Technology Summary: Vulcanization of Heavy-Metal Waste

Opportunity Statement

Various industrial activities like mining and manufacturing have resulted in increased depositions of heavy metals in terrestrial and aquatic environments. Release of these pollutants as industrial waste without proper treatment poses a significant threat to both environment and public health, as they are non-biodegradable. Mercury, for instance, is a pollutant that can travel very long distances and high levels of mercury, attributed to man-made emissions, have been found in certain fishes, making them unsafe for human consumption. Due to the severity of heavy-metal pollution, the use and disposal of heavy metals (e.g., lead and mercury) is often strictly regulated by governments around the world.

Recycling is currently one of the most preferred methods for disposal of heavy-metal waste. Shortages of metal resources in the market coupled with increased demand from developed and emerging countries are causing price increases that are leading the primary metal industry to look for alternative sources of metals under more sustainable and competitive conditions. Recovery of heavy metals from secondary sources becomes very attractive compared to mining of the metals, when energy efficiencies, waste handling and environmental impact are taken into consideration.

Problem

Conventional methods of heavy-metal recovery include pyrometallurgy processing, hydrometallurgy processing and bioleaching. However, none of these methods is able to provide a cost- effective solution and each has significant shortcomings. For example, pyrometallurgy processes require high energy consumption and produce toxic dioxins, hydrometallurgy processes have low recovery rates and may require expensive leaching agents, and bioleaching often requires a longer processing time for the bacteria to extract the metals.

Therefore, there is a need for a technology that can provide a low-cost, effective and environmentally friendly solution for extraction of heavy metals from industrial waste.

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360ip Partner's Solution

360ip Partner's invention is a novel process for vulcanizing heavy metal waste and recovering valuable metals from the heavy-metal waste. The method adopts the hydrothermal vulcanization mode by which the vulcanization rate of the heavy metals increases to as high as 90% and produces little secondary pollution.

The technology involves the following process steps:

1. Mechanical activation treatment

1.1 Crushing/grinding the heavy metal waste to a particle of size not more than 5 mm.

1.2 Addition of vulcanizer, vulcanizing accelerator, pH regulator and water.

1.2 Ball milling.

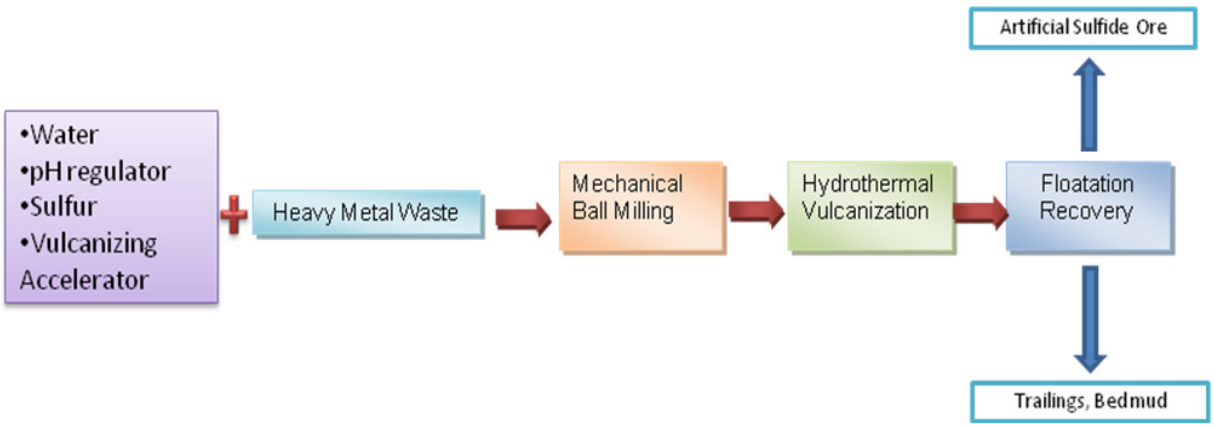
2. Hydrothermal vulcanization reaction

2.1. Transfer of liquid-solid mixture to a high-pressure reactor and sealed with required processing parameters.

2.2. The mixture is cooled after processing in the reactor.

3. Sulfur Ore floatation

3.1. Solid-liquid separation is carried out to extract the artificial sulfide that contains the recoverable materials.



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The technology has the following benefits:

- Cost-effective process with the use of low-cost vulcanizer materials.
- Generated sulfide has small size and high degree of crystallization, which enables a high-yield floatation recovery process.
- Short vulcanization time and high vulcanization rate of heavy metals.
- Low waste water pollution.

Patents

360ip's partner has filed one patent on this technology and plans to seek protection in multiple jurisdictions.

360ip is seeking interested parties for the licensing, further development and commercialization of this technology-based product.

For additional information, contact:
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