JSS-Quiz: Six Mental Exercises to Check your Fitness in Soil Chemistry

Quiz question 1

The concentration of a chemical in wet soil is 1 mg/kg. The dry soil density is 1.6 kg/L, the pore water content P_W of the soil is 0.35 L/L.

What is the concentration of the chemical after drying the soil, if there is no loss of chemical upon drying?

Quiz question 2

The bioconcentration factor BCF of a chemical in a carrot root be defined as

$$BCF = \frac{C_{Root}}{C_{Soil}}$$

where C_{Root} is the concentration of the chemical in the plant (mg/kg wet weight) and C_{Soil} is the concentration of the chemical in soil (mg/kg wet weight).

If the BCF is 1 kg/kg for wet weight (both soil and plant), what is it for dry weight (both soil and plant), soil data as before, carrot water content 0.89 L/kg?

Quiz question 3

The K_d (L/kg) is measured by sorption experiments with dry soil matrix shaken in aqueous solution and is defined as

$$K_d = \frac{C_{Matrix}}{C_{Water}}$$

where C_{Matrix} is the concentration (mg/kg) of a chemical in the soil matrix M (the dry soil), and C_{Water} is the equilibrium concentration in the aqueous solution (mg/L water).

The natural bulk soil consists of soil matrix and soil solution (soil gas neglected). If the K_d of a chemical is 10 L/kg, the dry soil density is 1.6 kg/L and the soil water content is 0.35 L/L; if furthermore the concentration of this chemical in the bulk soil is 1.0 mg/kg.

What is the concentration in the soil pore water?

Quiz question 4

A plant accumulates a heavy metal to a bioconcentration factor of 10 (dry weight based). There is a layer of 0.625 m soil with a dry density of 1.6 kg/L contaminated with 10 mg/kg of a heavy metal. Each year, the plant cover produces a net growth of 1 kg dry weight/m^2.

How long will it take until the concentration in the contaminated soil layer has fallen to 1 mg/kg, if plant extraction is the only relevant process?

Quiz question 5

Have a look at **Fig. 1**. It depicts two sets of data, and two regression lines. The first regression (open symbols, solid line) has a correlation coefficient r = 0.69, n = 10. The second regression (closed symbols, dotted line) has a correlation coefficient r = 0.98, n = 3.

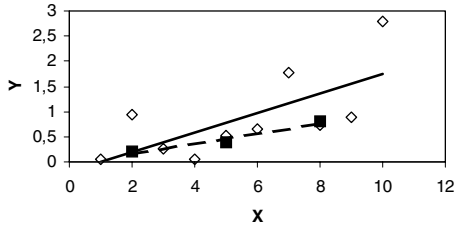

Fig. 1

Which correlation is 'better'?

Quiz question 6

The regression shown in **Fig. 2** has a correlation coefficient of r = 0.99, n = 10. Nonetheless, the regression was rejected by critical reviewers.

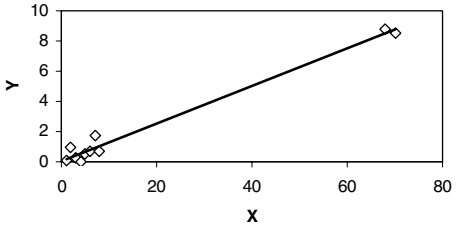

Fig. 2

Why?

Please submit the solutions via e-mail by Friday, 24 September 2004 to Stefan Trapp (stt@er.dtu.dk).
If you have found the solutions for all six exercises, and belong to the first TEN senders, then you will be awarded by a JSS-Free Subscription 2004–2005 (in print and online).
The solutions will be revealed in the JSS-October issue.