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Suspension Wien effect sensor method for distinguishing Zn^{2+} in inner and outer Helmholtz plane in electrical double layer of colloid particles

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Abstract: The electrical double layer (EDL) is a central theory that shed light on the interaction between ions and charged soil colloid particles. A new approach based on the suspension Wien effect sensor method was established to verify the EDL theory and to determine the ion distribution in the soil-water interface. The new approach was applied to assessing Zn^{2+} distribution in the EDL of Zn-saturated soil colloids. The results showed that more than 84% of Zn^{2+} was adsorbed via chemical interaction and located in the inner Helmholtz plane (IHP) layer. The remaining Zn^{2+} fraction was electrically adsorbed and distributed in the outer Helmholtz plane (OHP) layer (2.3% - 21.6 %) and the Gouy-Chapman (GC) diffuse layer (78.4% – 97.7 %). The proposed approach was employed to assess specific and non-specific adsorption and so to deepen the understanding of the metal sorption process in soils. Further, our findings reinforce the better adequacy of the Grahame-Stern-Gouy-Chapman (GSGC) EDL model to describe the ion distribution in the solid-water interface.

Key words: Wien effect; Zn; Helmholtz plane; electrical double layer