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ACCURATE CONTROL OF MOISTURE CONTENT IN PLANT ROOT ZONE IN SPACE

Abstract

Purpose: Bio-regenerative life-support systems proposed for long-duration space missions require an effective control of moisture in the root zone of plant for growing plants in space. In this paper, water delivery and control system was established through controlling the matric potential between micro-porous tubes and plant growth medium. Methods: Baked porous ceramic aggregates of 0.25-1mm particle size distribution were used for plant research in microgravity. Hydraulic characteristics including water and air volumetric content, water retention and hydraulic conductivity of the porous ceramic were measured. Using the water delivery and control systemthe plant Arabidopsis thaliana was germinate and grown in porous ceramic aggregates at a definite porous tube water pressure for 30 days. During this time, the moisture in the root zone of plant was controlled by the matric potential, which was nearly equilibrium with the tube water pressure. Water pressure in the porous tubes was controlled both by a valve and a pump which adjusted different inlet/outlet water flow rate. Results: We obtained the water retention characteristics and hydraulic conductivity function of porous ceramic. Based on these data, we further revealed that at porous tube water pressure of -0.05kPa-0.9kPa plant growth medium was readily available. The plant Arabidopsis thaliana was germinated and grown in a porous ceramic media at a porous tube water negative pressure, and the daily fluctuations of relative water content (RWC) in growing tray was varied within 2Conclusion: Using this water transport system (micro-porous tubes-growth media-plant), the plant roots are exposed to constant of soil moistures. Thus, it is an effective way by adjusting the porous tubes water pressure to maintain constant soil water potential in the plant growth medium in microgravity.