Estimation method for damage of PVC casing by self-rotating nozzle system

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Abstract

In the South Kanto natural gas fields, where natural gas dissolved in water is produced, polyvinyl chloride (PVC) casing is used for both production and reinjection wells. In the fields, waterjet (WJ) is used to clean inner wall of casing to recover the potential of the wells. However, it was found recently that it sometimes makes damages for casing. Therefore, we have to know the conditions in which the WJ system makes damages for PVC casing in cleaning operation.

In this study, laboratory experiments were conducted with various driving and ambient pressures, by using three kinds of self-rotating nozzle systems (R31, R47 and R70) which have different outside diameters. In particular, low ambient pressures of less than 0.5 MPa were used in the experiments to clarify the effects of cavitation on the damage of casing. Effective cutting distance, which is the distance from the exit of the nozzle to the damaged front when jetting is performed with enough time, was adopted to establish the estimation method for the damage of casing.

As a result, three major results on effective cutting distance were obtained. First, the effective cutting distance increases linearly with an increase in driving pressure. Second, the effective cutting distance increases with a decrease in ambient pressure. Finally, the effective cutting distance increases with the outside diameter of the self-rotating nozzle system regardless of the ambient pressure. In addition to these results, damages due to cavitation were observed at low ambient pressures.

In this study, an empirical formula to estimate the damages of casing was proposed, and relations among the effective cutting distance and three parameters of driving pressure, ambient pressure and the outside diameter of self-rotating nozzle system were clarified.