

ABSTRAK

INTEGRASI DATA OPERASI, *DIAGNOSTIC LEACH* DAN STUDI KINETIKA UNTUK MENILAI EFISIENSI SUPLAI OKSIGEN (OSR VS SPARGER) PADA SIANIDASI EMAS SKALA PLANT

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Penelitian ini mengevaluasi penggunaan *Oxygen Shear Reactor* (OSR) pada proses pelindian emas di PT MSM dibandingkan dengan sistem *sparger lance*. Hasil menunjukkan bahwa OSR mampu meningkatkan kadar oksigen terlarut *slurry* hingga 16,73 mg/L, lebih tinggi dibanding *sparger lance* (9,8 mg/L). Peningkatan ini berdampak pada *recovery* emas awal (4 jam) sebesar 59,48%, sedangkan *sparger* hanya mencapai 53,97%. Pada 24 jam, perbedaan *recovery* emas menjadi kecil (82,73% OSR dan 80,92% *sparger*) serta secara statistik tidak signifikan, namun perlu ditinjau apakah kenaikan $\pm 2\%$ *recovery* emas berpengaruh pada skala produksi.

Hasil korelasi menunjukkan bahwa *recovery* emas berlebih OSR memiliki hubungan sangat kuat dengan *Au in sulphide* ($r = 0,931$), menegaskan peran OSR dalam mengekspos emas yang terperangkap pada mineral sulfida. Analisis kinetika dengan *Shrinking Core Model* memperlihatkan bahwa pelindian pada kedua sistem tetap dikendalikan oleh *chemical reaction control*, dengan konstanta laju hampir sama ($k_{\text{OSR}} = 0,064$; $k_{\text{Sparger}} = 0,06$). Hal ini menegaskan bahwa OSR tidak mengubah mekanisme dasar pelindian, tetapi mampu mempercepat pencapaian *recovery* emas melalui peningkatan oksigen.

Berdasarkan hasil tersebut, OSR dinilai layak diterapkan penuh di PT MSM dari sisi teknis, dengan rekomendasi dilakukan kajian ekonomi lanjutan untuk menilai kelayakan investasi.

Kata kunci: *Diagnostic leaching*, *Dissolved oxygen*, *Oxygen Shear Reactor*, *Sparger lance*, *Recovery* emas

ABSTRACT

INTEGRATION OF OPERATIONAL DATA, DIAGNOSTIC LEACHING AND KINETIC STUDY TO EVALUATE THE EFFICIENCY OF OXYGEN SUPPLY (OSR VS. SPARGER) IN PLANT SCALE GOLD CYANIDATION

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This study evaluates the use of an Oxygen Shear Reactor (OSR) in the gold leaching process at PT MSM compared to the sparger lance system. The results show that the OSR is capable of increasing the dissolved oxygen level in the slurry to 16.73 mg/L, which is higher than that achieved with the sparger lance (9.8 mg/L). This increase led to an improvement in early gold recovery (after 4 hours) of 59.48%, while the sparger only reached 53.97%. After 24 hours, the difference in gold recovery became smaller (82.73% for OSR and 80.92% for the sparger) and statistically insignificant; however, it remains necessary to assess whether an approximate 2% increase in gold recovery has a meaningful impact at the production scale.

Correlation analysis indicates that excess gold recovery with OSR has a very strong correlation with Au in sulphide ($r = 0.931$), confirming OSR's role in exposing gold trapped within sulphide minerals. Kinetic analysis using the Shrinking Core Model shows that leaching in both systems is governed by chemical reaction control, with similar rate constants ($k_{OSR} = 0.064$; $k_{Sparger} = 0.06$). This indicates that OSR does not alter the fundamental mechanism but accelerates leaching by enhancing oxygen availability, thereby enabling faster achievement of gold recovery.

In conclusion, OSR is considered technically feasible for full-scale implementation at PT MSM, with an economic assessment recommended to evaluate the cost-benefit balance of its full-scale investment.

Keyword : Diagnostic leaching, Dissolved oxygen, Gold recovery Oxygen Shear Reactor, Sparger lance