Understanding the environmental and health considerations of repurposing mine tailing for bricks making

Responsible Mining and Resilient Communities

RMRC Project

Tailing pond in Las Partidas, Andes. Photo credit: Author

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Mercury and mining

• Mercury contamination from ASGM operations is an environmental, health and safety concern for communities and government. (UNEP, 2019)

• An example of a source of mercury contamination from ASGM is mine tailings left over from gold ore processing.

• One option to reduce mercury contamination is the repurposing of mine tailings material as aggregate for bricks production. (Roy, Adhikari, & Gupta, 2007)
Potential environmental and health concerns of mine tailing reuse

According to the EPA, hazardous waste is a material with chemical characteristics that may pose a risk for humans and other organism’s health when not disposed properly (EPA, 2005).

<table>
<thead>
<tr>
<th>Organization</th>
<th>Concentration (µg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA</td>
<td>100</td>
</tr>
<tr>
<td>NIOSH</td>
<td>50</td>
</tr>
<tr>
<td>American Conference of Government Industrial Hygienists (ACGIH)</td>
<td>25</td>
</tr>
<tr>
<td>Agency for Toxic Substances and Disease Registry (ATSDR)</td>
<td>1</td>
</tr>
<tr>
<td>EPA</td>
<td>0.3</td>
</tr>
</tbody>
</table>

(Garcia-Sanchez et al., 2006)
Potential environmental and health concerns of mine tailing reuse

From the GHS (Global Harmonized System) of the UN the exposure to hazardous materials is subjected to its source and media, classified as **acute toxicity and chronic toxicity** (repeated and long exposure). (UNECE, 2019)

**Exposure Route:**

- Dermal
- Oral
  - Inhalation
  - Ingestion
  - Dust
  - Mist
Past Initiatives

The main analysis that has previously been done on Mine Tailings Bricks (MTBs) are based on:

- Technical knowledge
- Environmental exposure
- Human exposure to Hg
- Cost viability
Past Initiatives (con’t)

• **Technical knowledge**: different techniques and technologies such as geopolymerization and additive have been studied in the brickmaking process to immobilize hazardous particles (Ahmari & Zhang, 2012).
Past Initiatives (con’t)

• **Environmental exposure:** Mercury volatilization, transport and fate of contaminants (Lu, Hsu, & Lin, 2019).

• **Human exposure to Hg:** Health issues, methylmercury and bioaccumulation factors (Cruz-Esquivel et al., 2019).

• **Cost viability:** Case studies using different methods of fabrication (Roy et al., 2007).
Andes case study

• One “entable” owner is trying to develop a method to repurpose bricks out of gold mine tailings.

• Prior to implementation of these bricks is important to know environmental, health and safety issues associated with mine tailings bricks (MTBs)

• Edilber has been working with the “Universidad de Antioquia”, analyzing the bricks through chemical tests (not specified).
Can bricks created out of mine tailings that have been exposed to mercury be safely implemented in community construction initiatives?

Do the MTBs pose a chemical or physical hazard for people using them?
Main aspects

Repurposing of mine tailings

- Bricks
- Health
- Environmental
Based on the testing protocol for asbestos, the American Society of Testing Materials has developed standard practices for exposure assessments.

As part of the exposure routes, is important to determine the potential effects of human health with dust or volatilization that may occur within the bricks structure.
• TCLP Test

Toxicity characteristic leaching procedure – Is a standardized test that determines the mobility of the contaminants, in this case Mercury (Hg).

The idea to perform this analysis is to test under the worst case scenario the exposure to contaminants that may be experienced by the community from the use of the bricks.

<table>
<thead>
<tr>
<th>Metal Values</th>
<th>TCLP Max. values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury (Hg) D009</td>
<td>0.2 ppm</td>
</tr>
<tr>
<td>Arsenic (As) D004</td>
<td>5.0 ppm</td>
</tr>
<tr>
<td>Lead (Pb) D008</td>
<td>5.0 ppm</td>
</tr>
</tbody>
</table>
Methods

The idea is to analyze 9 bricks samples made out of 3 different tailings ponds, using the same Hg extraction method. (The method Edilber thinks is the most effective).

<table>
<thead>
<tr>
<th>Items</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bricks x9</td>
<td>500g</td>
</tr>
<tr>
<td>Tailings</td>
<td>500g</td>
</tr>
</tbody>
</table>

Measurement of elemental Hg in the air, Photo credit: Caitlin
Deliverables

• From the test we can deliver a technical report based on the amount of mercury leaching out of the bricks from the TCLP test.

• Power point presentation

• The results can help understand the process from the mobility point of view, and will either have a good result for Edilber’s process or a negative result implying the need for more assistance and support for the processes he is carrying out.
  – Will serve as a comparison result for the Universidad de Antioquia results.
References


