ZETA DATA

Glass Container Manufacturing:

Preventing Bio-Fouling in Shear Spray Systems

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INTRODUCTION

The glass manufacturing industry expends significant money and manpower to control biological slime deposits common in the water systems used to cool and lubricate gob cutting shears. Biological growth in the shear lubricant system causes de-emulsification of the lubricant mixture, frequent filter maintenance, and eventually clogging of the spray nozzles, leading to failure of the gob cutter system and necessitating unscheduled production shut-downs.

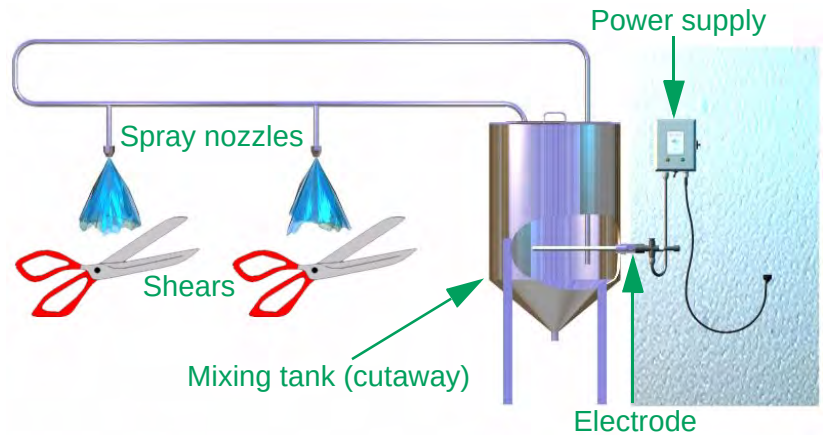

Figure 1: Diagram of Zeta Rod components on a shear spray lubricant system. The electrode is connected to a power supply, and installed through a weldolet fitting in the shear spray mixing tank. The treated shear spray mixture is fed through a recirculating system to the shear spray nozzles.

The Zeta Rod™ installed in a shear spray system prevents the proliferation of microorganisms, enhances the stability of the emulsion, and prevents nozzle plugging, providing clean, maintenance-free operation with minimal biocidal treatment.

SHEAR SPRAY SYSTEMS

Molten glass emerging from the furnace at approximately 2500° F is cut into "gobs" prior to dropping into the container forming equipment. The hot glass is cut by steel shears that pass through the glass stream several times per second. The shear assembly is prevented from burning or seizing by being sprayed with a water-based fluid mixture.

Shear lubricants are typically mixtures of synthetic or naturally-derived fatty compounds in a glycol emulsifying agent. The lubricant is mixed with water in a large tank, filtered, and piped to nozzles that direct the fluid onto the shear assemblies.

BIOFOULING

Bacteria and other microorganisms easily find their way into the water, lubricant, and mixing tank. The fatty components present in the lubricant mixture provide an excellent food source for vigorous microbial growth (one engineer involved in the design of shear spray systems has written that *"bacteria think [shear lubricant] is candy."*)

Development of troublesome levels of microorganisms in water systems involves the following steps (after Videla, H. A., Biofilms and Biofouling, in *Manual of Biocorrosion*, CRC Press, Boca Raton, FL, 1996):

1. Attachment of microbes to wetted surfaces of the tank or piping, or to globules of lubricant suspended in the shear spray mixture,
2. Absorption of nutrients present in the shear spray mixture,
3. Secretion of the glycocalyx, a polysaccharide-based coating that protects the developing microbial colonies from biocides and provides a favorable environment for growth,
4. Cell growth and reproduction leading to further proliferation of microorganisms.

Problems associated with extensive growth of microorganisms in shear spray systems include the formation of a "mat" that floats on the surface of the fluid in the mixing tank, the separation of globules of fatty material, and reduced pH from acids secreted by microbial metabolism that can lead to corrosion in the system.

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Most critically, the biological activity leads to plugging of the spray nozzles and catastrophic interruption of the production process.

ZETA ROD APPLICATION

The Zeta Rod is a capacitor-based system that elevates the natural surface charge of particles in water systems. This effect prevents water-borne microorganisms from becoming attached to wetted surfaces, keeping them in a relatively harmless free-swimming ("pelagic") form, and stops the sequence of events that leads to rampant growth.

The Zeta Rod is a ceramic-sheathed electrode that is installed in the mixing tank (see Figures 1 & 2). A powerful electrostatic field is generated within the tank that elevates the surface charge of particles in the water. Particles with elevated surface potential repel each other and are prevented from sticking together or to tanks, piping, and other wetted surfaces.

Figure 2: Installation of the Zeta Rod electrode and power supply at the shear spray lubricant mixing tank.

The result is that a Zeta Rod™-equipped shear spray system operates without a build-up of biological slime. The mixing tank and piping remain clean, filter life is extended, and spray nozzles can be operated at lower flows without fear of clogging.

In the case of the installation pictured in Figure 2, the shear spray system during the year prior to acquisition of the Zeta Rod had been a major cause of unscheduled plant shut-downs. Since installation of the Zeta Rod, there have been no production stoppages due to shear spray problems. Shear lubricant usage is down from approximately 3500 gal/day to about 2000 gal/day because nozzles are not plugging at the lower flow rates. Biocide usage has been significantly reduced because lower dosages are effective in controlling unattached microbial cells.

OTHER APPLICATIONS

For further information about other Zeta Rod™ applications in glass manufacturing, including:

- Cullet water slime and odor control,
- Furnace jacket water scale and biofouling prevention,
- Electrode holder scale control, and
- Control of scale, biofouling and corrosion in open-loop cooling tower and heat exchanger cooling water;

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