

Analysis of effectiveness of Ultrasonic Scale Preventer on preventing scale development in Sewage Pipe

This report is to summarize the pilot test result of the ultrasonic scale preventer which was installed for the dehydrator piping system of Tan-Cheon Sewage Treatment Plant in Korea. The device was operated for 6 months to solve serious and long known scale problems (especially **Struvite formation**) encountered within dehydrator piping system.

1. Overview

The USP-1000 was installed for No. 2 dehydrator supply pipe of Tan-Cheon Sewage Treatment Plant on November 6, 2008. After operating for six months, the pipe was opened on May 8, 2009.

2. Problems known prior to installation of the scale preventer

There were some serious scales built in the sewage sludge supplying pipe of the dehydrator. They should be removed from the pipe once or twice every year even though the job is very hard and cumbersome. It was noticed that the development of scale layers was unusually fast during the period of seasonal change between February and May. As the scales were so tightly stick to pipe walls, they couldn't be removed completely without a hammer.





It was noticed that the development of struvites in the pipe also resulted in a significant reduction in the amount of sludge which is delivered to a centrifugal dehydrator. Whenever this phenomenon was observed, the plant tried to cope with this problem by increasing pump speed from 510 rpm (normal speed) to 600 rpm.

3. Installation Spots

The transducers were installed on elbow (curved spot) and narrow neck of pipe at which pipe blockage occurred preferentially.



4. A set of photos illustrating scale layers developed in pipe walls

Before	After
	
Before	After
	
Before	After
	

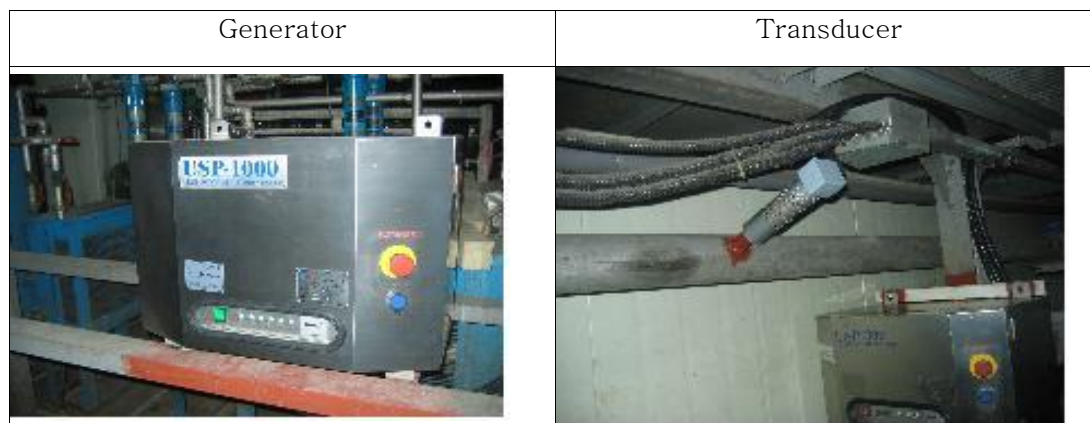
5. Conclusion

- ①. When the sludge supplying pipe with the USP-1000 was open on May 8, 2009, it was confirmed that most of the hard scales were totally eliminated.
- ②. The sticking scales which block sludge flow could be removed so easily by the installation of USP. The cleaning sludge pipes could be done simply just by simple water cleaning job.
- ③. Near both inlet and outlet, 4 mm thick of the sludge slimes were developed. These thin slimes were easily removed by only water cleaning.
- ④. For the pipe of the centrifugal dehydrator, the struvite sticking problems were completely resolved even though some black mud was remained.
- ⑤. At the valves, 1.5~2mm thick of scales were formed. However, they could be cleaned by a high pressure water cleaning method as the adhesiveness of the scales was markedly weakened by the USP.
- ⑥. The effect of the scale preventer(USP) has been proven from the field test. This means that an emergency plant down for pipe cleaning is not necessary any longer as the USP is reasonably installed at proper positions of the pipes which have encountered periodical scale troubles.

6. The working mechanism of Ultrasonic Scale Preventer

This instrument consists of a generator generating an ultrasonic wave and transducers delivering the ultrasonic wave to an object. The number of transducer depends on the diameter, length, and quantity of the pipe. The delivering speed of ultrasonic wave increases from vapor through liquid to metal. That is, the ultrasonic wave energy is transmitted into a whole facility very quickly through metallic medium as most facilities are primarily metallic.

©The composition of Ultrasonic Scale Preventer



© The principal of the elimination of scale.

A lot of invisible cracks are present within every scale. Many air bladders can infiltrate into the crack and explode repeatedly by the cavitation under ultrasonic wave energy. The scales under the continuous influence of ultrasonic wave energy are supposed to be dropped off from metal surface with time.

- Cavitation :

Ultrasonic vibrations cause to occur “empty effect” in the water, creating numerous small bubbles. These bubbles (air bladder) infiltrate into cracks of scales and explode within them repeatedly. As a consequence, existing scales are gradually destroyed and also the precipitation of new scales is prohibited by the same process. It should be noted that the high accelerated velocity (~30,000 times of G-force) & temperature are generated when air bladder is absorbed and exploded in the scales.

