**Evaluation of the effect of the use of bacterial alginate on wind erosion**

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**Introduction**Tailings erosion, caused by wind action affects productivity, the human health and the ecosystems [1]. One solution to mitigate the effects of the erosion caused by the wind is the use of biopolymers [2]. *Azobacter vinelandii* is a bacterium that produce the polymer alginate [3]. Biopolymers have been implemented in geotechnical engineering sectors and mainly act as binders for soil [2]. The objective of the study was to evaluate the effect of the alginate solution on mining tailings.

**Methodology**

Alginate was obtained from cultures of *A. vinelandii*. Experiments were carried out in a 20 L bioreactor at 30 °C. Alginate molecular weights (MW) of 80 and 300 kDa were obtained. Alginate solutions were prepared at two different concentrations at 1.0 and 1.5 g L-1, and a CaCl₂ concentration of 0.5 M was used. Tailings erosion was measured in a wind tunnel with an airflow of 12 m s-1 and an exposure time of 4 h.

**Results**

Increasing the alginate concentration decreases the % loss, using 1.5 g L -1 of alginate, only 0.4% tail loss was observed. Tail loss was not affected by MW of alginate. Other biopolymers have been reported to significantly improve erosion resistance by forming a biofilm [2]. Alginate forms a wind erosion resistant biofilm under the given conditions as shown in Figure 1, achieving only 0.3% tailing loss during the exposure time.

**Conclusion**

Alginate significantly reduces erosion in mine tailings, achieving only 0.4% loss at 1.5 g L-¹. Its efficacy is not dependent on molecular weight, and its ability to form a resistant biofilm highlights its potential as a sustainable solution to mitigate environmental erosion.

Figure 1. Biofilm formation at 1.5 g L -1 of alginate.

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**References**

[1] Valenzuela, P., & Vega, S. Dust suppressant treatments. Quality control. *Journal of Construction*, 13(3), 27-35 (2014).

[2] Kumar, S., Yadav, BD y Raj, R. Una revisión sobre la aplicación de biopolímeros (xantano, agar y guar) para la mejora sostenible del suelo. *Discov Appl Sci***6** , 393 (2024).

[3]​ Diaz-Barrera, A., Sanchez-Rosales, F., Padilla-Cordova, C., Andler, R., & Peña, C. (2021). Molecular weight and guluronic/mannuronic ratio of alginate produced by Azotobacter vinelandii at two bioreactor scales under diazotrophic conditions. Bioprocess and Biosystems Engineering, 44(6), 1275-1287.