

Use of different adsorption models for characterizing P adsorption by the bottom sediment of four degraded urban lakes (Kashubian Lakeland, northern Poland)

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ABSTRACT

The laboratory experiments on P adsorption were conducted on sediments of four degraded urban lakes, located in Kartuzy, Poland. Five isotherm models (Freundlich, Langmuir, double Langmuir, Brunauer–Emmett–Teller, Dubinin–Radushkevich) were tested to obtain the best fit to experimental data. The sediment of the studied lakes differed in sediment P adsorption abilities. The research revealed that simple determination coefficient (R^2) analysis is not sufficient when different models show similar R^2 values. In this case, the analysis of $\log K_d$ vs. $\log S$ plots could be recommended as a good tool for adsorption model identification. The sediments of three lakes (Mielenko, Karczemne, and Klasztorne Duże) showed convex sorption isotherms, while Klasztorne Małe Lake, which was restored by Phoslock® showed concave adsorption isotherms. Using Phoslock® for lake restoration significantly modified sediment P adsorption properties (higher P retention ability, higher EPC_0 value, a concave shape of adsorption isotherm) compared to natural, non-modified sediment. The results of the conducted experiments on the sediment of a lake polluted by road salt effluent (Mielenko Lake) showed that higher water EC probably can improve sediment P sorption abilities and P retention, which could potentially reduce the P pool available for primary production.

Keywords: Lake sediment; Phosphorus; Adsorption models; P inactivation; Phoslock®; Lake restoration; Road salt

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