The International Conferences on Engineering Sciences
Volume. 1, Number. 2, Year 2024
Page 13-16
Available online at: https://prosiding.aritekin.or.id/index.php/ICONFES

Comparison of Ultra Fine Grinding Effect on Gold Recovery Using Intensive Leach Test Method at PT Geoservices

Dyah Probowati[1], Nailzidane Nefananda Dziban[2*]
[1,2] Universitas Pembangunan Nasional "Veteran" Yogyakarta, Indonesia
**Corresponding author: nefanandane@gmail.com*

Abstract: *Indonesia is an archipelagic country that has abundant mineral wealth, both metal minerals and other minerals. Metal minerals, including gold, tend to have a higher economic value. Based on data from the Ministry of Energy and Mineral Resources, the world's gold reserves in 2020 were 50,300 tons of Au. Indonesia is among the 5 largest in the world with 5% of the total gold reserves, which is 2,600 tons of Au. Therefore, it is necessary to develop technology and science in the mining industry, especially gold and silver, to improve the optimization of the process and increase the added value of the mining products themselves. One of the gold extraction processes can be done hydrometallurgically with the cyanidation method using a intensive leach test. The results of this experiment show that factors such as cyanide usage and ultra fine particle size will greatly affect the recovery of gold and silver metals.*

Keywords: *Gold, Ultra Fine, Extraction.*

1. INTRODUCTION

Indonesia is an archipelagic country that has abundant mineral wealth, both metal minerals and other minerals. Metal minerals, including gold, tend to have a higher economic value. Based on data from the Ministry of Energy and Mineral Resources, the world's gold reserves in 2020 were 50,300 tons of Au. Indonesia is among the 5 largest in the world with 5% of the total gold reserves, which is 2,600 tons of Au. Therefore, Indonesia has an important role in providing the world with raw gold materials. The potential for gold deposits is found in several regions in Indonesia, such as on the islands of Kalimantan, Nusa Tenggara, Sumatra, Riau, Java, Sulawesi, Maluku, and Papua.

Gold is a metal that has high economic value so it is widely used as jewelry, investment, electronics and others. So that the need for gold will be higher, this encourages the gold and silver mining industry to continue to grow. Gold is obtained through a series of complex processing processes from ore to gold that has high purity (Petruk, n.d.).

Generally, gold is associated with other minerals such as silver and copper. Silver is more abundant than gold. There are several methods that can be used to process gold and silver such as gravity concentration, flotation and cyanidation. (Cyanidation Wastes of Gold-Silver Ores, n.d.). The cyanidation process equation can be seen in equation 1.

$$4Au(s) + 8NaCN(aq) + O2(g) + 2\ H2O(l) \rightarrow 4NaAu(CN)2(aq) + 4NaOH(aq) \quad (1)$$

Leaching is one of the methods for extracting gold from ores using cyanide as an extracting reagent, the cyanidation method is a method of processing gold and silver using cyanide as a leaching reagent, this method is the most widely used in the extraction industry

Received: October30, 2024; Revised: November 30, 2024; Accepted: December 18,2024; Published: December 30, 2024

throughout the world because the resulting gold and silver recovery is higher than other methods and with a relatively short processing time and more economical and also this cyanide reagent can also extract gold with various ore sizes from coarse to fine (Petersen & Van Deventer', 1991). By using this cyanidation method, there are also factors that influence the process of chemical reactions in this leaching process such as the pH of the slurry which is set under certain conditions, the residence time or time of the leaching process, the concentration of the leaching reagent, the level of dissolved oxygen which all these factors affect the percent extraction of a processing process that determines profit and loss in an industry (Mudder et al., n.d.).

In terms of particle size on gold extraction, particle size and recovery results are inversely proportional. The smaller the particle size, the higher the gold and silver recovery results. And vice versa, the larger the particle size, the smaller the gold and silver recovery produced. (Riswan, 2019)

2. RESEARCH METHODS

Intensive leach testing was carried out on the concentrate from the flotation process. Intensive leach was carried out on 2 different samples, namely samples A and B. In the 2 samples, there were 2 variations where 1 sample was subjected to ultra-fine grinding to a size of 20 microns and 1 sample was not subjected to ultra-fine grinding with a normal size of 75 microns. This test was carried out using several parameters, namely using 2 different types of particle sizes, namely 20 microns and 75 microns, other parameters were also used such as pH which was set in the range of 10.5 - 11, the NaCN concentration was maintained at 5000 ppm. The results of the head grade Au in the sample were Au contained at 3.92 ppm.

The tools used in this research include sample preparation of research materials including: pH meter, dissolve oxygen (DO) meter, burette, beaker glass, erlenmeyer flask, measuring tube, syringe, spatula, scale, timer, and bottle roller. While the materials used in this study include ore sample, *aquadest*, lime, rhodanine, $AgNO_3$ and NaCN.

Intensive leach test was started with preparing non-UFG and UFG samples for each code, namely A and B, which are flotation concentrates, Preparing 4 bottle rollers which are then coded on each bottle, Inserting samples into each bottle that has been coded and adding water according to the needs to achieve a solid percentage of 35%, Checking the pH of each sample and adjusting it until the pH reaches a range of 10.5 - 11 before adding NaCN, Taking a 5ml sample to be tested using AgNO¬3 in order to determine the NaCN requirements needed to achieve 5000 ppm NaCN, Calculating the NaCN requirements then inserting NaCN into

each bottle, Raising the bottle to the bottle roller and recording the rise time, Taking the bottle from the bottle roller and sampling at hours 2, 4, 8, 12, 24, 48, Sampling is done by taking 5ml of each solution to then be tested using AgNO3 to see the need for additional NaCN so that the cyanide level remains at 5000ppm, During sampling, 45ml was also taken and submitted to another division to determine the Au content that had been extracted from the sample. After sampling, water was added according to the initial parameters and pH monitoring was carried out at 10.5 - 11 and NaCN was added if the NaCN content was less than 5000ppm.

3. RESULT AND DISCUSSION RESULTS OF RESEARCH

It is known from the test results that there is a difference in the percentage of extraction, where sample A which was subjected to ultra-fine grinding had a higher final extraction percentage of 27.30% compared to that which was not subjected to ultra-fine grinding which only had an extraction percentage of 24.63%. However, with the increase in the extraction percentage, the consumption of cyanide used also increased more than 2 times between the samples subjected to UFG and those not subjected to UFG. In sample B there was also an increase in the extraction percentage from 26.76% to 35.48%, and the same thing happened in sample B where the consumption of NaCN was higher than the sample which was not subjected to UFG.

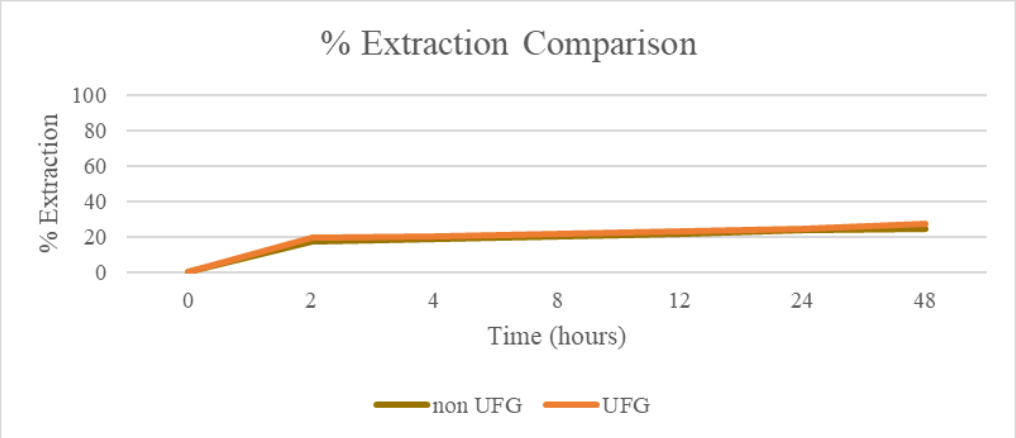

Figure 1. Au Leach Comparison Chart

From the results of the experiments conducted where particle sizes of 75 microns and 20 microns were used, the 20-micron sample had a higher recovery rate. However, there was also an increase in NaCN consumption because NaCN was used to bind Au or gold itself. This is in accordance with the theory that the finer the size of a particle, the greater the exposed surface area will be and this will have an impact on the extraction percentage because the reagent will be more easily in contact with the targeted or expected minerals. From the graph above, it is known that the extraction percentage obtained was higher when the sample was subjected to a size reduction process to a very fine or ultra-fine size.

4. CONCLUSION

The purpose of this recovery test is to determine whether the ultra-fine grinding process needs to be carried out on samples at PT Geoservices. In the results of size reduction between 75 microns and 20 microns, the highest recovery is found in the 20 micron size with each in sample A being 27.30% and in sample B being 35.48%. 2. There is an increase in NaCN consumption in both samples. This is reasonable because the exposed Au becomes more so that it requires more NaCN in the process.

ACKNOWLEDGEMENTS

The authors would like to thank PT Geoservices for supporting and facilitating this research.

REFERENCES

Cyanidation Wastes of Gold-Silver Ores. (n.d.).

Dehghani, A., Canada, S., Mojtahedzadeh, S. H., & Gharibi, K. (2009). Recovery of gold from the Mouteh Gold Mine tailings dam. In *Article in Journal of the Southern African Institute of Mining and Metallurgy*. https://www.researchgate.net/publication/288650815

Mudder, T. I., Michael, M., Botz, P. E., & Smith, A. (n.d.). *Chemistry and Treatment of Cyanidation Wastes SECOND EDITION MINING JOURNAL BOOKS LTD LONDON MJ*.

Petersen, F. W., & Van Deventer', J. S. J. (1991). *THE INFLUENCE OF pH, DISSOLVED OXYGEN AND ORGANICS ON THE ADSORPTION OF METAL CYANIDES ON ACTIVATED CARBON* (Vol. 46, Issue 12).

Riswan. (2019). THE EFFECT OF PARTICLE SIZE ON GOLD (Au) AND SILVER (Ag) RECOVERY IN AGITATEDLEACHED CYANIDATION AT PT. NUSA HALMAHERA MINERALS.