



Standard Practice for Dissolution of Solid Waste by Lithium Metaborate Fusion¹

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1. Scope

1.1 This practice covers the drying, ashing, and solubilization of solid waste using a lithium metaborate (LiBO_2) fusion for the subsequent determination of inorganic constituents by argon plasma emission spectroscopy or atomic absorption spectroscopy.

1.2 The following elements may be solubilized by this practice:

aluminum	chromium	silicon
barium	iron	titanium
cadmium	magnesium	vanadium
calcium	manganese	zinc
copper	nickel	

1.3 This practice has been used successfully with a bauxite ore and a neutralized metal treatment sludge. The practice may be applicable to other elements not listed above. Some metals, such as cadmium and zinc, may volatilize from some samples during the drying, ashing, or fusion steps. The analyst is responsible for determining whether the practice is applicable to the solid waste being tested.

1.4 This practice is intended for the solubilization of non-volatile inorganic constituents in solid waste. The LiBO_2 fusion is appropriate for a silicate matrix or acid resistant samples.

1.5 *This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For specific hazard statements see Section 7.

2. Referenced Documents

2.1 ASTM Standards:

D 1193 Specification for Reagent Water²

D 2777 Practice for Determination of Precision and Bias of Applicable Methods of Committee D-19 on Water²

D 3682 Test Method for Major and Minor Elements in Coal and Coke Ash by Atomic Absorption³

E 50 Practices for Apparatus, Reagents, and Safety Precautions for Chemical Analysis of Metals⁴

3. Summary of Practice

3.1 The solid waste is weighed, dried, and ashed at 550°C to remove water and organic constituents, and reweighed. A known portion of the ground ash is mixed with LiBO_2 in a graphite crucible and fused at 1000°C. Immediately after fusion, the molten mass is poured directly into stirred dilute HNO_3 solution, dissolved, filtered, and made to appropriate volume for subsequent analysis.

4. Significance and Use

4.1 A knowledge of the inorganic constituent composition in a waste is often required for the selection of appropriate waste disposal practices. Solid waste may exist in a variety of forms and contain a range of organic and inorganic constituents. This practice describes a drying and ashing step that may be applied to remove moisture and volatile and nonvolatile organic constituents prior to determining nonvolatile metals. Generation of a dry ash concentrates the inorganic constituents of interest and makes the LiBO_2 fusion feasible for a greater variety of waste samples. Acidification of the LiBO_2 fusion mix results in a solution amenable to inductively coupled plasma (ICP) or atomic absorption spectrometry (AAS) analysis.

5. Apparatus

5.1 *Analytical Balance*, sensitive to 0.1 mg.

5.2 *Fusion Muffle Furnace*, electrically heated, capable of maintaining a temperature of 1000°C.

5.3 *Ashing Muffle Furnace*, electrically heated, capable of maintaining a temperature of $550^\circ\text{C} \pm 30^\circ\text{C}$ and with an adequate air circulation. This may be accomplished by connecting rubber tubing to a controlled source of clean dry air. Then, via a ceramic tube inserted into a convenient muffle opening, flow approximately 4 L/min of air into the furnace.

5.4 *Drying Oven*, capable of operating at a temperature up to 150°C.

5.5 *Evaporating/Ashing Dish*, 50 to 100-mL capacity, made of platinum, silica, or porcelain.

5.6 *Fusion Crucibles*, graphite, 28 to 30-mL capacity.

¹ This practice is under the jurisdiction of ASTM Committee D34 on Waste Management and is the direct responsibility of Subcommittee D34.01.06 on Analytical Methods.

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² *Annual Book of ASTM Standards*, Vol 11.01.

³ *Annual Book of ASTM Standards*, Vol 05.05.

⁴ *Annual Book of ASTM Standards*, Vol 03.05.