



Organophilic clays as a tracer to determine Erosion processes

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In recent years the use of new tracing techniques to measure soil erosion has gained attention. Beside long time existing isotopic methods the use of rare earth elements has been reported. We wanted to contribute to the efforts of obtaining better methods for determination surface soil movement and tested a novel method using organophilic clays as a tracer for erosion related studies. At present tests to extract organophilic clays from soil have been performed successfully using an Industrial produced organophilic bentonite (Tixogel TVZ, Süd-Chemie) treated with quaternary ammonium surfactants. A liquid extraction method with barium ions (Ba^{2+}) and methanol was used to extract the n-alkyl ammonium compounds from the inter crystal layers of the modified Bentonite. To increase extraction efficiency, an ultrasound device was used (UW 2200 Bandelin, 10.000 cycles per second, vibration amplitude $54 \mu m$, sonification time of one minute). This procedure lead to a recovery rate of about 85% for the organophilic bentonite. This was clearly superior to alternative extraction methods such as acetonitrile in different mixing ratios. Quantification of the extracted surfactants was performed via high performance liquid chromatography – mass spectrometry (HPLC-MS, Agilent 1200 SL HPLC and 6220 time-of-flight MS). The mass spectra of this industrial produced organophilic clay mineral showed four different molecular masses ($M+H^+$ of 304.30, 332.33, 360.36 and 388.39). The four substances could be separated by HPLC (20 x 2 mm Zorbax C18 reversed phase column, 0.5 mL/min isocratic flow with 90% acetonitrile and 0.1% formic acid in water, run time of 7 minutes). The linear working range of the method was 5 to 1000 $\mu g/L$, with a limit of quantification of 1 $\mu g/L$ n-alkyl ammonium compound. All four compounds of the Tixogel were extracted with identical extraction efficiencies and are hence suitable for accurate quantification procedures. Next steps of the methodology to develop are the application of the organophilic clays in an indoor rainfall simulation experiment at a small scale of $2 m^2$. At present the methodology has been tested only for one particular soil. Future tests will be performed to see if the chosen methodology needs soil specific treatment when applied to more soils of different textural composition.