Challenges to measuring of the contact angle and the surface tension of water under reduced gravity

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Matric potential gradient is one of the driving forces of water movement in porous media. It has been reported that water movement in porous media under microgravity was slower than that under 1G, and hydraulic characteristic curve changed. Therefore, there is a possibility that the matric potential changes under reduced gravity. Capillary pressure is the main factor of dominating the matric potential value in porous media with a relatively large pore size. In this study we investigated the dependence of capillary force on gravity. Capillary forces are governed by the surface tension and contact angle that the liquid makes with the solid surfaces. We measured the contact angle of droplets on glass plate under microgravity condition to reveal the dependence of the contact angle on gravity. For large droplets, the contact angle under microgravity was larger than that under 1G, but the difference in contact angle between 1G and μG reduced with smaller droplets. We also conducted parabolic experiments to measure the surface tension of water under reduced gravity (μG, 1/6G, 1/3G, 1G). The maximum bubble pressure method which is one of the methods measuring surface tension was used. The bubble pressure greatly changed due to dynamically change of the inboard air pressure during parabolic flight. Evaluation of the surface tension by removing air pressure and hydraulic pressure from bubble pressure will be discussed.

Keywords: capillary pressure, contact angle, surface tension, reduced gravity, maximum bubble method

