SMITH & LOVELESS INC.

System Application

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Aerobic Treatment System Treats High-Strength Industrial Wastewater

KANSAS

Application Profile:	**Russell, KS**
S&L Equipment:	**Model R OXIGEST®**
Installed:	**1996**

A Midwestern wheat-starch gluten plants' manufacturing process generates high-strength wastewater. The BOD coming from this gluten plant is nearly 20,000 mg/L with a total suspended solids (TSS) concentration (after upstream solids removal) of 5,000 to 15,000 mg/L. Because of this high loading, the anaerobic treatment process required an aerobic polishing unit to bring the BOD down to levels of typical domestic wastewater. Design loads to the polishing unit included 0.3 MGD, 1320-2750 mg/L BOD and 2100 mg/L TSS.

As the city developed its industrial pretreatment permit for the wheat-starch gluten plant, it was noted that there was also a high concentration of convertible nitrogen estimated at about 600 mg/L. Realizing the impact that this could have on the receiving stream, the State of Kansas imposed a nitrogen limit. The city, in turn, added an ammonia nitrogen limit to the industrial pretreatment permit, which required a more sophisticated aerobic polishing plant.

As the S&L process engineers looked at the design, it soon became evident that the high oxygen demand for BOD removal and the nitrification process would result in a high power demand to supply the volume of air required. For example, the oxidation of the BOD would require 1.0 to 1.5 kg O_2 per kg BOD. The nitrification process would require 4.6 kilograms O_2 per kilogram of ammonia nitrogen. This resulted in a requirement for a very large aeration system.

S&L provided a Model R **OXIGEST** *Wastewater Treatment System complete with treatment zones, clarifier and denitrification processing in a single tank to aerobically polish high strength industrial wastewater. Fine bubble diffusion (above left) is employed for efficient oxygen transfer. The S&L field erection crew (right) puts the finishing touches on the plant.*

To reduce equipment and power costs, S&L incorporated two solutions. First,fine bubble diffusers were employed to obtain the highest possible oxygen transfer efficiency. Second, denitrification was added to reduce the oxygen demand. Thus, the process chosen was a simple two-step, single-sludge nitrification/denitrification process.

The S&L aerobic wastewater treatment system consisted of a 145' diameter Model R **OXIGEST** with a 45' diameter inner clarifier. The outer ring of the treatment plant was divided into three sections: anoxic zone, aeration zone and biosolids holding. The anoxic zone, used for denitrification, was further divided into four compartments. The aeration zone, used for carbonaceous BOD reduction and nitrification, was also divided further into three compartments. The tank configuration for the anoxic and aerobic zones resembled a plug flow reactor process. The biosolids holding tank was designed with dewaterable tank walls so the water level could vary independently. The anoxic compartments contain submerged mixers. Future provisions for converting the last two anoxic compartments into aerobic treatment basins were made by including aeration headers with these jet mixers. In addition, the anoxic compartments were supplied with floating covers to limit air entrainment and any potential odor that might occur.

Operational data demonstrates how wastewater with a high nitrogen concentration can be effectively treated using an aerobic treatment system using the two-stage single-sludge nitrification/denitrification process.

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