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Capillary force under microgravity estimated from Hagen-Poiseuille Equation.

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International Space Exploration Coordination Group plans a long-term human space mission on the Moon or near Earth's asteroids to make a pass to Mars. Food supply as well as recycling atmosphere and water is one of the largest concerns on the long-term human space mission. Growing plants during the mission in a spacecraft or a base may ease those concerns. Water movement in a substrate is an important factor for plant growth; however, there are few reports on water movement in porous media under microgravity. Our objective of this study is to reveal whether or not Hagen-Poiseuille Equation is applicable under microgravity. To visualize water movement in a capillary tube, 0.8 mm inner diameter tubes were used to observe water movement driven by the capillary force under the 2.5 s microgravity condition made by a free-fall tower. Water movement was captured with a video camera, and water infiltration rates were analyzed by image analysis software. Water infiltration rates in glass tubes under microgravity were much smaller than 1G theoretical value calculated with Hagen-Poiseuille Equation. Capillary force or capillary pressure, which is a main driving force of water movement in glass tubes, was also much smaller under microgravity than 1G theoretical values. These results suggested that, under microgravity, either surface tension, contact angle, or viscosity of water could be different from the 1G condition.

References

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