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Recycle of quarry byproducts for producing a new Zn fertilizer

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Zinc (Zn) is a crucial micronutrient for plants, related with tolerance against diseases. When crop demand exceeds Zn availability in the soil, using Zn-fertilizers becomes necessary (biofortication), however, even in foliar application, soluble Zn salts are mostly used, which are prone to leaching and consequently exhibit limited uptake by plants.

In response to this challenge, a novel controlled-release formulation, utilizing mine wastes as carrier, was developed, involving an energy-efficient process with ambient temperature and pressure, and a reaction time of approximately 8 hours.

Formulations were prepared by mixing a zeolite-rich (clinoptilolite) tuff with 2 quarry by-products, namely lapillus and pumice, using different dosages. We conducted studies on the kinetics of Zn adsorption and release, ultimately identifying the most effective mixture which comprised 70% zeolite-rich tuff and 30% pumice.

To assess the effectiveness, a fertilization test was performed via foliar application in *Vitis vinifera*, aiming to evaluate the Zn coverage, and the persistence of the product against simulated rainfall, in comparison with conventional ZnSO₄ fertilizer.

The test confirmed greater Zn resistance to rain leaching, also suggesting potential for reducing treatment dosages, thereby mitigating environmental-related impacts. Moreover, the presence of 30% pumice would allow significative reuse of mining byproduct.

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