Prediction soil water retention curve from soil particle-size analysis using fractal geometry

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Soil Water Retention Curve (SWRC) is one of the basic characteristics in determination of soil hydraulic parameters including unsaturated hydraulic conductivity. Since, SWRC is needed in most soil and water studies, Scientists' effort have been made on the indirect methods such as pedo transfer function and empirical relationships to estimate SWRC. There is a close relationship between SWRC and particle-size distribution (PSD). Fractal geometry was used in this study to find out a relationship between the fractal dimensions of these two curves. This helps us to obtain SWRC equation based on soil particle size analysis. To achieve the above objective, 40 soil samples with 7 different textures were collected and their physical characteristics were measured. Two power equations were presented for determination of fractal dimension of particle-size distribution and soil water retention curve based on their clay percentages with correlation coefficients equal to 0.96 and 0.83 respectively. Combining two power equations, a linear equation was obtained between the fractal dimension of SWRC (D_{swrc}) and the fractal dimension of PSD (D_{psd}). To evaluate this relationship, the physical properties of another five soils were used; firstly, D_{psd} of the soils were measured and then using $D_{swrc} - D_{psd}$ relationship, the D_{swrc} and consequently the SWRC equations were estimated. Comparing the predicted and measured values for 5 soils resulted a correlation coefficient higher than 0.78 with a 1:1 line. The result of this study indicates that this method can be used to estimate soil water retention curve satisfactory.