

Concentration and characterization of groundwater colloids from the northwest edge of Sichuan basin, China

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ABSTRACT: Natural groundwater colloids are significantly important since they are closely related with toxic substances migration in subsurface systems. In this paper, a cross-flow ultrafiltration (CFUF) system equipped with 100 kDa cartridges was developed to enrich groundwater colloids and multiple state-of-the-art analytical techniques were used to characterize the properties of the colloids. The average equivalent circle diameter of the colloids was 347 ± 188 nm by scanning electron microscopy (SEM) images. Atomic force microscopy (AFM) result showed that the colloids with a median height of 10.4 ± 2.1 nm and with two different morphologies existed which could be described as erythrocyte and platelet structure. X-ray diffraction (XRD) analysis showed that the mineralogical composition of inorganic colloids consisted of albite ($\text{NaAlSi}_3\text{O}_8$), orthoclase (KAlSi_3O_8), clinocllore ($(\text{Mg,Fe})_6(\text{Si,Al})_4\text{O}_{10}(\text{OH})_8$), lepidocrocite ($\text{Fe III O}(\text{OH})$), muscovite ($\text{KAl}_2(\text{Si}_3\text{Al})\text{O}_{10}(\text{OH,F})_2$), calcite (CaCO_3) and quartz (SiO_2), most of which was confirmed by transmission electron microscopy (TEM) with energy dispersive X-ray spectroscopy (EDS) information. Different types of dissolved organic matter (DOM) were characterized by 3D excitation-emission matrix spectroscopy (EEMS), while a larger fraction of 'protein-like' fluorescent dissolved organic matter (DOM) was found. Bacteria was observed under 488 nm laser excitation by inverted fluorescence microscopy (IFM) and 16S rDNA sequencing revealed that *Thermomonas* was the most likely genus the bacteria may belong to.