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Developing reservoir sediment ceramsite as a novel growing medium: I low temperature and anaerobic production

Yu-Hsiang Liu, Yi-Hao Chu, and Chih-Hsin Cheng

School of Forestry and Resource Conservation, National Taiwan University, Taipei 106, Taiwan

Ceramsite is a typical substrate used in soilless culture systems. It is clean and durable but usually shows poor performance in water and nutrient retention capacity. In this study, we used reservoir sediment as the material to produce ceramsite to use as a growing medium. We sintered it under relatively low temperature (600°C, 800°C, and 1000°C) and anaerobic conditions with and without organic matter addition (5%, 10%, and 15%). We examined their water holding capacity, bulk density, mechanic strength, and pH, which were related to the essential characteristics using the growing media. The results showed that organic matter addition decreased bulk density and mechanic strength but increased water holding capacity and pH. The sintering temperature has less influence on bulk density and water holding capacity but increased mechanic strength and pH with the increasing sintering temperature. Compared with the commercial high-temperature ceramsite and lava rock, the water holding capacity in our ceramsite can be three times higher than those. The microstructure from scanning electronic microscopy indicated the rough surface in ceramsite at 600°C and 800°C but became glassy surface at 1000°C which was similar to the commercial ceramsite and lava rock that showed more glassy and non-porous surface. The addition of organic matter maintained rough surfaces at 1000°C, which can be the mechanism to have higher water and nutrient retention. Our results suggest that the ceramsite produced from reservoir sediment under lower temperature and anaerobic conditions with organic matter addition can be used as a growing medium to replace commercial ceramsite with its better water retention capability.