

Comparison of Methods of Determining Texture Fractal Dimension: A Case Study of the Soils of Taqanak, Shahrekord

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Abstract

Texture fractal dimension is a physical index to describe soil particle size distribution having a variety of applications. Fractal dimension may be calculated from three relations of mass-time, mass-diameter and modified mass-diameter (Kravchenko-Zhang) with two linear and nonlinear options for fittings. The aim of the present study was to compare methods and select an appropriate one and fitting option for determining the fractal dimension using hydrometer data. Sixty soil samples were collected from four fields of Taqanak, near Shahrekord. After removal of organic matter and other initial treatments, hydrometer readings were obtained at 0.67, 1, 2, 5, 15, 30, 60, 120, 180, 1440 and 2880 minutes and were converted to mass-time or mass-diameter data. Nonlinear fitting of the Kravchenko-Zhang mass-diameter relation was selected as the most appropriate method of calculating the fractal dimension of solid particles, due to its highest coefficient of determination and smallest mean square error and lowest Akaike Information Criteria. Error analysis also confirmed this conclusion. There was a significant, though not very strong, relationship between the fractal dimension obtained by linear and nonlinear fitting of mass- diameter and Kravchenko-Zhang mass-diameter methods. These relationships can be used to correct the fractal dimension determined by other methods and fitting options.

Keywords: Soil particle size distribution, Mass-time, mass-diameter, Kravchenko-Zhang, Linear and nonlinear fitting, D correction and conversion.

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