

## Occupational asthma to gel flux containing dodecanedioic acid

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**Key words:** noncolophony flux; Oasys; occupational asthma; serial peak expiratory flow; specific inhalation challenge testing.

Most occupational asthma from electronic solder fluxes is due to colophony (1, 2). We report the first case of occupational asthma to electronic colophony-free gel flux predominantly containing dodecanedioic acid.

**Mean PEF declined up to 120 l/min when visiting the soldering bays.**

The patient worked as an electronics instructor from 1999; he initially used solder wire and a separate flux (both colophony). In 2002, he changed to a colophony-free solder wire (predominantly palmitic acid) and a separate gel flux. In 2004, he developed work-related stuffy nose and dyspnoea. This became worse in 2005 when he woke up twice a night and had a blocked nose, wheeze and sputum for the first 2 h after waking. He was worse in the evening after soldering or the night following soldering. He had no asthma, hay fever or eczema in childhood. His father had occupational asthma from corn dust, but his sister had no asthma. He smoked seven to 10 cigarettes per day since age 17 and gave up 6 weeks before being seen in clinic. He had negative skin tests to all common environmental allergens.

He completed serial peak expiratory flow (PEF) measurements every 2 h for a total of 4 weeks. When plotted in Oasys (3), the record showed large deteriorations in PEF (declining up to 120 l/min from mean rest PEF) when he visited the soldering bays and intermittent smaller

deteriorations when working in the office. The record was scored by the Oasys work effect index (3) as 3.00 (probable occupational asthma; a score of >2.50 has a sensitivity of 75% and specificity of 94%; 3). The area between the curves (ABC) plot (4) in Oasys analysed the two exposures separately and gave an ABC from waking score of 56 l/min/h in the soldering bay and 5 l/min for the office work (an ABC score of  $\geq 15$  l/min/h has a sensitivity of 69% and specificity of 100% for occupational asthma diagnosis; 4). His mean work day diurnal variation was 21% and mean rest day diurnal variation was 12%.

His exhaled nitric oxide (FE<sub>NO</sub>) level while exposed was 14.3 ppb (Aerocrine Niox at 50 ml/s). He was admitted for specific inhalation challenge testing to both solder wires and fluxes. He melted approximately 5 m of solder wire (using an iron heated to 370°C) spread over three challenges totalling 70 min. For the fluxes, he dipped the soldering iron into the flux approximately every 10 s, letting it fume into the challenge chamber after each insertion. For the colophony flux, he did this over three challenges totalling 17 min and for only 8 min when using the colophony-free gel flux. Figure 1 shows the results of the colophony and dodecanedioic acid fluxes. His forced expiratory volume in 1 s (FEV<sub>1</sub>) fell by a maximum of 23%

from baseline when he was exposed to the dodecanedioic acid flux. He was negative to the colophony wire and wire containing predominantly palmitic acid. His nonspecific reactivity was >4800 µg of methacholine (via the Yan method) prechallenge, becoming measurable postchallenge at 3490 µg. Two years after removal from exposure and while working as an apprenticeship manager without soldering exposure, his asthma continues, but is no longer work-related and his FE<sub>NO</sub> remains normal at 10.7 ppb.

Dodecanedioic acid has an asthma hazard index of 0.94 using the chemical asthma hazard assessment programme (5); a value >0.5 has a high probability of being an asthmagen. Other noncolophony based fluxes such as palmitic acid and adipic acid (previously described in a pharmaceutical worker; 6) also have high hazard indexes (0.92 and 0.75 respectively).

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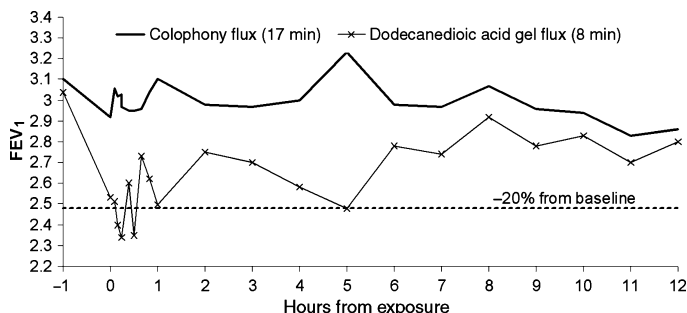


Figure 1. Specific inhalation challenge test results.

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mucilages, pigments, etc. Food additive industry has extensively used it as a poultry feed colourant to give more attractive colour to eggs and chicken meat, because of

**Marigold flour has been extensively used by the food additive industry as a poultry feed colourant to give more attractive colour to eggs and chicken meat.**

the abundance of pigments and carotenoids (1, 2) in its composition. Cases of contact dermatitis related to marigold flour have been previously described, (3) but there are no reported cases suggesting the behaviour of Marigold flour as a causal agent of type 1 hypersensitivity. We present the case of a 29-year-old man who has been working as a porter in an animal fodder factory for 6 years. He has been suffering from soft rhinitis for 2 years, since the day he started to

carry marigold flour sacks. He presented an important episode of rhinitis and asthma after the manipulation of marigold’s flour sacks 15 days before his visit to our medical service. No atopy antecedents can be found in his family, although he suffered from pollinosis since he was a teenager. *In vivo* study was performed by prick test to inhalants (positive to house dust mites, and pollens from *Artemisia vulgaris*, *Helianthus annuus*, *Taraxacum officinalis*, *Platanus acerifolia* and *Olea europaea*), foods (positive to strawberry, peach, pineapple, prawn and sunflower seeds), cereal flours [positive to barley, corn, rice and grass pea (*Lathyrus sativus*), marigold flour (Bial Aristegui; 20 mg/ml). Nasal challenge test was positive to marigold flour (2 mg/ml) and to *A. vulgaris* pollen (0.2 mg/ml) (eight negative controls was made with negative results). Baseline spirometry and bronchodilator test were normal.

**Occupational allergy caused by marigold (*Tagetes erecta*) flour inhalation**

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**Key words:** Marigold flour; occupational allergy; poultry feed colorant; type I hypersensitivity.

Marigold flour is prepared from the flowers of *Tagetes erecta* or the flowers of *Calendula officinalis*, plants belonging to the Asteraceae or Compositae family. It is used since ancient times (Romans used it as a medicine) and it has been named: Marigold (in English) and ‘Caléndula’ or ‘Maravillas’ (in Spanish).

Active components include saponin, essential oils, flavonoids, carotenoids,

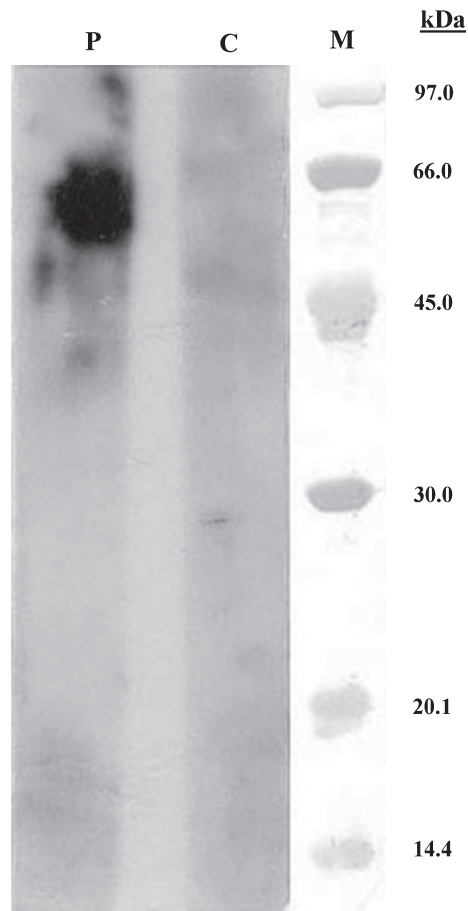


Figure 1. SDS-PAGE Immunoblotting with marigold flour extract. Lane P: patient serum; Lane C: control serum (pool of sera from nonatopic subject); Lane M: molecular mass marker.