Bench Scale Beneficiation Studies On Manganese Ores from Central India Mines

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Objectives

Manganese ore predominantly serves as a critical component in **steelmaking** processes , High-grade manganese is deliberately introduced to enhance the mechanical characteristics of steel. Additionally, it undergoes transformation into ferrous alloys, such as ferromanganese and silicomanganese, playing a **vital role in the deoxidization of steel** and effectively thwarting the formation of detrimental impurities. Beneficiation of a manganese ores with a grade of **30.00% Mno(A1 Sample) & 27% MnO(A2 Sample)** from central India region was investigated . The purpose of the study was to produce a higher grade of manganese concentrate suitable for end user industry. Through the **hydrocycloning**, we were able to increase the manganese concentration in these samples by around **15%**, making them suitable for sale in the market. Project dataset is Available on https://github.com/timecoder03/FYP.

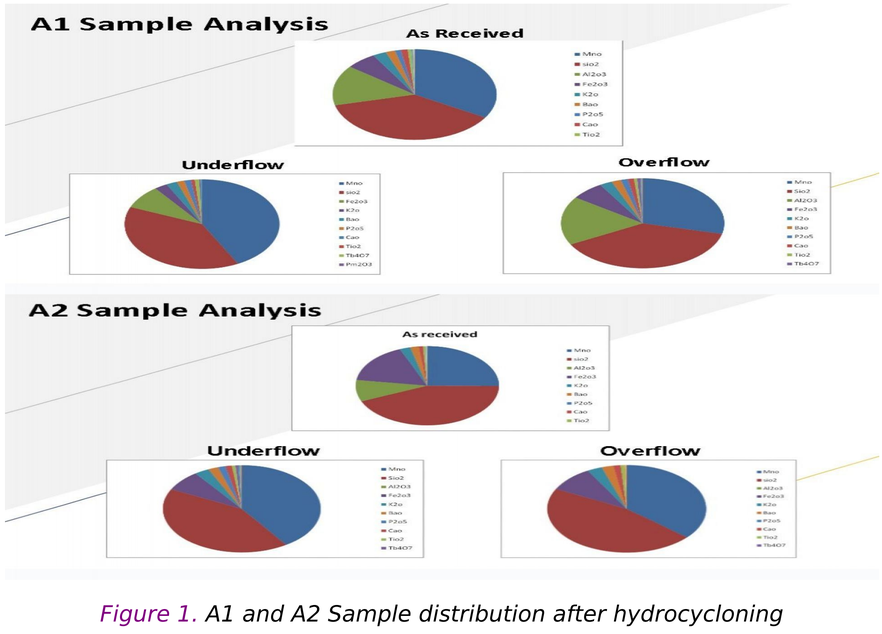


Figure 1. A1 and A2 Sample distribution after hydrocycloning

Study Methodology

⇒ **Moisture Content and Agglomerates**: The sample initially exhibited moisture content, leading to the formation of agglomerates that exceeded a size threshold of 1 mm.

⇒ **Drying and Sieving**: To overcome the agglomeration issue, the sample was subjected to a drying process in an open atmosphere. Afterward, the sample was passed through an automated sieve shaker to obtain particles with a size of less than 1 mm.

⇒ **Hydrocyclone Separation**: The operational setup involved the use of a Model E-HCTR hydrocyclone. It operated at a feed rate of 0.8 TPH, and the pump maintained a speed of 1200 rpm. The slurry's underflow and overflow components were collected separately in two containers. They were allowed to settle for 24 hours.

⇒ **Drying Post-Separation**: After the settling period, both the underflow and overflow samples were subjected to a drying process in an open atmosphere under ambient room temperature conditions.

⇒ **XRF Analysis**: Following the drying process, As received, underflow and overflow samples, each weighing 20 grams, were meticulously collected and forwarded for XRF analysis. After performing X-ray fluorescence (XRF) analysis, it was determined that the ore primarily contains Silica (SiO2), Magnesia (MnO), and Alumina (Al2O3). Additionally, small traces of lime, Magnetite, pure potash, barium oxide, strontia, rutile, terbium oxide, sulfur trioxide, and rubidium oxide were identified in the sample.

⇒ **SEM Analysis**: The underflow of sample 1 was subjected to SEM analysis. Particle size analysis of underflow was determined.

XRD and SEM Results

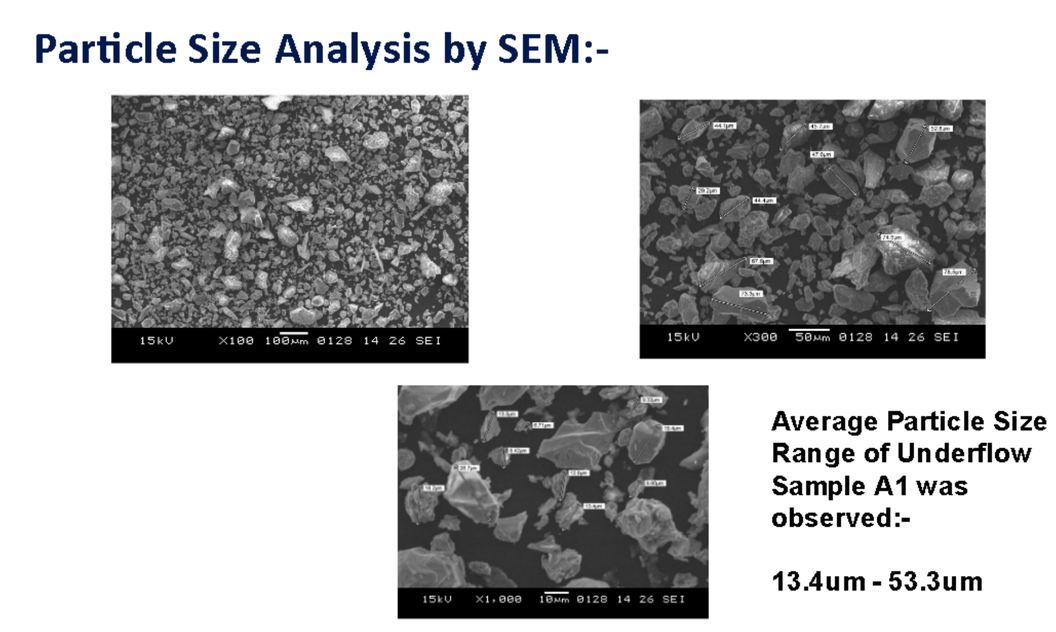


Figure 3

Table 1. .

Samples	%Mno	%Sio2	%enrichment
A1 Received	30.57	37.61	
A1 underflow	42.29	38.93	13%(↑)
A1 overflow	28.80	38.35	
A2 Received	27.21	39.78	
A2 underflow	40.75	42.24	14%(↑)
A2 overflow	33.45	42.62	

Observations

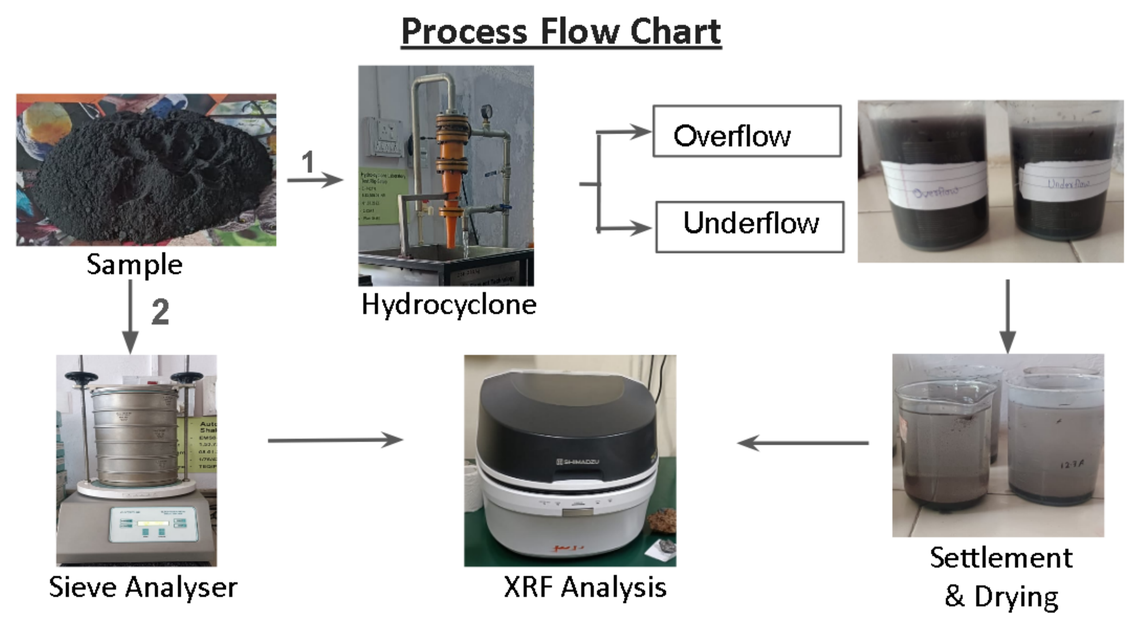
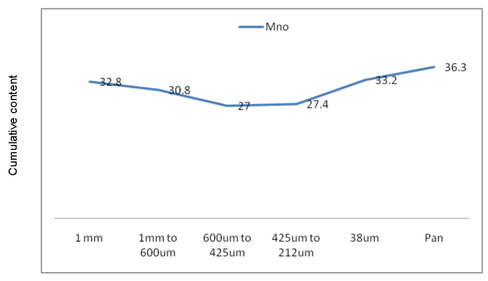
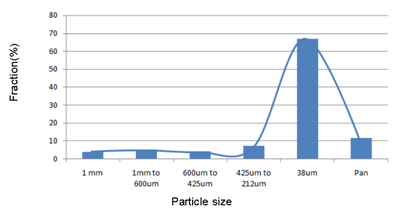


Figure 2. Process Flow Chart.



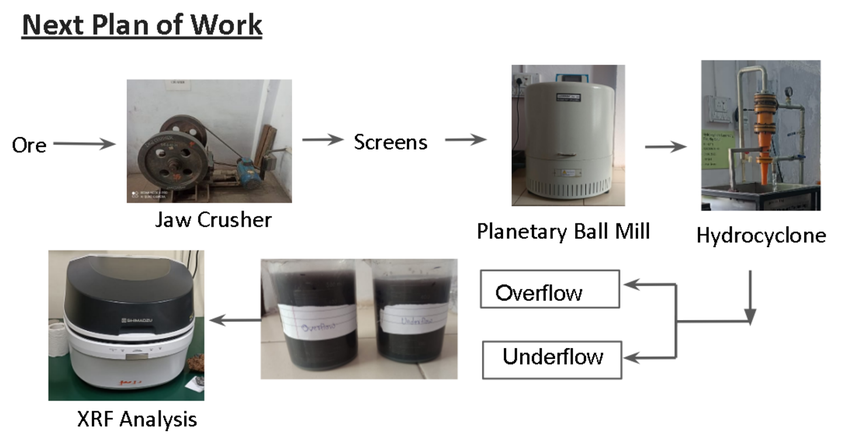
(a) Manganese Content



(b) Particle Size Distribution of A1 Sample

Conclusion

- According to sieve analysis, the most significant manganese concentrate grade was observed in two distinct particle size fractions -212+38µm and below 38µm.
- After SEM analysis of underflow sample had average particle size in range of 53.3um - 13.4 um. This outcome serves as a conclusive indication of the successful separation of manganese ores.
- Through the hydrocycloning, we were able to increase the manganese concentration in these samples by 15%, making them suitable for sale in the market.



References

V.A. Sontakkey , Ipsita Mohanram , R. S. Aehdi1 , V.A.J. Aruna and S. M. Lal ,Indian Bureau of mines, Nagpur, Ipsita Mohanram,Utilization of Manganese Dump Rejects of Central India Region for Industrial Applications„Researchgate Conference paper, 2016.