Establishment of Corrosion Control Technology by Organic Acid/Carbonic Acid

(Research of FY 2017-2021)

1. Purpose

Recently in wastewater facilities, there are concerns regarding the degradations of the anti-corrosive coating layer by an organic acid or concrete deterioration caused by carbonic acid. However, the actual situation is unknown well.

This study aims to figure out the practical conditions of the degradation of the anti-corrosive coating layers caused by an organic acid or carbonic acid and establish their control technology.

2. Outcomes of this year

This year, researchers investigated the corrosive environment and degradation conditions of one WWTP which is considered to have the deterioration of the anti-corrosive coating layer caused by organic acid. Table 1 and Table 2 show the summary of the investigated facility, and investigation items, respectively. In the WWTP, a thickened sludge receiving tank that storages raw sludge and excess sludge, was chosen for inspection target because the facility is considered to have a high concentration of organic acid inside its sediment, or biofilm, including scum.

Table 1: Scope of investigation

Targeted WWTP	“A” WWTP
Targeted facility	Thickened sludge receiving tank
Operation years of the facility	13 years
Place of investigation	Gas-liquid interface (near L.W.L)
Kind of anti-corrosion	Coating-type lining (category D1)
Anti-corrosive material	Polyurea resin
Thickness of anti-corrosive coating	3mm (designed value)
Used years of anti-corrosive coating	13 years

Table 2: Survey item

corrosion environment survey	Gas phase	Hydrogen sulfide gas concentration
	Water quality	Sludge
		Sludge filtrate (centrifuged filtrate)
	Concrete surface	
Corrosion/deterioration survey	Corrosion production	
	Exfoliation, swelling, crack	
	Aggregate exposure, surface abnormality	
	Covering depth of remaining reinforcement	
	Penetration depth of organic acid	
	Penetration depth of sulfur	
	Neutralization/carbonation depth	
	Anti-corrosive coating layer	Abnormality of the existing anti-corrosive coating layers
		adhesion test
		Thickness

(1) Table 3 describes results of corrosion environment test.

- It was verified that the sludge of the target facility had high concentrated organic acid.

- It was presumed that the target facility was in the harsh corrosion environment since it had highly concentrated hydrogen sulfide gas inside

Table 3: Survey results of corrosion/deterioration environment

Survey item		Result
Gas phase	Concentration of hydrogen sulfide gas (average)	371.2ppm
	Inside temperature of a tank	17.5℃
Sludge	Water temperature	14.0℃
	pH	5.0
	ORP (Oxidation-reduction potential)	-45mV
Sludge filtrate	Acetic acid	439mg/l
	Propionic acid	616mg/l
	i-butyric acid	41mg/l
	n-butyric acid	334mg/l
	i-valeric acid	58mg/l
	n-valeric acid	169mg/l

(2) Electrochemical marking was made for the anti-corrosive coating layer. The analysis outcomes were compared to the sulfur invasion depth to presume invasion depth of acids other than sulfur. Figure 1 represents the results of EDS (Energy dispersive X-ray spectrometry) analysis.

- The analysis proved that the acid invasion depth was larger than sulfur invasion depth which is 27μm to 114μm.
- As highly concentrated organic acid exists in sludge, it is presumed that the invasion of the anti-corrosive coating layer is caused by the organic acid.
- One of the reasons why the organic acid had a large invasion depth is considered that the inspection site was exposed to liquid phase for

a longer time than the gas phase because it was near L.W.L which is the gas-liquid interface.

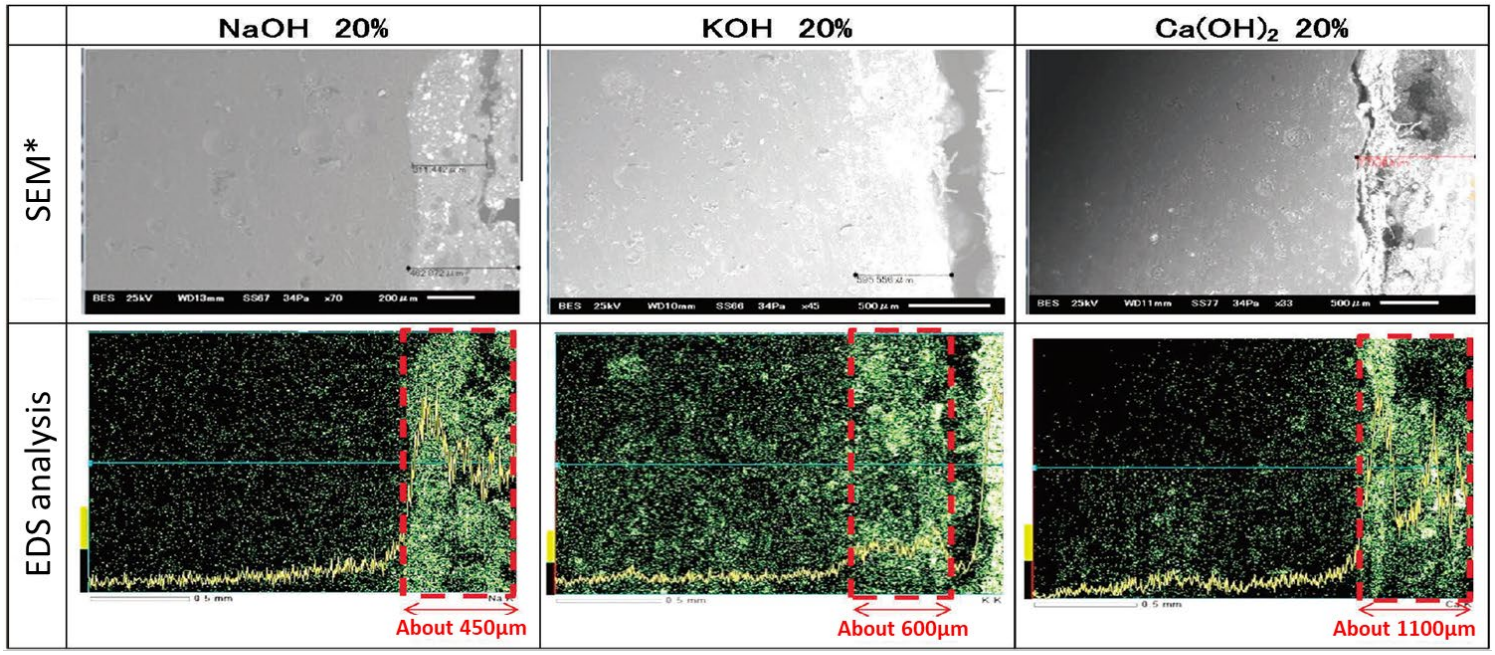

Figure1: Results of Alkali marking test

3. Future plan

The investigation will continue at the actual facilities to know the practical conditions of the deterioration environment of organic acid. For carbonic acid, a field survey is scheduled at the actual facilities.

Keywords: ***Organic acid, Anti-corrosive coating layer, Degradation/Deterioration***