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Height–time and weight–time approach in capillary penetration: investigation of similarities and differences

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Abstract

Capillary penetration is commonly used in a wide range of applications such as oil recovery, textile engineering and food technology. Furthermore, it is a useful tool for surface characterization of powders and porous media. Two are the commonest experimental methods to study capillary penetration: the height-time and the weight-time technique. However, it is not clear whether the two approaches provide the same results. This work aims to investigate similarities and differences between the two approaches and assess whether it is possible to replace one with another. To this end, capillary penetration experiments were performed in different porous media where the pore size distribution and shape varied. Height and weight data were recorded simultaneously. It was found that results of the two experimental approaches are not always equivalent and that this depends on the porous medium properties. In some cases results depended on the degree of saturation of the porous medium with the penetrating liquid. An analysis of weight-time data to provide pore size distribution as a function of pore volume is proposed. Furthermore, two different approaches of the fractal theory were applied and the time exponent, the material fractal dimension and the tortuosity fractal dimension were determined.

Keywords

Capillary penetration, wicking, weight – time, height-time, porous media, tortuosity fractal dimension, polyethylene, cellulose, time- exponent

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