine constituents of the positive ingredient were tested. The patient reacted to one of them, tall oil fatty acids monoethanolamide (tall oil MEA; CAS no. 68440-25-5): 10% ++, 3.2% ++, 1% ++,

Correspondence: Kristiina Aalto-Korte, Finnish Institute of Occupational Health (FIOH), Control of Hypersensitivity Diseases, Topeliuksenkatu 41 a A, FI-00250 Helsinki, Finland. Tel: +358-30-4741; Fax: +358-9-5875 449. E-mail: kristiina.aalto-korte@ttl.fi

Conflict of interest: The authors have declared no conflicts.

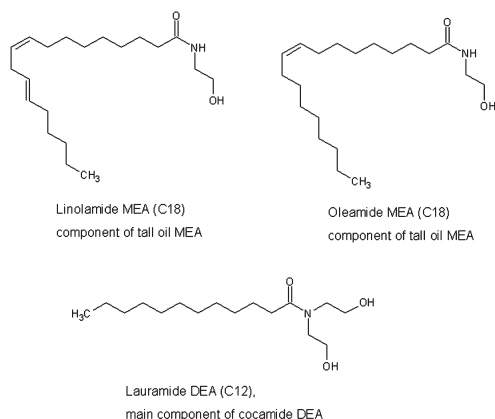


Fig. 1. Chemical structures of the main components of tall oil fatty acids monoethanolamide (tall oil MEA) – linoleic acid monoethanolamide (linolamide MEA) and oleic acid monoethanolamide (oleamide MEA) – and, for comparison, the structure of lauric acid diethanolamide (lauramide DEA), the main component of coconut fatty acids diethanolamide (cocamide DEA).

0.32% ++, 0.1% ++, 0.032% ++, 0.01% ++, 0.0032% +, and 0.001% + (all in pet.). Twenty control patients reacted negatively to the 0.01% concentration, and one control patient with ‘angry back’ had an irritant reaction.

Discussion

The sensitizing component, tall oil MEA, is a reaction product of tall oil fatty acids with (mono)ethanolamine. Tall oil is composed of fatty acids with chain lengths of 16–20, and the main fatty acid components are oleic acid (monounsaturated C18) and linoleic acid (polyunsaturated C18). In addition, tall oil contains rosin

acids (e.g. abietic acid), which are well-known allergens in metalworking fluids. However, the concentration of rosin acids in tall oil fatty acids is only 1–2% (1). Tall oil MEA is related to coconut oil fatty acids diethanolamide (cocamide DEA; coconut diethanolamide), which is based on coconut oil and diethanolamine. Tall oil and coconut oil share some fatty acid components, but the mean chain length in coconut oil is shorter, the main component being lauric acid (saturated C12). Tall oil MEA probably contains monoethanolamine as an impurity, but our patient did not react to monoethanolamine, cocamide DEA, abietic acid or colophonium on patch testing. We were not able to trace the exact allergen further, but the fact that a low concentration of 10 ppm provoked an allergic reaction implies that the allergens must be some of the main components of tall oil MEA, such as oleic acid monoethanolamide (CAS no. 111-58-0; Fig. 1) or linoleic acid monoethanolamide (CAS no. 68171-52-8; Fig. 1). It is possible that the length of the fatty acid chain is not critical for the allergy, and that the patient would react to any chain. The monoethanolamide part of tall oil MEA rather than the fatty acid chain length is the allergenic part of the molecule. Contact allergy to tall oil MEA has not been reported before. There are, however, some reports of cocamide DEA allergy from oil and metalworking fluid (2, 3).

The composition of metalworking fluids is complex, and, in addition to the well-known allergens [e.g. formaldehyde, resin acids, and ethanolamine (4, 5)], they may contain new allergens that can only be found by testing the patients’ own metalworking fluids and their ingredients. It is important to take into account the sensitizing properties of the ethanolamine derivatives of fatty acids.

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