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Approaches to improve the efficient bioleaching of arsenopyrite flotation concentrate

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INTRODUCTION & AIM

Bacterial leaching is known as a green technology for the recovery of valuable metals. However, it has some "bottle neck" problems too. Arsenopyrite, a gold-bearing ore, is a refractory mineral material which is hardly soluble and contains toxic arsenic compounds which worsen bioleaching results. The most common biotechnology used for this process includes the bacteria *Acidithiobacillus ferrooxidans*, which are autotrophic, acidophilic and resistant to inorganic arsenic compounds. Attempts to dissolve arsenopyrite with increasing volumes of sulfuric acid and supplements of iron, as an energy source for the leaching bacteria, provoke the following: an acidification of the environment and its pollution with excess of iron.

We simplified this procedure by

i) exchanging the sulfuric acid for HCl,

ii) the use of a new active strain of *A. ferrooxidans* AA-ZhNR.

METHOD

Bench scale experiments of the bioleaching of arsenopyrite flotation concentrate were produced to compare it with i) the common (classical) medium 9K based on sulfuric acid and iron and a known leaching strain, *A. ferrooxidans* TFbk, and ii) our HCl medium without iron supplements and with our strain. The degradation of the flotation concentrate was evaluated by the accumulation of dissolved sulfate estimated with ion chromatography.

RESULTS & DISCUSSION

The degradation of the flotation concentrate was evaluated by the accumulation of dissolved sulfate. The experiments showed that the application of *A. ferrooxidans* AA-ZhNR, with the arsenopyrite flotation concentrate as a single source of energy, resulted in 4-fold higher production of dissolved sulfate.

CONCLUSION

On the whole, the bioleaching of arsenopyrite concentrate may be increased by i) selection of the new effective strains and ii) application of the raw mineral material as a single energy source, i.e. without additives of any alternative energy sources.

FUTURE WORK / REFERENCES

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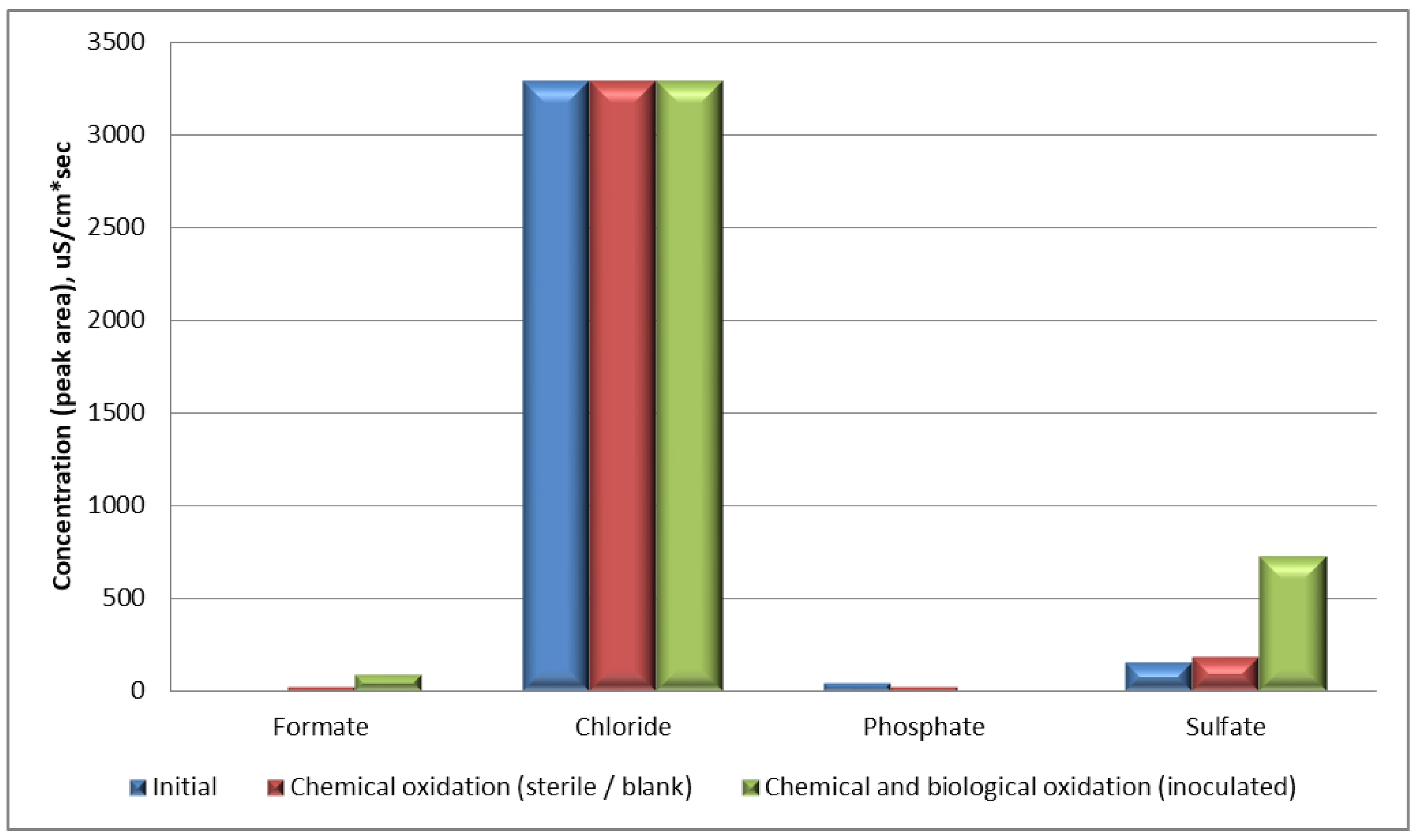
RESULTS : DATA

Figure 1. Leaching of flotation arsenopyrite concentrate, at 24°C for 18 days.

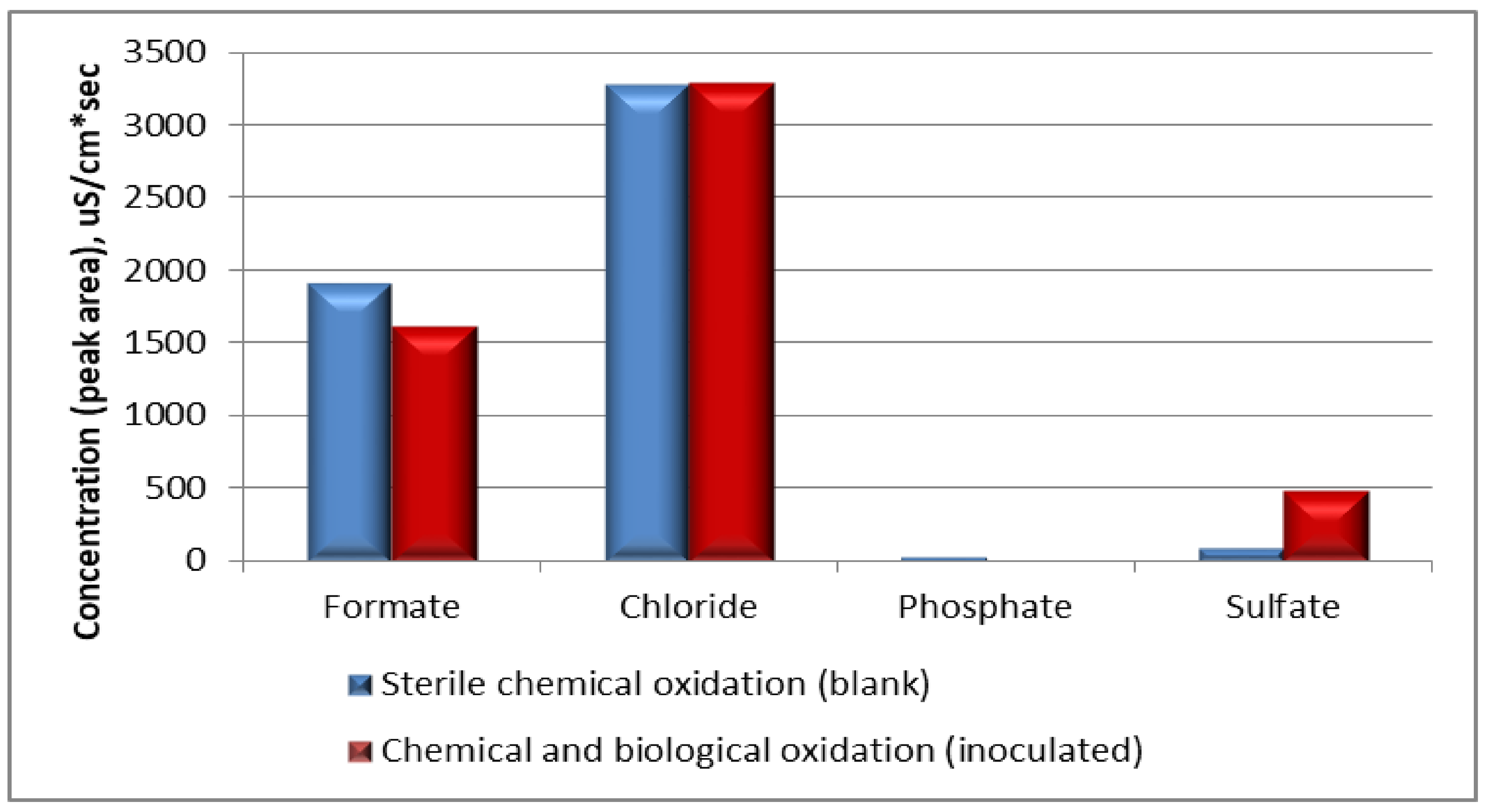
The inoculated strain is *A. ferrooxidans* AA-ZhNR. Peak areas were recalculated for all flasks using chloride content as an internal standard.



During sterilization of flotation concentrate samples by autoclaving, 183 mg sulfates/L passed into the solution. Subsequent chemical oxidation over 18 days amounted to an additional 39 mg sulfates/l. Biological oxidation over 18 days, excluding chemical oxidation, amounted to 659 mg sulfates/L.

Figure 2. Leaching of flotation arsenopyrite concentrate at 24°C for 18 days.

The inoculated strain is *A. ferrooxidans* AA-ZhNR. Peak areas were recalculated for all flasks using chloride content as an internal standard.



An additional source of energy for bacteria, formate, was added to the medium. Bacterial consumption of formate in 18 days is 15.52%. At the same time, biological oxidation over 18 days excluding chemical oxidation amounted to 449 mg sulfates/L, that is, 31.87% less than without formate. Conclusion Under these conditions, the bacteria switched to a noticeable extent to the additionally introduced alternative energy source to sulfide - formate.