

Abstract

Saturated hydraulic conductivity (k) describing the ability of the porous media to allow flow is defined by Darcy's law. Beside pore space properties it depends on the properties of liquid; therefore it is conventionally determined for water at 15 °C. Values of hydraulic conductivity vary between 10^{-3} m/s and 10^{-7} m/s for sands and sandstones and rises with increasing grain size and porosity. Hydraulic conductivity can be estimated by empirical formulas or measured by laboratory and field methods. Laboratory determination includes the constant head and the falling head permeameter tests. The constant head permeameter test is suitable for material with values of hydraulic conductivity ranging between 10^{-1} m/s and 10^{-6} m/s; the falling head test for values between 10^{-7} m/s and 10^{-11} m/s. Unsaturated hydraulic conductivity is a function of moisture (and pressure head). Retention curve describing the dependence of moisture on pressure head is the basic characteristic of each material. The unsaturated hydraulic conductivity can be calculated from the parameters of retention curve and the value of the saturated hydraulic conductivity using Van Genuchten – Mualem formula (1980). Fine grain rocks with small pores have higher values of hydraulic conductivity than coarse grain rocks in condition of significantly negative values of pressure head.

I have measured the saturated hydraulic conductivity of several drill cores from Upper Cretaceous Hrubá skála sandstones in Střeleč quarry and other localities in the Český Ráj region using the laboratory constant head permeameter test. Permeameter was built for measuring on special sandstone samples sealed in PVC plugs 63 mm in diameter. I have drawn the retention curve from moisture and pressure head data and compared the measured saturated hydraulic conductivity data with the graph of decreasing hydraulic conductivity with decreasing pressure head. The values of saturated hydraulic conductivity varied between $2 \cdot 10^{-6}$ m/s and $9 \cdot 10^{-5}$ m/s. The values of unsaturated hydraulic conductivity calculated by Van Genuchten – Mualem model sharply declined from $3 \cdot 10^{-5}$ m/s to the order of 10^{-10} m/s in decrease of pressure head from 0 m to -5 m and ranged in order of 10^{-14} m/s in the lowest measured pressure head (about -20 m).

Keywords: Hydraulic conductivity, saturated and unsaturated zone, permeameter, retention curve