Effects of various ion solutions on phosphorus adsorption in the sediments of a water body that originated from agricultural land subsidence and submergence caused by coal mining activities

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\textbf{ABSTRACT}

Extensive subsidence and submergence of agricultural land has been caused by coal mining activities in the Huainan Coal Mine Area, China. Considering the site-specific regional water chemistry, we investigated the influence of ion solutions on phosphorus (P) adsorption behavior in the sediments of a 20-year-old body of water. The P isothermal adsorption was measured in four different types of ion solutions, prepared through additions of sodium chloride (NaCl), calcium chloride (CaCl\textsubscript{2}), sodium bicarbonate (NaHCO\textsubscript{3}), a mixture of sodium bicarbonate and calcium chloride (NaHCO\textsubscript{3} + CaCl\textsubscript{2}), and ultra pure water (deionized water with specific resistivity reaching the value of 18 M\textOmega{} cm) as a control. The sediments parameters analyzed included P-fractions, organic matter (OM), iron oxides, clay, and others, with the aim of analyzing their individual effects on P adsorption. Cationic calcium (Ca\textsuperscript{2+}) was found to enhance P adsorption ability, while a weakly alkaline environment (simulated through NaHCO\textsubscript{3} addition) reduced it. The effects of ion solutions on P adsorption potential were in the order CaCl\textsubscript{2} > NaHCO\textsubscript{3} + CaCl\textsubscript{2} > NaCl > ultra pure water > NaHCO\textsubscript{3}. The two-dimensional structure of lake sediments overlying inundated agricultural soil could be responsible for the observed differences between sediment properties and P adsorption features in different layers of sediments.

\textit{Keywords:} Coal mine; Sediments; Land subsidence; Phosphorus; Isothermal adsorption

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