

Method 1340

In Vitro Bioaccessibility Assay for Lead in Soil

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You LEAD Me Into The House!

- ▶ toys and jewelry
- ▶ lead-glazed earthenware
- ▶ clay pots
- ▶ glazed mugs
- ▶ lead from gasoline- Lead does not break down or burn up- contaminated soil - tracked into homes.
- ▶ lead-based paint that was used in homes before laws were enacted to regulate it. United States alone, at one time, had an estimated 38 million homes—40 percent of all housing—has lead paint.
- ▶ lead pipes or lead-soldered copper pipes for water

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- ▶ ACCORDING to a study by the Johns Hopkins Bloomberg School of Public Health, lead inhibits a **protein** that is important for brain development and cognition. Studies show that **children absorb up to 50 percent of the lead ingested**, whereas adults usually absorb only 10 to 15 percent.
- ▶ Lead poisoning can result from the accumulation of lead in the body over a period of time.
- ▶ Recent research has suggested that even levels of lead that fall under some government-issued toxicity limits may cause harm.
- ▶ At present >10 ug/dL; CDC recommends the public health level to be reduced to 5 ug/dL.

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- ▶ The problems, according to the National Safety Council in the United States, can include “learning disabilities, attention deficit disorders, behavioral problems, stunted growth, impaired hearing, and kidney damage” in children.
- ▶ Women who may become pregnant should take extra precautions to avoid exposure because lead can harm the fetus.
- ▶ **SOME SYMPTOMS OF LEAD POISONING IN CHILDREN**
Abdominal pain, aggressiveness, anemia, attention problems, constipation, fatigue, headaches, irritability, loss of developmental skills, low appetite and energy, slow growth.—*MEDLINE PLUS MEDICAL ENCYCLOPEDIA*.

Bioavailability

- ▶ Bioavailability (BA) – The fraction of an ingested dose (i.e., *in vivo*) that crosses the gastrointestinal epithelium and becomes available for distribution to internal target tissues and organs.
- ▶ The juvenile swine model, developed by USEPA Region VIII, considered the most appropriate for measuring child exposure.
- ▶ Knowledge of lead bioavailability is important because the amount of lead that actually enters the blood and body tissues from an ingested medium depends on the physical-chemical properties of the lead and of the medium. For example, lead in soil may exist, at least in part, as poorly water-soluble minerals, and may also exist inside particles of inert matrices such as rock or slag of variable size, shape, and association. These chemical and physical properties may tend to influence (usually decrease) the absorption (bioavailability) of lead when ingested. Thus, equal ingested doses of different forms of lead in different media may not be of equal health concern.

Summary of Method

- ▶ After drying and sieving, 1 g of soil sample is rotated with 100 mL of buffered extraction fluid (0.4M Glycine) at 37 °C for one hour. The supernatant is separated from the sample by filtration and analyzed for lead by an appropriate analytical method (e.g., Method 6010 (ICP) and Method 6020 (ICP-MS)).
- ▶ Extraction, filtration, and final pH determination completed within 90 minutes.

In vitro Bioaccessibility (IVBA) Calculation

In vitro bioaccessibility (IVBA) is calculated and expressed on a percentage basis using the following equation:

$$\text{In vitro bioaccessibility} = \frac{Pb_{ext} \cdot V_{ext} \cdot 100}{Pb_{soil} \cdot Soil_{mass}}$$

where:

Pb_{ext} = *in vitro* extractable Pb in the *in vitro* extract (mg/L)

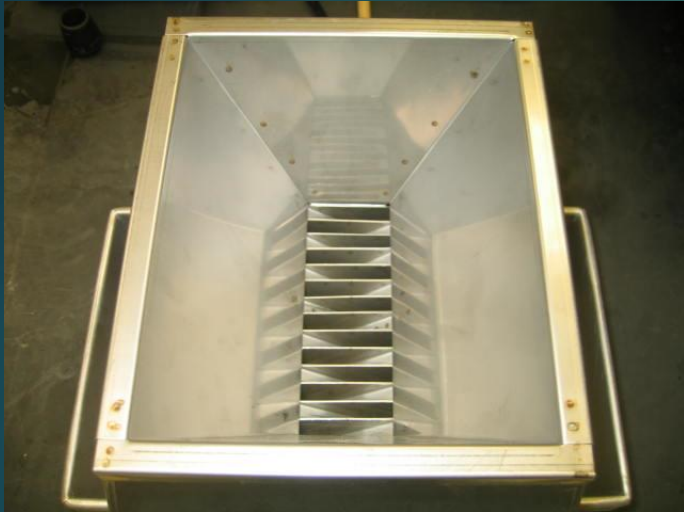
V_{ext} = extraction solution volume (L)

Pb_{soil} = Pb concentration in the soil sample being assayed (mg/kg)

$Soil_{mass}$ = mass of soil sample being assayed (kg)

Analysis	Frequency	Control Limits	Corrective Action
Bottle/Reagent blank	once per rotation	<MRL (30 µg/L lead)	Determine source of contamination, make new extraction fluid and rerun all analyses affected by contamination levels
Blank spike (10 mg/L)	once per analytical batch (minimum 1 in 20 samples)	85-115% recovery	Ensure dilutions and spike concentrations are correct. If no error is found, re-extract the samples or flag the data.
Matrix spike (10 mg/L)	Once per analytical batch, minimum 1 in 10 samples	75-125% recovery	Ensure dilutions and spike concentrations are correct. If no error is found, flag the data.
Duplicate sample	Once per analytical batch, minimum 1 in 10 samples	±20% RPD	Re-extract the samples or flag the data.
Control soil (NIST 2710 or 2710a or 2711 or 2711a)	once per rotation	NIST 2710a mean 67.5% (acceptable range 60.7-74.2%) NIST 2711a mean 85.7% (acceptable range 75.2-96.2%) (for NIST 2710 and 2711 values see section 13.0)	Re-extract the samples or flag the data.

Riffle Splitter



< 250 μm Stainless Steel Sieve



Heated Tumbler



CaptairFlex Ductless Fume Hood



Questions?????

