Safe Methods of Use 25:

Laboratory handling of Erionite

Purpose: This applies to **principal investigators (PIs), sector managers, designated laboratory persons (DLPs)**, technical staff and students who use laboratories within the University of Auckland.

Note: the word 'shall', denotes a mandatory requirement and the word 'should' denotes a recommendation.

A. Definition

Erionite (CAS Registry No.: 66733-21-9) is a rare, naturally occurring fibrous mineral that belongs to a group of hydrated aluminosilicate minerals called zeolites. Its molecular formula is: $(Na_2, K_2, Ca, Mg)_{4.5}Al_9Si_{27}O_{72}•27H_2O$).

Three members of erionite have been identified: erionite-Ca, erionite-Na, and erionite-K.

Erionite is most often found in volcanic ash layers (rhyolitic 'tuff') that have been altered and weathered, as well as in rhyolitic lava.

Erionite is listed by the International Agency for Research on Cancer (IARC) as a Group 1 Carcinogen[1], and is almost certainly the most toxic naturally occurring fibrous mineral known[2].

Erionite is not specifically categorised as a hazardous substance by either New Zealand's 1996 Hazardous Substances and New Organisms Act (HSNO Act), or New Zealand's Health and Safety at Work (Hazardous Substances) Regulations 2017, however it is a potential human carcinogenic.

Globally, there are no occupational exposure limits (OELs) for erionite (as of June 2020).

Although erionite has a similar morphology to that of amphibole asbestos (i.e. it has a chain-like structure), it has different chemical and physical properties.

B. Identification

It is likely that erionite will be encountered de novo, or with a low degree of certainty.

Erionite occurs as two major morphotypes: a short fibre form ('wool-like'), and a long fibre form. When ground to powder, erionite fibres resemble amphibole asbestos fibres, morphologically.

Erionite is often found with other non-carcinogenic zeolite minerals (e.g. mordenite, clinoptilolite, phillipsite).

For sample analysis, a combination of scanning electron microscope (SEM) and energy dispersive x-ray spectroscopy (EDS) or x-ray diffraction (XRD), or transmission electron microscopy (TEM) equipped with EDS ***should*** be used to give an elemental composition required for identification of the mineral erionite. Electron probe micro analysis (EPMA) may also be used.

Phased contrast microscopy (PCM), polarized light microscopy (PLM) and transmission electron microscopy (TEM) should not be used on bulk sample analysis because they are not as reliable at discriminating among erionite, asbestos, non-erionite and non-mineral fibres.

C. Laboratory procedures and storage

Globally, there are no designated laboratory procedures specific to working with erionite.

The U.S. Occupational Safety and Health Administration's guidance for working with asbestos could serve as a model for limiting the generation and inhalation/respiration of dust known or thought to be contaminated with erionite.

Possible erionite samples ***should*** be prepared while minimising any fugitive dust from being released.

Putative erionite samples ***shall*** be double-bagged and clearly labelled.

It is highly recommended that work involving erionite grinding or erionite dust/powder is undertaken under a fume hood. Where this is not possible work with possible erionite ***should*** take place on an impervious tray or similar shallow secondary container to prevent contamination of bench surfaces. In this case, if any other laboratory users are present they ***shall*** wear the appropriate PPEs as well.

D. Personal Protective Equipment (PPE)

As erionite particles can be <10µm in size, they are therefore respirable (AS/NZS 1715:2009:3.6.2).

Larger particles 10-100 µm in size are classified as inhalable or inspirable. Inhalation or respiration of dust containing erionite fibres is the only known means by which human health can be affected by erionite.

Inhalation/respiration of erionite fibres can cause malignant mesothelioma, a rare form of cancer.

Respiratory protective equipment (RPE) - to avoid inhaling erionite fibres - ***shall*** be worn during crushing and handling of possible erionite.

The type of RPE ***shall*** be either a Class P1 (intended for use against mechanically generated particulates) or a Class P2 respirator (intended for use against both mechanically and thermally generated particulates) as per AS/NZS 1716:2012.

The RPE should be selected maintained and worn, as per AS/NZS 1715:2009.

A labcoat ***shall*** be worn (either disposable or able to be washed), to avoid the risk of carrying erionite fibres away from the laboratory/worksite on clothing. Safety glasses and disposable gloves ***shall*** also be worn.

E. Disposal

As a precautionary measure, bag all powdered waste and seal it well before disposal.

F. First Aid/Emergency Treatment

If dust is inhaled, remove patient from contaminated area and encourage to blow nose to ensure clear passage of breathing. If irritation or discomfort persists, seek medical attention.

There is a long latency (~25 years) between exposure and inception of symptoms of malignant mesothelioma.

References

[1]IARC. (1987). Erionite. In: Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man. Geneva: World Health Organization, International Agency for Research on Cancer, Silica and Some Silicates Summary of Data Reported and Evaluation. Vol 42: 187-9.

[2]Dogan AU, Dogan M. (2008). Re-evaluation and re-classification of erionite series minerals. *Environmental Geochemistry & Health* 30: 355-366.