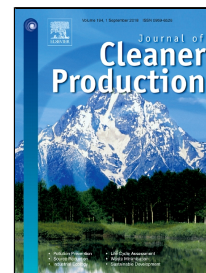


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Beneficial use of Ni-rich petroleum coke ashes: product characterization and effects on soil properties and plant growth



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1 **Beneficial use of Ni-rich petroleum coke ashes: product characterization and** 2 **effects on soil properties and plant growth**

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16 17 **Abstract**

18 Fly and bottom ashes - by-products of petroleum coke combustion - contain important plant
19 nutrients (e.g., Ca, S) and may be used as soil acidity amendments, yet their metals content might be
20 a concern. Finding innovative alternatives for the beneficial use of such by-products is key for
21 assuring their environmental sustainability. In this study, we first carried out a comprehensive
22 characterization of fly and bottom ashes, i.e., physical, chemical, mineralogical, and structural
23 analyzes. Next, we created a new product based on these ashes to meet the demand of the Brazilian
24 legislation. To test the agronomic efficiency of the product and the environmental implications of
25 its agricultural use, greenhouse experiments were performed with two Oxisols, cultivated with
26 maize and soybean. The treatments consisted on the application of two doses of different products,
27 aiming to increase soil base saturation to 50% and 70%, and three sources: 1) a blend of fly and
28 bottom ashes with commercial limestone (blended limestone, BL); 2) a positive control, commercial
29 limestone enriched with Ni and S (enriched limestone, EL); and, 3) a negative control (commercial
30 limestone, CL). The BL was efficient for soil acidity correction, providing Ca, Mg, S, and Ni to
31 maize and soybean plants. Plant dry weight did not change following the application of the product,
32 yet the BL was effective as a Ni-fertilizer, since it was able to increase soil-Ni up to 5-fold, as well
33 as Ni content in maize and in soybean leaves by 5- and 4-fold, respectively, positively affecting N
34 metabolism. Our findings revealed that, while improving many soil attributes, the BL is a viable and

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