Establishment of Corrosion Control Technology by Organic Acid/Carbonic Acid

(Research of FY 2017-2021)

1. Purpose

Recently, wastewater facilities have been concerned about the anti-corrosion coating layer's degradation by organic acid and concrete deterioration by carbonic acid. But, there is little knowledge of their actual situation.

This study aims to understand the situation of the anti-corrosion coating layers' degradation caused by organic acid and carbonic acid in wastewater facilities and establish a countermeasure technology.

2. Outcomes of This Year

(1) Field survey for concrete degradation by carbonic acid

Followed by the last year this year's investigation targeted two new WWTPs to study the degradation environment, such as carbonic gas concentration inside the covered reaction tank, and degradation status, such as the carbonation depth of concrete bodies. The carbonic gas concentration in the gas phase was higher than in the atmosphere. Carbonic gas concentration and carbonation depth significantly varied even in the same reaction tank (table 1.)

- The gas phase partly showed reinforcement exposure, supposedly caused by carbonic acid gas. Besides, the liquid phase partly showed concrete surface elusion and aggregate exposure caused by erosive free carbon dioxide.

- The carbonation progressed more in the aerobic tank's deep than shallow part of the liquid phase. On the other hand, since the carbonation was more significant in the shallow part than in the deep part last year, further investigation is required.

Table 1. Measured carbonic acid gas concentration and carbonation depth in the gas phase

		Measured average carbonation depth (mm)	Years in service	Average carbonic gas concentration (ppm)
Block 1: Anaerobic tank	1	22.0	25	11,612
	2	26.5		
	3	26.0		
Block 2: Aerobic tank	1	31.2	25	17,900
	2	31.8		
	3	26.8		
Block 3: Aerobic tank	1	9.4	25	20,986
	2	6.5		
	3	7.6		
Block 4: Aerobic tank	1	13.5	25	20,295
	2	13.5		
	3	13.6		

*Carbonation depth was measured at 3 points of each block

(2) Field survey for the degradation of anti-corrosion coating layer by organic acid

Following the last year, specimens were taken at each phase of the treatment process to analyze organic acid concentration and components in two WWTPs, as new test sites.

- Organic acid concentration tended to be high by verifying that highly concentrated organic acid of raw or thickened sludge and scums of first settling or gravity thickening tanks and a long retention time at each treatment process.

(3) Investigation of the organic acid-resistant performance of anti-corrosion coating materials

An acetic acid immersion test was conducted using anti-corrosion coating materials with or without organic acid-resistant capabilities. The test compared these materials for their changes in appearance, weight, shape

(length, width, and thickness), and physical properties (hardness, bending strength, and deflection.)

- The organic acid-resistant resin had fewer changes than general resin with no organic acid-resistant for all conditions, including weight, form, and property changes. It verified organic acid-resistant resin has little impact on acetic acid, and the trend was significant, especially with a 10% acetic acid solution.

3. Future Schedule

The field survey will continue for the environments and conditions of deterioration and organic acid-resistant performance of anti-corrosion coating materials at existing facilities to accumulate knowledge.

Keywords: **Organic acid, Carbonic Acid, Degradation of anti-corrosion coating layer, Concrete Degradation/Deterioration**