

Overview of the technology of iron ore processing in Vietnam: A case study in the tailings from the tailing storage facility (TSF) of the Kip-Tuoc processing plant

Thanh-Hai Pham^{1,*}, Dzung Thi Kim Nhu¹, Luan Van Pham¹, Nhung Thi Pham¹, Toi Trung Tran¹, Chinh Thi Vu¹, Thinh Duc Tran²

¹ Faculty of Mining, Hanoi University of Mining and Geology

Address: No.18 Vien Street, Duc Thang Ward, Bac Tu Liem District, Ha Noi, Vietnam

² Vinacomin – Minerals Holding Corporation

Address: No. 193, Nguyen Huy Tuong Street, Thanh Xuan Trung Ward, Thanh Xuan District, Ha Noi, Vietnam

Corresponding author Email: phamthanhhai@hmg.edu.vn

Abstract

Iron is the most popular and important metal in the world. The iron-containing minerals are recovered from the iron run-of-mine ore and the tailing storage facilities (TSF) of the previous processes. There are many methods to upgrade the iron content as well as to separate the iron minerals and gangue. The article shows an overview of the main methods in order to treat the type of raw material (including magnetic separation, gravity separation, flotation, etc.). Moreover, a case study about the iron recovery of Kip-Tuoc (Vietnam) tailing ore from the TSF is presented. The result indicated that by applying the suitable method and carefully controlling the operational parameters, the iron (from the tailing pond with a grade content of 14.28% Fe) is still recovered up to 57.57% at the grade content of 59.49% Fe [1], [2].

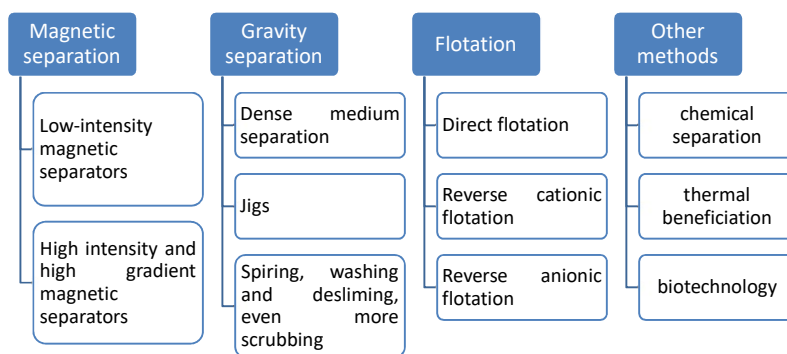


Figure 1. Iron ore beneficiation technology [1]

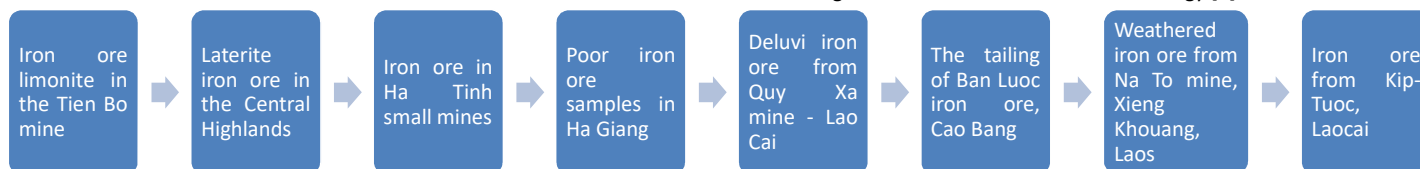
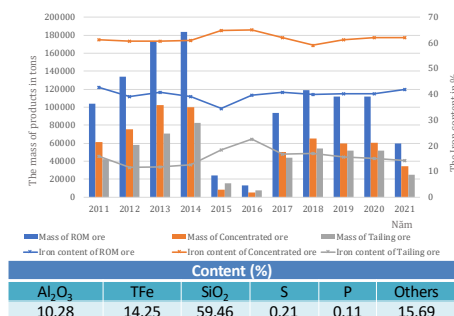


Figure 2. Research on Iron ore beneficiation in Vietnam [2]



Minerals	Range content (~%)
Illite (Mica)	~ 29-31%
Clorite	~ 4-6 %
Quartz	~ 29-31 %
Felspar	~ 2-4 %
Albite	~ 12-14 %
Hematite	~ 15-17 %
Magnetite	~ 2-4 %

Figure 3. Charateristic of Iron tailing ore from TSF Kip Tuoc, Lao Cai [3]

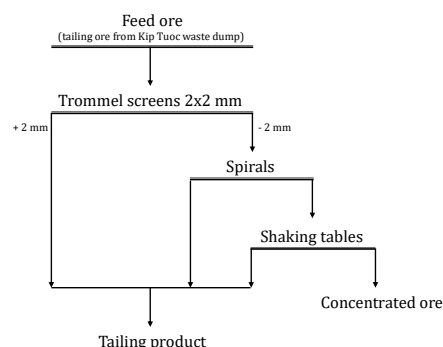


Figure 4. Proposed flowsheet and the result in recovering iron tailing ore from Kip Tuoc

Stages	Trommel screen	Spiral	Shaking table	
Optimal study condition	Rotating speed: 35 RPM; Liquid/Solid ratio: 5; Pressure washing (water): 2 atm; Feed rate: 6 m³/h.	Solid concentration: 25%; Flow rate of feed slurry: 3 m3/h.	Frequency: 1.67 Hz;	
			Amplitude: 10 mm;	
			Feed rate: 0.3 kg/minute;	
			Loading water: 0.6 liters/minute;	
			Washing water: 1.2 liters/minute;	
			Inclined bed surface: 1.5 degree.	
Product		Iron content (%Fe)	Yield (%)	Recovery (%)
1. Oversize product after trommel screen stage		10.7	2.56	1.92
1. Tailing after spiral		10.56	14.58	10.78
1. Tailing after shaking table stage stage		6.15	69.04	29.73
Total tailing		7.03	86.18	42.43
Concentrate		59.49	13.82	57.57
Feed ore (from TSF)		14.28	100	100

Table 1. The suggested optimal parameters and the result of iron tailing re-processing

Conclusion

Iron is the most important material for the life and defense industries. Almost iron has recovered from iron ore with the popular minerals hematite, magnetite, goethite, etc. Besides that, the tailing iron ore, which is the the product of the previous low-efficiency process, needs reprocessing and recovering.

The paper presents a review of the main methods to upgrade the iron content as well as separate iron minerals out of the gangue. It can be seen that magnetic separation, gravity separation, and flotation are used most.

Based on the literature review, the paper also shows the case study of upgrading the tailing ore of the Kip Tuoc iron ore processing plant. By using the combination of the trommel screen, spiral, and shaking table, the iron grade content increased to 59.49 % at a recovery ratio of 57.57%. The tailing after re-processing has 7.03% Fe content. The case study also defines the optimal parameters for each stage at the lab scale. Those are the important basics for scale-up in the future as well as the reference for the iron tailing processing at other TSF in Vietnam and on the world.

References

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2. IMSAT, "Thiết kế cơ sở: "Dự án đầu tư xây dựng công trình mở rộng năng công suất mỏ sắt Kíp Tuốc - Lào Cai đạt 100.000 tấn quặng tính/năm.", IMSAT, Hanoi, 2009
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