

The Mosaic Spent Liquor Treatment Process

Neil Beckingham and Charles Dyke (Speaker)

Hatch Associates Consultants, Inc., 1202 Tech Blvd., Suite 205, Tampa, Florida

nbeckingham@hatch.ca, cdyke@hatch.ca

Abstract

During the manufacturing of phosphate fertilizers, a spent process fluid, or “spent liquor”, is produced and subsequently stored in large ponds. Spent liquor, also called “pond water”, is a very low pH brine with a high total dissolved solids (TDS) content, containing high levels of phosphate, fluoride, sulphate, silicon, sodium, calcium, and ammonium. If necessary, it can be treated by double liming to neutralize it and remove some of its mineral content. However, this method is relatively expensive, does not make the water suitable for discharge, and can cause other waste management issues, such as sludge disposal.

In 2004, Hatch partnered with Mosaic, one of the world’s leading fertilizer manufacturers, to develop a cost effective and sustainable treatment method for fertilizer plant spent liquor so that it could meet the requirements for discharge to Florida Class III waters. The partnership ensured that the key issues and potential solutions were understood, researched, and modeled effectively. The research was followed by laboratory tests and extensive pilot testing. The project work ultimately resulted in the development of the Mosaic Spent Liquor Treatment Process (SLTP). The SLTP is a membrane-based treatment process that removes essentially all of the fluoride, ammonia, and phosphate from spent liquor, while reducing its TDS from 35,000 to below 500 mg/L. SLTP economics compare favorably to traditional methods of pond water treatment.

In 2008, Mosaic awarded Hatch a contract to build a 1.44 million-gallons-day (MGD) SLTP plant at Mosaic’s Bartow, FL, facility. Hatch performed engineering design, procurement, construction, and commissioning services for the Bartow SLTP, and operates the SLTP under an evergreen plant operations and maintenance (O&M) contract with Mosaic.

This project has been noteworthy for the following:

- The Bartow SLTP was constructed ahead of schedule, with no lost time incidents during construction. Commissioning began in June 2009, and the plant began treating spent liquor in September 2009.
- The plant is currently operating in an optimization mode leading to acceptance testing. During operation, contaminant levels in the treated water have been well below design discharge limits, and through April 2010 the SLTP has discharged over 100 million gallons (MG) of treated spent liquor.

Bartow spent liquor characteristics, design criteria, and SLTP effluent quality during start-up and commissioning are shown in Figure 1. The data shown is operating data from December 2009 through April 2010. The discharge quality has met contract limits approximately 99% of on-stream time.

Figure 1: Bartow Spent Liquor Characteristics and SLTP Discharge Quality

Parameter	Spent Liquor (Average)	Bartow SLTP Discharge Range (Average)	Contract Limits (24-hr Composite)
pH	1.4	7.5 – 8.5	6.5 - 8.5
Conductivity ($\mu S/cm$)	24,600	30 - 110 (70)	1,275
Phosphorus (mg/L)	6,000	ND - 0.5 (0.07)	10
Fluoride (mg/L)	6,900	1.0 – 8.6 (4.5)	10
Ammonium (mg/L)	890	ND – 0.02*	0.02*

* Free ammonia, calculated by using ammonia/ammonium conversion chart
 ND = non-detectable

Specific design and operating features of the SLTP process are patent-pending or proprietary and cannot be disclosed at this time. Additional general information about the process will be provided at the conference technical session.