

# **Non-Destructive Detection of Artificial Water Leakage in Agricultural Pipeline System by Acoustic Emission and Time-Frequency Analysis**

**Taiki Hagiwara<sup>1</sup>, Tetsuya Suzuki<sup>2</sup>**

<sup>1</sup>Environmental Science and Technology, Graduate School of Science and Technology, Niigata University, Japan, <sup>2</sup>Faculty of Agriculture, Niigata University, Japan

Agricultural pipeline system performs irrigation for paddy fields and fields. Agricultural pipelines undergo inner water pressure for water usage. Water leakage accidents often occur in the pipeline system and make irrigation for agricultural fields impossible. Maintaining in-service structures needs to detect the water leakage. In this study, the detection method of water leakage in pipeline system by acoustic emission is developed. In experimental procedures for an in-service structure in Japan, water pressure and AE behavior in an agricultural pipeline were measured. The measurement using water pressure and AE sensors was conducted at the downstream of the pipeline system. Opening the sludge drain valve at the 75 m upper of the measurement point simulated water leakage. Opening and closing the water control valve of the lowest pipeline generated transient water pressure fluctuations. The water fluctuations with or without the artificial water leakage was measured. In analytical procedures, AE parameter and time-frequency analysis for the measured data are conducted. As a result, the AE energy parameter is correlated with the transient water pressure fluctuations during the valve opening. The time-frequency analysis detects the difference of the frequency distribution due to the water leakage. Therefore, the AE and time-frequency analysis can evaluate the artificial water leakage of in-service pipeline system.