

Dialkyl Thioureas

Giuseppe Militello and Rebecca Marcus

THIOUREA is an organic compound commonly used in the production of rubber and neoprene. Thioureas are particularly efficient vulcanization accelerators that provide an ideal balance of tensile strength, resilience, compression set, heat aging, and water resistance in the finished product.¹ These compounds are also found in fungicides, pesticides, paint and glue removers, phone card thermocoatings, polyvinyl chloride (PVC) adhesive tapes, anticorrosive agents, silver polish dips, and diazo papers used in photography, blueprints, and textile patterns.^{2,3} Although relatively uncommon, thiourea-induced allergic contact dermatitis (ACD) should be considered in a patient who presents with dermatitis and reports a history of exposure to the aforementioned items. In reports of thiourea ACD, the most common documented source is neoprene, a widely used synthetic rubber valued for its soft texture and cushioning ability; its resistance to fire, oil, and ozone; and its resilience in flexion and compression.² There are several published reports of ACD caused by shoe insoles, shoe adhesives, orthopedic braces, keyboard wrist supports, continuous positive airway pressure (CPAP) mask straps, slimming suits, wet suits, and diving equipment, all of which had thiourea-containing neoprene as a component. Diphenylthiourea (DPTU), dibutylthiourea (DBTU), diethylthiourea (DETU), ethylbutylthiourea (EBTU), and ethylenethiourea (ETU) are responsible for the majority of cases of neoprene ACD.²

When thiourea-induced ACD is suspected, patch testing is often performed with mixed dialkyl thioureas 1% in petrolatum (Chemotechnique Diagnostics, Malmö, Sweden), a component of the standard series used by the North American Contact Dermatitis Group (NACDG) consisting of a combination of DETU and DBTU.¹ Between 1998 and 2000, the NACDG and the Mayo

SECTION EDITORS:

Douglas L. Powell, MD

Department of Dermatology
University of Utah
Room 4B454 SOM
30 North 1900 East
Salt Lake City, UT 84132
Tel: 801-581-6465
E-mail: Doug.Powell@derm.med.utah.edu

Matthew J. Zirwas, MD

Division of Dermatology
Department of Medicine
Ohio State University
OSU Dermatology-East
5965 East Broad Street, Suite 290
Columbus, OH 43213
Tel: 614-864-8302
E-mail: matt.zirwas@osumc.edu

Allergen Avoidance provides clinicians with high-quality up-to-date practical information to supply to patients about specific contact allergens.

Clinic patch-tested 5,807 and 1,321 patients, respectively.¹ Although these tests yielded positive reactions to mixed dialkyl thioureas in 1.2% and 1.1% of tested patients, respectively, it has been reported that using only this thiourea mixture will fail to diagnose 25% of patients with thiourea-induced ACD.^{1,3} Other major alkylated thiourea allergens are dimethylthiourea and ethylbutylthiourea; cyclic thioureas such as DPTU and ETU are also known causes of thiourea-induced ACD. Therefore, the inclusion of these compounds in a patch test series may be required for accurate diagnosis. Although DBTU and DPTU are the most commonly reported thiourea allergens, thiourea compounds do not usually cross-react, and each compound thus needs to be tested separately.⁴ A detailed history from the patient may reveal which thioureas are the more likely suspects. Unfortunately, thiourea allergens are not included in the Thin-Layer Rapid Use Epicutaneous (T.R.U.E.) Test (Mekos Laboratories A/S, Hillerød, Denmark).

From the Department of Dermatology, Columbia University, New York, NY.

Address reprint requests to Rebecca Marcus, MD, Clinical Research Fellow, Department of Dermatology, Columbia University, 161 Fort Washington Avenue, Room 1261, New York, NY 10032. E-mail: rpm22@columbia.edu

DOI 10.2310/6620.2008.07080

© 2008 American Contact Dermatitis Society. All Rights Reserved.

Dialkyl Thioureas

What are they?

Dialkyl thioureas are chemicals that are most commonly used to make rubber products, especially neoprene rubber. Neoprene is a soft flexible synthetic rubber often used to make shoe insoles and adhesives, swimming goggles, orthopedic braces, gloves, wet suits, and straps for continuous positive airway pressure (CPAP) masks.

Dialkyl thioureas include diethylthiourea, dibutylthiourea, diphenylthiourea, ethylbutylthiourea, and ethylenethiourea.

Where are they found?

Dialkyl thioureas are found in neoprene products such as the following:

- Orthopedic braces
- Knee and elbow heat retainers
- Wet suits and diving gear
- Swim goggles
- Rubber mask straps
- Computer keyboard wrist supports
- Neoprene weather slimming suits
- Shoe insoles
- Shoe adhesives
- Gloves

They are also found in other items such as the following:

- Phone card thermocoatings
- Pesticides
- Fungicides
- Adhesives
- Paint and glue removers
- Silver polishes
- Diazo photocopy papers (no longer used for photocopies or blueprints)

How can they be avoided?

You should try to determine whether you were exposed to neoprene, glues, or other thiourea-containing products on areas where dermatitis is present. Samples of the items suspected of causing dermatitis may be used for patch testing by a dermatologist.

The following companies offer neoprene-free sports equipment:

- Cropper Medical (Ashland, OR)
- Bauerfiend USA (Wichita, KS)
- Nexcare (St. Paul, MN)
- Speedo (Los Angeles, CA)
- TYR sport (Huntington, CA)
- Skyline Northwest (Lake Oswego, OR)
- Shock Doctor (Plymouth, MN)
- McKeon Products (Warren, MI)
- E.A.R. Inc. (Boulder, CO)
- All-Star Sports Equipment (Shirley, MA)

References

1. Wettner D, Davis M, Yiannias J, et al. Patch test results from the Mayo Clinic Contact Dermatitis Group, 1998-2000. *J Am Acad Dermatol* 2005;53:416–21.
2. Woo D, Militello G, James W. Neoprene. *Dermatitis* 2004;15:206–9.
3. Shinichiro S, Cahill J, Nixon R. Allergic contact dermatitis to thiourea in a neoprene knee brace. *Australas J Dermatol* 2006;47:67–9.
4. Kanerva L, Estlander T, Alanko K, Jolanki R. Occupational airborne allergic contact dermatitis from dibutylthiourea. *Contact Dermatitis* 1998;38:347–8.