Mobilization of exchangeable aluminum in acid sulfate soils (ASS)

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The conversion of coastal lowland sulfidic sediments for agricultural activities has been a common practice and has caused substantial acidification and degradation of adjacent estuarine water quality and ecosystems in Eastern Australia, and other areas worldwide [1].

The geochemistry of Al in acid sulfate soils (ASS) has rarely been the focus of research that has been published to date despite the abundance of this metal in released waters. Reactive, or, exchangeable Al can easily be sorbed/desorbed from soil mineral surfaces. Hence, the study of this pool of Al represents an opportunity to identify some release mechanisms and a more appropriate method to estimate Al likely to be released from ASS.

Extractants were chosen to isolate the exchangeable pool of Al in 30 soil samples from the Tweed Shire in north-eastern NSW, Australia: 1M KCl ($AI_{KCl ext}$), 0.2 M CuCl₂ ($AI_{CuCl₂ ext}$) and isotope exchange using ²⁶Al as a tracer (AI_{exch}) with analysis via Accelerator Mass Spectrometry (AMS). 1M KCl extraction is a standard method to determine the 'exchangeable' pool of Al and other metals [2 - 6] and is currently the recommended method for ASS. CuCl₂ was used for its high affinity for organic ligands [2, 3, 7] while ²⁶Al isotope exchange is a novel method than can be used to study the complex processes of aluminum storage and release [7, 8].

The results showed that the pool of Al extracted by 1M KCl was significantly lower than the isotopically exchangeable Al, especially in NOM-rich soils. Al_{CuCl2} was higher than $Al_{KCl ext}$ in all soils and was up to 8-fold higher in high NOM content soils, suggesting significant complexation of Al by NOM.

Therefore, the data obtained from current methods of estimation of exchangeable Al in ASS containing large amounts of NOM should be used cautiously as they will not be representative of the reactive Al likely to be released into solution and to contribute to acid generation.

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