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Effects of Shapes of Pore Throat on Water Infiltration under Microgravity.

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Crop production using soil on Moon or Mars will be needed for a long-duration space mission. Water movement in porous media under microgravity must be known for agriculture in space. Water in porous media is mainly moved by a matric potential gradient. According to previous research, water movement in soil is extremely slower under microgravity than under 1G although a capillary force, which is the main contributor to matric potential, is apparent in microgravity. We conducted drop–tower experiments to reveal why the infiltration rate of water in porous media became slower under microgravity conditions. We hypothesized that specific pore shapes among soil particles and changes in the contact angle between water and soil particles made water move slower in porous media under microgravity. Various capillary shapes were made with acrylic and polycarbonate materials to carry out capillary rise experiments using distilled water and various concentrations of aqueous ethanol solutions (10, 40, 75, and 100% v/v). Droplets of distilled water were made on acrylic and polycarbonate plates to measure contact angles under both microgravity and 1G conditions. We found that capillary shapes affected a water rise rate whereas the contact angles of droplets with small capillary length hardly changed.

References

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