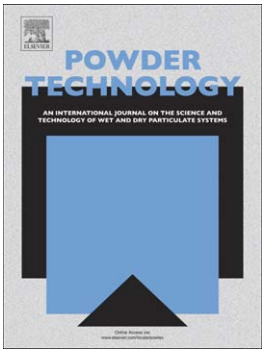

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Water Retention Curves of Multicomponent Mixtures of Spherical Particles

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Abstract

The water retention curve (WRC) is a key material function to define the unsaturated behaviour of natural and artificial particulate media. In many circumstances, it is necessary to have the estimate of the WRC in the early stage of a project or a research activity. This paper presents an empirical method to predict the moisture characteristics of an artificial porous media, glass beads with diameters between 0.5 mm and 3 mm, on the base of its particle size distribution. The proposed method allows to estimate the parameters of the van Genuchten equation, a frequently used model. Homogeneous spheres, binary mixtures and ternary mixtures are analyzed and several experiments have been performed on a Tempe Cell, modified to work in the desired suction range during the drying process. The proposed equations have been fitted to experimental data with a fairly good agreement, in particular for homogeneous spheres. The uncertainty analysis is performed and some limitations of the model are discussed.

Keywords: water retention curve, artificial porous media, glass beads, van Genuchten equation

1. Introduction

The artificial porous media are widely used in laboratory experiments in order to study many environmental and industrial phenomena. For example, in the last years extensive research has been conducted on gravity-driven flow motion through porous media, motivated by several applications including enhanced oil recovery, contaminant migration, seawater intrusion and well drilling. Even though many experimental activities in two dimensions are still performed in Hele-Shaw cells [1, 2, 3], the use of an artificial