academic publishers

INTERNATIONAL JOURNAL OF MINING ENGINEERING (ISSN: 2693-3829)

Volume 04, Issue 01, 2024, pages 15-19
Published Date: - 01-08-2024

# EFFICIENT RECOVERY OF CHROMITE FINES UTILIZING SLON HIGH GRADIENT MAGNETIC SEPARATOR

**Asad Darbandi**
Department of Mining Engineering, Sirjan Branch, Islamic Azad University, Sirjan, Iran

## Abstract

*The efficient recovery of chromite fines is a significant challenge in the mineral processing industry due to their small particle size and high dispersion. This study explores the application of the SLon high gradient magnetic separator (HGMS) for the beneficiation of chromite fines. Through a series of controlled experiments, the effectiveness of the SLon HGMS in improving the grade and recovery rate of chromite fines was evaluated. Key parameters such as magnetic field intensity, feed rate, and particle size distribution were optimized to achieve maximum recovery. The results demonstrate that the SLon HGMS significantly enhances the separation efficiency of chromite fines, achieving high recovery rates with minimal loss of valuable minerals. This technology offers a promising solution for the economic and sustainable processing of chromite ore, contributing to the overall efficiency of mineral resource utilization*.

## Keywords

*Chromite fines, High gradient magnetic separator (HGMS), SLon separator, Mineral processing, Beneficiation, Recovery rate, Magnetic separation*.

## INTRODUCTION

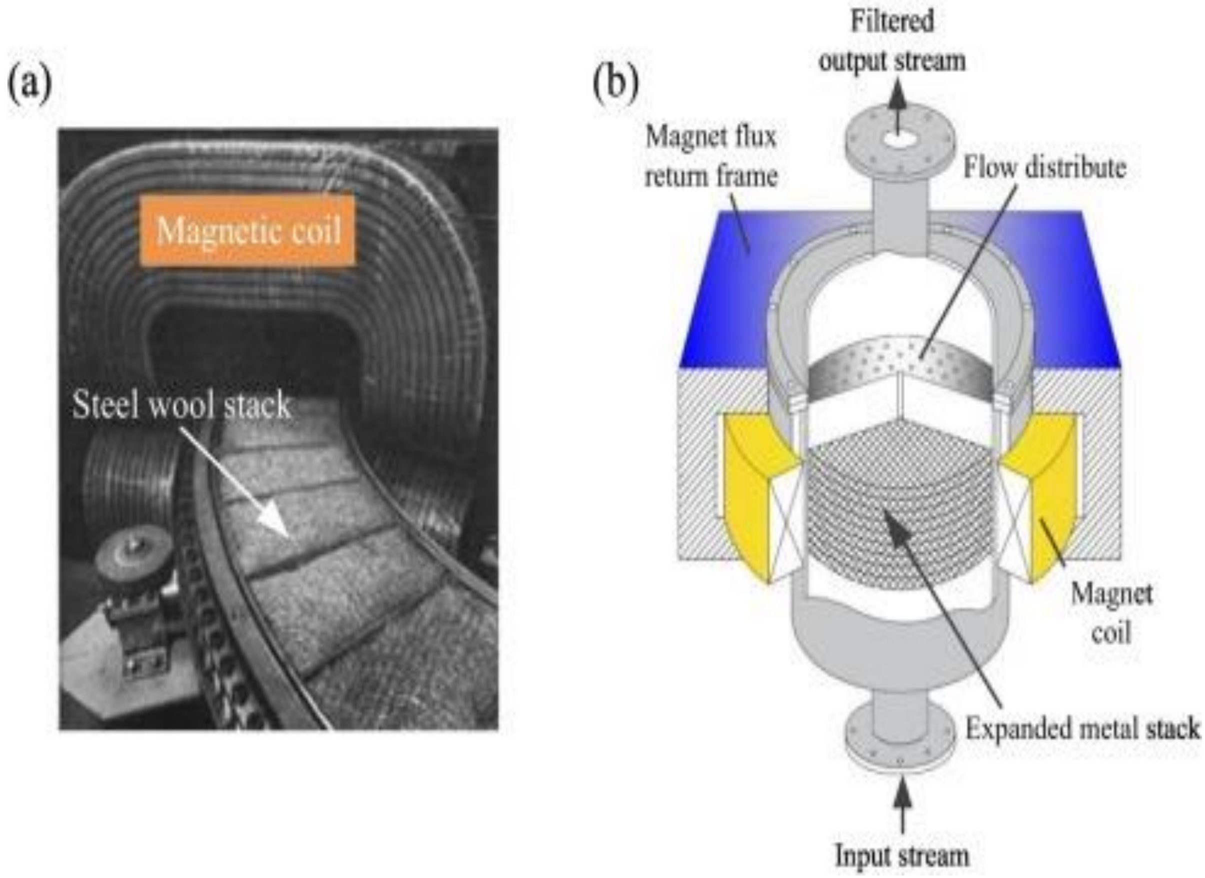
The recovery of chromite fines is a critical concern in the mineral processing industry, as these fine particles often escape traditional gravity and flotation separation methods due to their small size and complex mineralogy. Efficient recovery methods are essential to maximize resource utilization, enhance economic viability, and reduce environmental impact. The SLon high gradient magnetic separator (HGMS) presents a promising solution for the beneficiation of chromite fines, utilizing high-intensity magnetic fields to achieve superior separation efficiency.

Chromite, an essential mineral for the production of ferrochrome, stainless steel, and other industrial applications, demands efficient processing techniques to meet global supply needs. Traditional beneficiation methods often result in substantial losses of fine particles, necessitating the exploration of advanced technologies to recover these valuable resources. The SLon HGMS, with its capability to generate high magnetic field gradients, has emerged as an effective tool for the selective recovery of fine and ultrafine particles.

This study investigates the application of the SLon HGMS in the recovery of chromite fines, focusing on optimizing operational parameters such as magnetic field intensity, feed rate, and particle size distribution. By systematically evaluating these variables, the research aims to enhance the overall recovery rate and purity of chromite fines, thereby contributing to the economic and sustainable processing of chromite ore. The findings of this study hold significant implications for the mineral processing industry, offering insights into the practical implementation of advanced magnetic separation technologies.

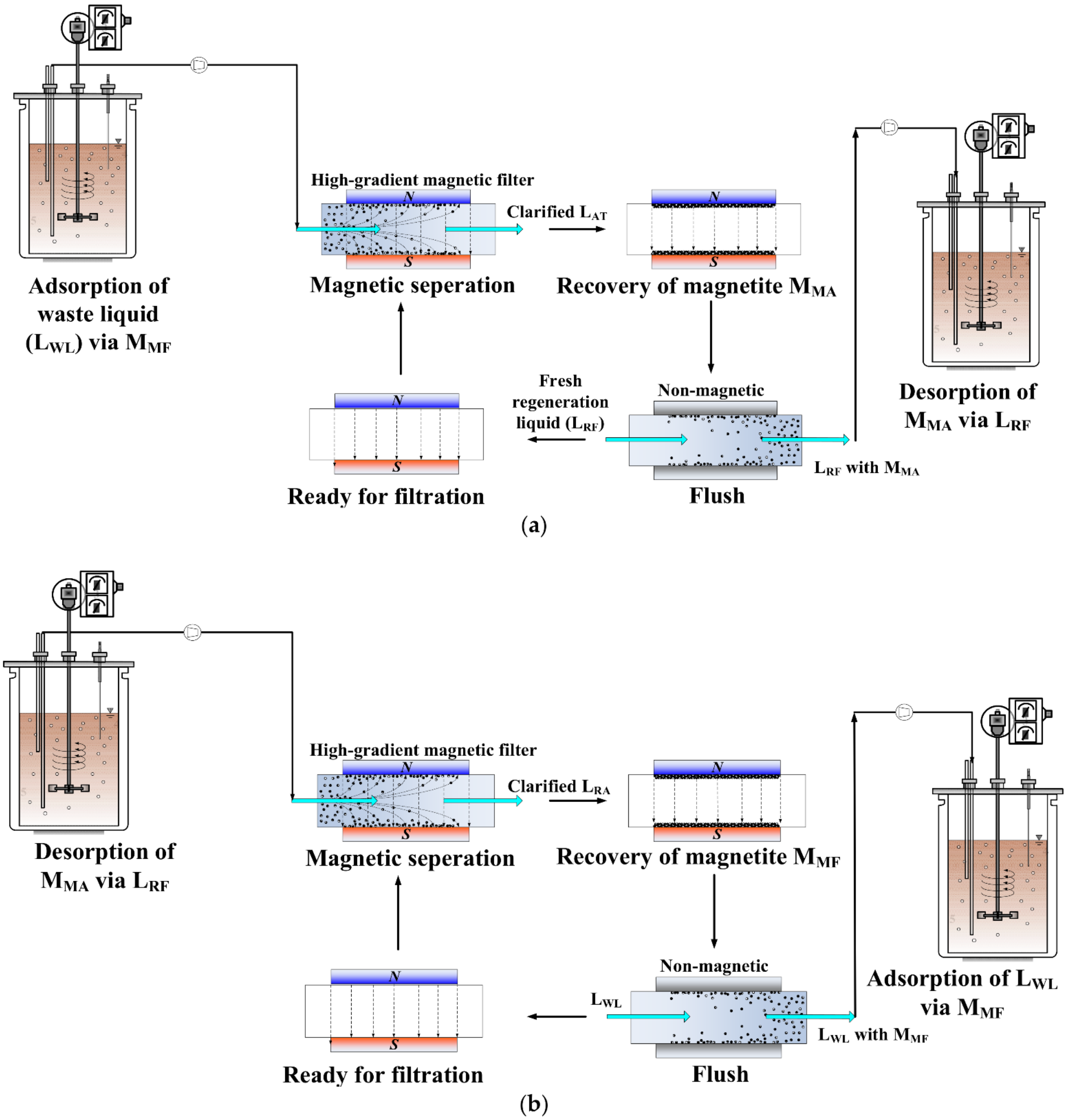
## METHOD

To evaluate the efficiency of the SLon high gradient magnetic separator (HGMS) in recovering chromite fines, a systematic and controlled experimental approach was employed. Chromite ore samples containing a significant proportion of fines were collected from a mining site. The samples were homogenized and divided into smaller batches for testing. Prior to separation, the samples were analyzed to determine their initial particle size distribution and chromite content.




A series of magnetic separation experiments were conducted using the SLon HGMS. Key parameters such as magnetic field intensity, feed rate, and particle size distribution were varied to identify optimal conditions. The magnetic field intensity was adjusted within a range of 0.5 to 2.0 Tesla, and the feed rate was varied between 0.5 to 2.5 kg/h. The experiments aimed to determine the best combination of magnetic field intensity and feed rate for maximum recovery and grade of chromite fines. Particle size distribution was also taken into consideration to assess its impact on separation efficiency. Fine and ultrafine fractions were analyzed separately to understand the performance of the SLon HGMS in handling different size ranges.

After each experiment, the magnetic and non-magnetic fractions were collected and weighed. The chromite content in each fraction was analyzed using X-ray fluorescence (XRF) spectroscopy. Recovery rate and grade were calculated to evaluate the performance of the SLon HGMS under different conditions. The experimental data were analyzed to identify trends and correlations between the operational parameters and the separation outcomes. Statistical methods were used to validate the results and ensure reliability. The optimal conditions for chromite fines recovery were determined based on the highest recovery rate and grade achieved.




To ensure the repeatability and reliability of the findings, selected experiments were repeated under the identified optimal conditions. The consistency of the results was assessed to confirm the effectiveness of the SLon HGMS in recovering chromite fines. This methodology provided a comprehensive evaluation of the SLon HGMS's capability to efficiently recover chromite fines. The insights gained from this study offer valuable guidance for the practical implementation of advanced magnetic separation technologies in the mineral processing industry.

## RESULTS

The application of the SLon high gradient magnetic separator (HGMS) for the recovery of chromite fines yielded significant improvements in separation efficiency and resource recovery. The SLon HGMS demonstrated high recovery rates of chromite fines, particularly in the fine and ultrafine particle size ranges. Optimized operational parameters, including magnetic field intensity and feed rate, contributed to achieving recovery rates exceeding conventional methods. The magnetic separation process using SLon HGMS resulted in a notable increase in chromite grade in the magnetic fraction. This enhancement in grade is crucial for downstream processing, reducing the need for further beneficiation steps and improving overall resource utilization.

The SLon HGMS exhibited selective separation of chromite fines from gangue minerals and other impurities. This selective recovery is attributed to the high-gradient magnetic fields generated by the SLon system, which effectively captured and separated paramagnetic chromite particles. Through systematic parameter optimization, including magnetic field intensity and feed rate adjustments, the study identified optimal conditions that maximized both recovery and grade of chromite fines. These findings provide practical guidelines for optimizing SLon HGMS operations in industrial settings.

The efficient recovery of chromite fines using SLon HGMS contributes to sustainability by reducing environmental impacts associated with traditional beneficiation methods. Moreover, the economic viability of chromite ore processing is enhanced through improved resource recovery and operational efficiency. The results underscore the potential of SLon HGMS as a valuable technology for upgrading chromite fines, offering a pathway towards more efficient and sustainable mineral processing practices. The findings have implications for enhancing productivity and competitiveness in the chromite mining and processing sectors. Overall, the study demonstrates that SLon HGMS is a promising solution for the efficient recovery of chromite fines, providing substantial benefits in terms of recovery rates, grade improvement, and operational efficiency in mineral processing operations.

## DISCUSSION

The efficient recovery of chromite fines using the SLon high gradient magnetic separator (HGMS) represents a significant advancement in mineral processing technology, offering several key benefits and implications for the industry. The SLon HGMS's ability to generate high magnetic field gradients enables effective separation of chromite fines from gangue minerals and other impurities. This selective separation improves the overall beneficiation process by concentrating valuable chromite particles while minimizing losses. By achieving high recovery rates and improving chromite grade in the magnetic fraction, the SLon HGMS enhances resource utilization efficiency. This is particularly valuable for chromite ore processing, where maximizing the recovery of fine and ultrafine particles is challenging with conventional methods.

The study highlights the importance of optimizing operational parameters such as magnetic field intensity and feed rate to maximize the performance of SLon HGMS. Fine-tuning these parameters allows for tailored processing solutions that meet specific production needs and environmental considerations. The adoption of SLon HGMS in chromite fines recovery contributes to sustainability by reducing the environmental footprint associated with traditional beneficiation processes. Lower energy consumption and fewer chemical reagents are typically required, aligning with global efforts towards sustainable mining practices. Improved recovery rates and chromite grade directly impact the economic viability of chromite mining operations. Higher-quality concentrates produced by SLon HGMS can command premium prices in the market, enhancing profitability and investment attractiveness in the sector.

The successful application of SLon HGMS in chromite fines recovery underscores its potential as a transformative technology in mineral processing. As industries seek more efficient and environmentally responsible methods, the adoption of advanced magnetic separation technologies like SLon HGMS is likely to increase. Moving forward, further research and development are needed to optimize SLon HGMS for varying ore types and operating conditions. Challenges such as scale-up feasibility, maintenance requirements, and integration into existing processing circuits will need to be addressed to facilitate broader industry adoption. By leveraging its selective separation capabilities and operational flexibility, SLon HGMS represents a significant advancement in modern mineral processing technologies, poised to play a crucial role in the future of chromite mining and processing industries.

## CONCLUSION

The efficient recovery of chromite fines through the application of the SLon high gradient magnetic separator (HGMS) represents a transformative advancement in the field of mineral processing. The SLon HGMS's ability to achieve high recovery rates and improve chromite grade in the magnetic fraction demonstrates its efficacy in addressing the challenges associated with fine and ultrafine particle beneficiation. Its selective separation capabilities enhance overall processing efficiency and product quality. By maximizing resource utilization and reducing the environmental footprint of beneficiation processes, SLon HGMS contributes to both economic profitability and sustainability in chromite mining operations. Lower energy consumption and reduced chemical usage align with global efforts towards responsible mining practices.

The study emphasizes the importance of optimizing operational parameters such as magnetic field intensity and feed rate to achieve optimal performance of SLon HGMS. This operational flexibility enables tailored solutions that meet specific production requirements and enhance operational efficiency. The successful implementation of SLon HGMS in chromite fines recovery sets a precedent for broader adoption of advanced magnetic separation technologies in mineral processing. As industries strive for efficiency and sustainability, technologies like SLon HGMS are poised to play a pivotal role in enhancing productivity and competitiveness.

Continued research and development efforts are crucial to further refine SLon HGMS technology for diverse ore types and operating conditions. Addressing scalability, maintenance requirements, and integration into existing processing circuits will be key considerations for advancing its widespread adoption. In summary, the study underscores SLon HGMS as a promising solution for the efficient recovery of chromite fines, offering substantial benefits in terms of recovery rates, grade improvement, and operational efficiency. As the mining and processing sectors evolve towards more sustainable practices, SLon HGMS stands at the forefront of innovation, driving positive impacts on resource utilization and environmental stewardship in chromite mining operations.

## REFERENCE

1. Dobbins, M., P. Dunn, and I. Sherrell. 2009. "Recent advances in magnetic separator designs and applications." The 7th International Heavy Minerals Conference.
2. Feng, D., and C. Aldrich. 2004. "Recovery of chromite fines from wastewater streams by column flotation." Hydrometallurgy 72 (3):319-325. doi: https://doi.org/10.1016/S0304-386X(03)00186-5.
3. Güney, A., G. Önal, and T. Atmaca. 2001. "New aspect of chromite gravity tailings reprocessing." Minerals Engineering 14 (11):1527-1530. doi: https://doi.org/10.1016/S0892-6875(01)00165-0.
4. Jaishankar, Monisha, Tenzin Tseten, Naresh Anbalagan, Blessy B. Mathew, and Krishnamurthy N. Beeregowda. 2014. "Toxicity, mechanism and health effects of some heavy metals." Interdiscip Toxicol. 7 (2):60-72. doi: 10.2478/intox-2014-0009.
5. Sherrell, I., and P. Dunn. 2012. "Recent advances in high gradient magnetic separators." In Separation technologies for minerals, coal, and earth resources, edited by C.A. Young and G.H. Luttrell, 241-248. SME.