

LETTER TO THE EDITOR



Allergic contact dermatitis due to didecyldimethylammonium chloride included in a swimsuit

Dear Editor,

Didecyldimethylammonium chloride (DDAC) is a quaternary ammonium compound that is widely used in disinfectants. Some cases of allergic contact dermatitis caused by DDAC have been described in the literature.¹⁻⁴ To the best of our knowledge, this is the first case of allergic contact dermatitis caused by DDAC in clothing. We report a rare case of allergic contact dermatitis due to DDAC.

A 12-year-old girl wore a new swimsuit (Figure S1A) while swimming. She noticed erythema on the area of her trunk covered by the swimsuit several hours after taking off the swimsuit. The skin symptoms gradually improved over several days, and then she visited our department. Allergic contact dermatitis was suspected, and patch testing was performed with the swimsuit (as is) and a Japanese baseline series. The results of the patch tests were determined after 2 and 3 days and 1 week according to the guidelines of the International Contact Dermatitis Research Group (ICDRG). Positive reactions to the swimsuit (+) (Figure S1B) and to mercaptobenzothiazole and a fragrance mix (+) were detected after 1 week, but not on days 2 or 3. No rubber products had been in contact with the patient's trunk. We asked the National Institutes of Technology and Evaluation to analyze the composition of the swimsuit. Several ingredients, such as plasticizers, surfactants, and dyes, were detected in the swimsuit. Patch tests of the swimsuit's components, including DDAC (0.1% pet.), were performed (Table S1). Positive reactions (+) to DDAC (0.1% pet.) were detected on days 2 and 3 and at 1 week (Figure S1C). In three healthy controls, patch tests produced negative reactions to DDAC (0.1% pet.). It

has previously been reported that patch tests of DDAC (0.1% aq.) produced negative results in 20 control subjects.¹ Based on these results, a diagnosis of allergic contact dermatitis due to the DDAC present in her swimsuit was made.

Quaternary ammonium compounds are found in disinfectants, softening agents, soap, and shampoo. In our case, the patient may have become sensitized to DDAC when she used such DDAC-containing products. Cross-reactions can occur among quaternary ammonium compounds.^{1,2} Thus, the patient was instructed to avoid contact with products including such compounds. In addition, new clothing often contains quaternary ammonium compounds. Therefore, she was instructed to wash new clothing before wearing it because quaternary ammonium compounds are water-soluble. There has been no recurrence of the skin symptoms since.

Only four cases of allergic contact dermatitis due to DDAC have been reported in the literature (Table 1).¹⁻⁴ We also should know this ingredient causes a strong irritating reaction when it adheres to the skin. In the current coronavirus disease 2019 (COVID-19) pandemic, clinicians should be aware that quaternary ammonium compounds, including DDAC, can cause allergic contact dermatitis in individuals that are using disinfectants containing such compounds more often than usual, and new clothing often contains such compounds.

KEYWORDS

allergic contact dermatitis, didecyldimethylammonium chloride, patch testing, quaternary ammonium, swimsuit

TABLE 1 Case reports of allergic contact dermatitis due to didecyldimethylammonium chloride (DDAC)

Age/sex	Location of contact dermatitis	Product containing DDAC	Patch test reactions at 72 h according to ICDRG (dilution)	Other agents that produced positive patch test reactions	Reference number
24/F	Hands, arms, and face	Disinfectant	+++ (0.1% aq.), ++ (0.01% aq.)	Bis-(aminopropyl)-lauryl amine, nickel sulfate, balsam of Peru, and thimerosal	1
57/F	Hands and arms	Disinfectant	+++ (0.1% aq.)	N,N-bis(3-aminopropyl) dodecylamine, fragrance mix, and tert. butylhydroquinone	2
31/F	Face	Disinfectant	+ (0.1% pet.),? (0.01% pet.)	–	3
64/F	Foot	Shoe refresher spray	+ (0.08% aq.), + (0.008% aq.)	Potassium dichromate, cobalt chloride, and fragrance mix II	4
12/F	Trunk	Swimsuit	+ (0.1% pet.)	Mercaptobenzothiazole and fragrance mix	Our case

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CONFLICTS OF INTEREST

No conflicts of interest exist.

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SUPPORTING INFORMATION

Additional Supporting Information may be found online in the Supporting Information section.



Supplementary Fig. 1. The patient's swimsuit (A) and the patch test reaction to the swimsuit (as is) at 1 week (B) and that to DDAC at 48 hours and 72 hours (C).

Supplementary Table 1. Patch test results of the ingredients included in the swimsuit.

Ingredients	Concentrations	48 hours	72 hours	1 week
Disperse Yellow 64	1% pet.	-	-	-
Disperse Red 60	1% pet.	-	-	-
Antioxidant SWP	5% pet.	-	-	-
Antioxidant 425	5% pet.	-	-	-
2,6-Di-tert-butyl-p-cresol	2% pet.	-	-	-
2,4-Di-tert-butylphenol	2% pet.	-	-	-
Octicizer	5% pet.	-	-	-
Tinuvin326	1% pet.	-	-	-
ParsolMCX	10% pet.	-	-	-
h-ParsolMCX	10% pet.	-	-	-
α - Hexylcinnamaldehyde	10% pet.	-	-	-
Ethylene brassylate	2% pet.	-	-	-
Diethyl phthalate	5% pet.	-	-	-
Di(2-ethylhexyl) phthalate	5% pet.	-	-	-
Triphenyl phosphate	5% pet.	-	-	-
Didecylmethylamine	1% pet.	-	-	-
DDAC	1% pet.	+	+	?+
PoE-Do-35 Polyethylene glycol dodecyl ether	2.5% pet.	-	-	-
PoE-Do-30 Polyethylene glycol dodecyl ether	2.5% pet.	-	-	-