Case Study III

Water-Cooled Extruder Downtime and Maintenance Costs

Background. A manufacturer of food packaging products operates a 6.0" diameter 36:1 Welex water-cooled extruder in conjunction with three other Welex co-extruders (two 2.5" and one 3.5" diameter). The main extrusion line was installed in 1997. A fifth 4.5" diameter line was installed two years later. The extrusion plant produces HIPS sheet which is then thermoformed into various packaging products.

Demineralized water had been used as the barrel zone heater/cooler cooling water. In a recent twelve month period the plant experienced a total of fifty-four unscheduled extrusion outages due to corroded and failed system components and/or plugged and fouled zone valves and heater/cooled sections. The average outage lasted 4.29-hours for maintenance to repair the system and restore it to service. Total unscheduled extrusion maintenance costs for the twelve month period were $136,000.

In the costs previously identified, no dollar amount had been estimated for lost finished packaging product sales revenues. This particular extrusion/thermoforming plant was intended to operate 24-hpd, 361-dpy. If only the costs for bulk plastic are considered and a 4,000-pph extruded sheet capability, potential lost revenues in material costs alone can exceed hundreds of thousand dollars annually.

Four of the five extrusion lines were restored utilizing recommended chemical cleaning procedures. Due to the design of the fifth extruder's reservoir tank, that system was not initially restored. During the restoration phase of the extrusion lines, each reservoir tank was found to contain several inches of compacted corrosion product debris. Each tank was manually cleaned and most of the system component parts (supply and return hoses, etc.) were replaced by manufacture-specified items. An analysis of the debris from one of the reservoir tanks is summarized in Table 1.

	Percent
Iron (as Fe_2O_3)	67.5
Copper (as CuO)	8.3
Aluminum (as Al_2O_3)	6.4
Zinc (as ZnO)	10.3
Lead (as PbO)	0.6
Nickel (as NiO)	0.6
Chromium (as Cr_2O_3)	0.7
Manganese (as MnO)	0.4
Molybdenum (as MoO_3)	0.3

Table 1. Case Study III Initial Extruder Coolant Suspended Solids Analysis.

After cleaning and restoration the four extruders were placed back into service. An ***Extrusion Performance Fluid (EPF)*** was employed as the only barrel cooling medium. After approximately five weeks operation each of the restored extruder systems were re-sampled and analyzed in order to evaluate the success of the cleaning and restoration procedures.

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Samples from one extruder are summarized in Table 2 confirming the effectiveness of the cleaning procedures.

	Before	After
Iron (as Fe)	20.8	2.5
Copper (as Cu)	19.6	0.7
Aluminum (as Al)	0.5	0.8
Zinc (as Zn)	25.7	0.4
Lead (as Pb)	0.6	<0.1
Nickel (as Ni)	0.6	<0.1
Chromium (as Cr)	0.3	<0.1
Manganese (as Mn)	0.2	<0.1
Suspended Solids	~100,000	34.0

Table 2. Case Study III Extruder Coolant Analyses before Restoration and Five Weeks after Operation with ***EPF*** (ppm).

Results. Seven months post cleaning and restoration, plant engineering reported that they have had a total of three unscheduled outages of the extrusion equipment compared to an average of thirty-one events for an equivalent period the year before. The failures were to the older supply and return coolant hoses that replacement parts were unavailable when the equipment was initially restored.

Summary. Water-cooled extruder barrel cooling systems maintained with ***Extrusion Performance Fluids*** and periodically monitored:

- **Minimize Production Downtime Losses**
- **Reduce Maintenance Expenses**
- **Extend Extrusion Equipment Component Life**

For additional information regarding the cleaning, restoration and maintenance of water-cooled extruder barrel cooling water system, please contact *Chemagineering Corporation* at www.chemagineering.com.

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