Gravity effects on liquid behavior in porous media of uniform glass beads.

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In recent years, evidence of the existence of water has been found on the moon and Mars. The water resources on the moon or Mars are expected to be utilized as an in situ resource for future manned exploration. It is necessary to elucidate how the water exists in the porous media and how we can extract it. Under the 1G condition, water flow in porous media is expressed by Richards' equation. According to Richards' equation, water moves by a matric potential gradient and a gravity gradient. It was reported that water movement by a matric potential gradient, however, changed under microgravity. Therefore, water movement under low gravity might be different from estimation by conventional water movement theory. In this study, we observed water movement in porous media made of glass beads under microgravity and evaluated the effects of gravity on liquid behavior in porous media. We conducted infiltration experiments using porous media of 0.4 mm grass beads under microgravity conditions created by parabolic flight. The advances of the gas-liquid interface were captured by a video camera and the infiltration rate was calculated. We also conducted a horizontal infiltration experiment under 1G and compared the infiltration rate under each gravity conditions. The infiltration rate under microgravity was slightly lower than the horizontal infiltration rate under 1G. The decrease of infiltration rate, however, was smaller than the decrease in the previous study using 1.5 mm glass beads.

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