Use of Methane Fermentation Digestate for Hydroponic Culture

Axxxxx B. Cxxx*[1], **Dxxx Exxxx**[2]

(1. *Graduate school of Engineering, XXX University, Matsuyama, Japan;*

2. *Graduate school of Life and Environmental Sciences, XXX University, CA, USA*)

Abstract: The residual product of anaerobic digestion, called digestate, contains high concentrations of inorganics like nitrogen and potassium, and it can be used as liquid fertilizer for crop production. When using digestate as nutrient solution for hydroponic culture, however, plant growth is often strongly inhibited due to root damage. This damage may be caused by several potential inhibitors contained in the digestate. In this study, we aimed to identify the main source(s) of inhibition when cucumber seedlings were grown hydroponically with digestate as nutrient solution, focusing on nitrogen form, particulates, microorganisms, and pH of the digestate. When inorganic nitrogen in the digestate was provided as a high concentration of NH_4^+ (260 mg NH_4^+–N L^{-1}), all the seedlings' roots died, regardless of whether particulates and microorganisms were present. The inhibition of shoot and root growth in NH_4^+ was mitigated by decreasing the pH of the digestate, and this effect was enhanced by inactivating the microorganisms in the digestate. When the nitrogen form in the digestate was a low concentration of NH_4^+ (20 mg NH_4^+–N L^{-1}) and a high concentration of NO_3^- (110 mg NO_3^-–N L^{-1}), the dry weights of shoots and roots were much greater than those grown with only NH_4^+ (130 mg NH_4^+–N L^{-1}). This effect was enhanced by removing particulates and microorganisms from the digestate by membrane filtration. These results indicate that decreasing NH_4^+ and pH and increasing NO_3^- in filtered digestate can improve the suitability of digestate as a nutrient solution for plant hydroponics.

Keywords: Agronomic use of digestate, hydroponics, plant reaction

Corresponding author: Axxxxx B. Cxxx, Professor, XXX University.

Email: axxxx@envi.osakafu-u.ac.jp