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Recycling of Manganese Ore Waste

In Ukraine, there is a great amount of manganese slimes which have accumulated for many years as a result of extraction and enrichment of manganese ores. Their storage requires constant monitoring of the impact on the air and groundwater. Tailings of manganese slimes cover large areas of land suitable for agricultural production. Moreover, manganese is a polytropic poison, which has a harmful effect on human body. In order to avoid the negative impact of manganese slimes on the environment and humans, it is necessary to find a way of their utilization.

The research of the enrichment of manganese ore waste was carried out using laboratory magnetic separators of two types.

The first was deflecting-type separator, which consists of Ne-Fe-B permanent magnets. Magnetic field of the separator is configured in such a way that an isogradient plane is formed in space along which the magnetic particles slip away from the working zone under the action of gravity. Non-magnetic particles move downward into the collector of the non-magnetic fraction. Separator is designed for enrichment of particles with a size of less than 2 mm. Studies have shown that when the content of manganese in the initial product is from 10 to 15%, the average recovery of manganese to the concentrate is 82%, and with initial manganese content from 5 to 10%, the recovery decreases to 76%. This type of separator permits to obtain waste with a low content of manganese, which provides more rational use of raw materials. The main advantage of the separator is work in an active mode without consuming electricity.

The second type of separator was a roller belt separator with roll diameter of 20 mm and a bi-gradient magnetic system. Separation of manganese-containing products comprising particles smaller than 2 mm has shown that the extraction of the magnetic fraction is 72%. This type of separator allows to obtain high-quality concentrates, however, there is a relatively high quantity of manganese particles which are caught into the non-magnetic fraction.

As a result of the research, the deflecting-type separator proved to be more effective for particle size of less than 200 μm, while the roller belt separator gave the better results of manganese extraction for a fineness of more than 200 μm.

Therefore, it is advisable to use the roller belt and deflecting-type high-gradient separators together. Moreover, processing of manganese ore waste will not only solve a number of environmental problems, but will also give the opportunity to obtain a commodity product with a content of manganese of more than 37%.