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Service Reference

Topic: Biological Contamination in the Anolyte System

Please read all the instructions listed below carefully to familiarize yourself with the project before attempting to perform any of the work or unpacking any further.

Required Materials

- UFSc approved material

Required Tools

- None

The occurrence of biological growth in the anolyte system is a rather common nuisance to electro-coat operators. Sometimes the rapid degradation (pitting, etc.) of 316L anodes is thought to be the result of attack from the by-products of some forms of biological growth, but this has not been confirmed in a controlled laboratory test. Biological activity in the anolyte does not usually cause ED film defects. Biological growth is harmful in that it can clog anolyte return lines. This results in less cooling of the Cell (faster dissolution of the 316L anodes due to higher temperatures inside the Cell) and less acid removal by the anolyte system.

Biological growth generally falls into two broad categories – bacteria or fungus. Both of these types of organisms are everywhere. They are noticed in the anolyte solution because they have found a good food source and a nice place to live. Most of the time they die as fast as they multiply. However, in the anolyte solution they can thrive, especially if: 1) the anolyte conductivity is less than 1800 μSiemens/cm; 2) the anolyte is mostly DI water (after a flushing of the anolyte tank and acid is not added to increase the conductivity); 3) the anolyte fluid is ever stagnant (anolyte pump turned off); 4) warmer weather in the evenings (late spring and summer), 5) malfunction in the DI water system.

A coordinated effort should be made with the E-coat maintenance manager, ED paint company representative, local water treatment company representative, and a representative of UFS Corporation. These individuals can work together to find the source of the biological contamination and take action to reduce or eliminate the problem. UFSc recommends that a sample be taken of the contamination and a culture test performed to identify the contamination. The ED paint company, local water treatment company or a local university may be able to offer assistance with the culture testing and analysis.

Once the anolyte system is attacked by a biological infestation, it is common for the organism to build multiple layers or colonies. Each of the colonies has a protective outer shell. Therefore, it will take a determined effort to remove the contamination from the anolyte system (cells, piping, valves, tank, etc.). Efforts to clean or eliminate the contamination may only remove one or two layers or colonies at a time, so treatments on successive weekends are usually necessary.

There are several strategies that can be used to avoid biological contamination, including:

Think and act in a safe manner. Always disconnect power and use a lockout before you work on the E-coat system, or any of the related subsystems. Observe any confined space conditions. Use the appropriate safety equipment & clothing for the task.more

1. Raise the anolyte conductivity to above 1800 μSiemens/cm;

2. Always keep the anolyte pump operating;

3. After each flushing of the anolyte tank, add enough acid to raise the conductivity to above 1800 μSiemens/cm;

4. Use a UV bulb on the outlet of your DI or RO water system. (Note: Select the UV bulb with the wavelength that has the best kill rate for the most common biological organisms in your area. UV lamp manufacturers can provide assistance in this selection.);

5. Use a biocide approved by your ED paint company. Keep in mind that most biocides only act to prevent the growth of organisms. If there is an infestation in your system, you are advised to clean the entire anolyte system (cells, piping, holding tank, pump, etc.) first before the biocide is used;

6. Generally hydrogen peroxide can be used as an alternate to mechanical cleaning of the anolyte system (hydrogen peroxide oxidizes organic matter). **Oxidants are a necessary evil when working with membranes. Oxidants should be used sparingly knowing the membrane life will be reduced.**

Some of the more common biocides include copper, cupric acetate, silver nitrate, Kathon (Rohm & Hass) and Spectrus NX 1103. **Important: Do not use any biocides that contain halides such as chlorides or bromides. Chlorides and bromides can attack the 316L anodes. Seek approval from UFSc before any biocide not listed above is used.**

If biological growth is found in the anolyte, one of the preliminary tasks to be done is to plan the removal of the growth at the same time as plans are made to reduce the chances of reoccurrence. The steps below are meant to provide general assistance in removing the biological growth from the anolyte system. Please review these steps with your paint supplier. They may want you to drain your paint to prevent any possibility of the hydrogen peroxide getting into the paint bath.

1. On a weekend, add enough hydrogen peroxide to the anolyte system to equal about 5% by volume. NOTE: Hydrogen peroxide usually comes in 30% strength. If your anolyte tank holds 250 l (66 gallons), then 5% equals 12.5 l (3.3 gallons). If you buy the hydrogen peroxide in 30% strength, then you will have to add 41.6 l (11.5 gallons) of the hydrogen peroxide. **TIP: Lower the level in the anolyte tank to just above the pump suction in order to reduce the amount of hydrogen peroxide required.**

2. Turn off the DI water valve during the cleaning process so no hydrogen peroxide is sent to the waste water system.

3. Add a very open (400 μ or more) nylon, or equal, strainer bag to the Return Manifold, just as it enters the anolyte tank. Check this bag every couple of hours and change as required.

4. Circulate for at least 24 to 36 hours before dumping the anolyte tank in order to activate all the hydrogen peroxide, otherwise some of the good bacteria may be killed in the waste water system.

5. Dump the anolyte tank, add DI water, add acid to raise the conductivity, turn the DI water valve back on, and clean out the strainer bag.

6. Repeat Steps 1-5 on the next weekend until there is no more evidence of biological growth in the strainer bag or elsewhere in the anolyte system.

7. If this cleaning does not work, then the next step is to perform mechanical cleaning to remove the biological growth. You can use a soft bristle bottlebrush to clean out the inside of the Membrane Shell, anolyte supply lines, and the Electrode. Flush out the manifolds by adding a clean out plug at each of the terminations. Use air pressure to blow out lines. **NOTE: DO NOT PRESSURIZE THE INSIDE OF A MEMBRANE SHELL.** Repeat Steps 1-5 after all the flushing and mechanical cleaning is over.

Troubleshooting: Sometimes the occurrence of biological growth is accomplished by a rise in the pH of the ED paint bath. Check for biological growth in the post rinses. Biological growths can attach themselves (or fix) to acid groups. This results in a higher pH. When these biological growths are killed, it is possible some of the fixed acid groups become unattached and then begin to drive down the pH. Be careful when adding acid to the ED paint bath before the biological growths are removed from the post rinses.

Excessive pressure drop across ME Cell: One of the consequences of the growth of fungus is the blockage of the flow of anolyte through the Cells. This is especially critical for closed top ME Cells. In these cases there can be a significant pressure drop across the Cell. The pressure drop is harmful because it can 1) cause anolyte to leak out from the fittings, and or 2) cause irreversible damage to the ion-exchange membrane. In either case anolyte will find its way into the ED bath, which can lead to poor performance and even defects.

For more information, see the original manual that came with the equipment or call UFSc at the phone number shown above. The ED paint supplier or the local water treatment company can also be contacted.