

國立中興大學水土保持學研究所碩士論文

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土壤表面電荷量之測定與估算

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## 中文摘要

本文之目的為測定土壤表面帶電量及帶電情形，以大肚山紅壤、彰化埔心與西勢之粘板岩沖積土為材料，測定土壤之表面淨電荷、零電荷點、土壤表面積和鑑定其所含礦物；測定之結果如下：

1. 三種土壤均含有 Illite, Kaolinite, Quartz 及 Hematite，紅壤並含有 Halloysite，兩種粘板岩沖積土並含有 Feldspar，埔心粘板岩沖積土並含有 Chlorite，此中 Illite 及 Chlorite 屬永久電荷礦物，其餘均為可變電荷礦物。

2. 大肚山紅壤之表面淨電荷為負，埔心與西勢粘板岩沖積土因含多量的鈣與鎂，導致 Charge reversal，而使表面淨電荷為正。

3. 土壤零電荷點以電位滴定曲綫測定之，大肚山紅壤之  $pH_0 = 4.2$ ，西勢粘板岩沖積土之  $pH_0 = 8.45$ ，埔心粘板岩沖積土之  $pH_0 = 8.05$ ，後兩者所測定之值與理論不符，兩種粘板岩沖積土乃屬塩份土，需先將可溶性塩洗去後，再測定零電荷點。洗塩操作費時甚長，故乃以原土樣測定之，而發生與理論不符之結果。

4. 大肚山紅壤之表面積為  $21.376 M^2/g$ ，西勢粘板岩沖積土之表面積為  $19.556 M^2/g$ ，埔心粘板岩沖積土之表面積為  $70.828 M^2/g$ 。

5. 以 Gouy-Chapman 公式和 Stern 理論計算大肚山紅壤之表面電荷量，結果兩理論均不十分合適，此因計算值

不包含永久電荷在內之故，但在低濃度電解質（ $0.001N$ ， $0.01N$ ， $NaCl$ ）中，Gouy-Chapman 公式較接近實測值，高濃度電解質（ $0.1N$ ， $NaCl$ ）中，Stern 理論較接近實測值。

## ABSTRACT

The surface charge characteristics of one Red Soil (Ta-Du Mountain) and two Slate Alluvial Soils (Hsi-Shih and Pu-Hsin at Cheng-Hua County) were determined. The net surface charge of Red Soil was negative, while those of the two Slate Alluvial Soils whose salt content were very high (25 - 50 me/100g) were positive due to the charge reversal.

Zero points of charge were determined by potentiometric titration with NaCl as the supporting electrolyte. Potentiometric titration curves showed that the zero points of charge of Red Soil, Hsi-Shih's Slate Alluvial Soil and Pu-Hsin's Slate Alluvial Soil were 4.2, 8.45, and 8.05, respectively. The zero points of charge of Slate Alluvial Soils were not reasonable because of high salt content involved. For saline soils, the determination of ZPC by potentiometric titration, the sample must be washed soluble salts out previously with very dilute HCl and water. No attempt was made to do this since it is a time consumed procedure.

The surface charge densities of Red Soil were calculated from Gouy-Chapman Equation and Stern Model. The calculated results indicated that Gouy-Chapman Equation was more or less adequate for the low electrolyte concentration, and Stern Model for high electrolyte concentration.