

# Exchangeable base cations

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**The amount of base cations in the soil depends, in addition to the soil's ability to bind cations (due to the soil particles' negative charges) on processes that add and remove base cations. In the long term, supply is through weathering and deposition from atmosphere or through human activity (eg fertilization). The losses consist of leaching and harvesting and harvesting of vegetation.**

The soil particles are electrically charged and can therefore bind different ions that are dissolved in the soil liquid at their surface. The binding is unspecific, any charged ion having a charge opposite to that on the surface can participate in the bond. An ion is also not bound to any particular charge on the particle surface. The electrostatically bonded ions are interchangeable and can replace places with other charged ions.



Bestämning av humuslagrets mäktighet. Foto: Gunnar Odell.

## The significance of the exchangeable ions in the ground

Through exchange processes, the exchangeable ions are in equilibrium with the ground fluid. If the composition of the soil fluid is changed, this directly affects the composition of the exchangeable ions. An example of this is acid deposition with precipitation that leads to lowered pH in the groundwater and increased excretion of Al (3+) in the groundwater which in turn competes for bound base cations. Thereby, the exchangeable base cations buffer groundwater and groundwater against pH reductions.

The interchangeable ions can be picked up by plants by exchange processes and are therefore important from a nutrient point of view. The absorption takes place so that the plant through the root exchanges base cations against hydrogen ( $H^+$ ), and anions against bicarbonate ( $HCO_3^-$ ) or hydroxide ( $OH^-$ ), respectively. Since the plant takes up more positive ions than negative, the plant uptake leads to biological soil acidification. In those cases where the uptake of plants returns to the ground by the decomposition of dead plant parts, the acidification is compensated. The biological acidification in these cases is only

temporary. However, as a rule, plants are harvested whereby biomass and its content of absorbed ions are removed from the plant premises. In these cases, biological acidification is permanent.

A number of studies have shown that the abduction processes in many ecosystems, among other things. Swedish woodland, today is larger than the supply. This reduces both the supply of base cations and the base saturation in the ground.

## **Maps of the content of replaceable base cations 1993-2002**

Facts:

### **Determination of interchangeable base cations**

The exchangeable base cations are determined by first weighing 2.00 g of humus or 15.00 g of mineral soil into a 250 ml polyethylene shake flask. Then 100 ml of 1N  $\text{NH}_4\text{OAc}$  solution (buffered to pH 7.0) is added. The sample is shaken for 90 minutes in a shaker. The suspension solution is filtered through paper filters (ashless filter paper, Munktell 00K, diameter: 18 cm). The concentration of base cations in 10 ml of the extraction solution is analyzed with an ICP-AES (inductively coupled plasma emission spectrophotometer with emission spectroscopy quantification).

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