

Water scarcity: ambitious sustainability goals achieved using Buckman monochloramine technology

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INTRODUCTION:

A packaging manufacturer located in Italy chose Buckman in 2016 to develop part of its long-term environmental sustainability strategy by applying a full state-of-the-art chemical and digital solution. The mill was focused on the reduction of water consumption and made large investments in technology to achieve their objective, which was the basis for the aligned project vision with Buckman. The customer's goal was to achieve a net positive environmental outcome regarding water efficiency, anticipating and managing risks related to current and potential future increased water stress.

The historical abundance of water in the mill area is nowadays a myth of the past; growing demand for agricultural and industrial purposes on top of well-known climate change consequences determine strict extraction limits and few choices of water sources depending on seasonal availability.

The aim of this leading packaging group is to create zero water impact by 2030, an ambitious plan if you consider that papermaking is one of the most water-intensive industries, and emerging challenges are created by the economy, such as the increasing mechanical properties of the board!



Water plays a critical role since fibers are transported through the production process, from pulp to paper using water; all chemicals are diluted or prepared into water and then saturated steam is used to dry the paper. In the recycle process, water is even more important to separate and remove contaminants from the fibers, ensuring proper cleaning of the furnish in the stock preparation.

Water recirculation has been the primary, low-cost method for reducing water consumption, but closing the loop dramatically increases organic, inorganic and microbiological contamination in the process water.

A typical and dangerous consequence of process water contamination by organic material (starch contained in recycled corrugated furnish) is the pre-acidification and consequent calcium solubilization in the water. This phenomenon has severe consequences on dropping paper characteristics, creating a bad odor (volatile fatty acids) in the process and ultimately poor performance of anaerobic and aerobic digesters. The complexity of achieving the water closure target is intimately linked with anaerobic and aerobic digester performance, with the interactions impacting machine runnability and, above all, potential serious consequences on effluent discharge limitations.

Prior to their partnership with Buckman, the mill tried other chemical solutions. Unfortunately, they resulted in serious negative consequences on the wastewater treatment plant, showing the importance of a more consistent and professional approach to calcium stabilization and starch preservation.

By implementing the Buckman Joint Problem Solving methodology, mill personnel worked together with Buckman to identify the key success factors for the project.

Figure 1: Healthy anaerobic sludge

Volatile fatty acid, amylolytic activity, ATP, bacteria and fungi counts, pH, temperature, conductivity, ORP and water hardness were the most important parameters monitored; a model was created to interpret the status quo and the desired outcomes of the treatment.

After one year of system knowledge and deep process understanding, Buckman implemented its ammonia-based precursor for monochloramine technology.

Monochloramine is the chemical compound with the formula NH_2Cl . Buckman monochloramine is formed in situ from ammonia solution and a halogen-free precursor in combination with sodium hypochlorite. Monochloramine acts as a mild oxidant with a high affinity for specific microbial proteins. The mode of action on microorganisms inhibits food uptake and formation of organic acids by blocking microbial enzymes.

The trial started in the most difficult season of the year, between spring and summer, when water sources were changed and reduced on top of increasing environmental temperatures.

A perfect storm, you may think? No, it wasn't, thanks to the strong preparation and expertise involved from both parties.

The outstanding results achieved since the start up would not have been possible without Buckman's proprietary dosing equipment, installed following the customer's requirements on top of highest safety standards guaranteed by both companies.

Buckman's proprietary dosing equipment, boosted by state-of-the-art digital features, is designed to apply different dosages flexibly to the various parts of the process and assures the highest safety standards (multiple interlocks, shut off valves, remote control).

The application of Buckman's monochloramine technology provides significant benefits on various levels beyond its antimicrobial properties. The process stability in combination with infection control allows for closing the water circuit at the desired level by keeping the wastewater treatment plant and paper mill at maximum efficiency.

Moreover, monochloramine is also an extremely effective biocidal and is able to penetrate organic deposits even if they are layered with mineral scale. It helps to clean up the process and keeps it free from organic/inorganic deposits going forward, providing an opportunity to reduce stops for boilouts and schedule stops only around required machine maintenance.

Five-year consolidated results show:

- 20% less fresh water consumption
- 74% reduction in calcium carbonate precipitation in anaerobic reactors
- No need to inject fresh anaerobic biomass in the reactors thus saving money and emissions
- Improved performance of anaerobic biomass generated emissions
- 60% more biogas with a 1.5% savings of total consumption of fresh methane
- 40% reduction of calcium carbonate in the activated sludge tank, resulting in less required maintenance
- 15% increase in machine runnability due to fewer breaks



Figure 2: Headbox after process treatment with Buckman MCA.

Annual return on investment for the mill is calculated at more than 100.000 €/y; return on environment is unbelievable considering the water saved can fill more than 120 Olympic pools.

The above results are the expression of continuous dedication, high level service provided on a weekly basis and a customer-centric approach. Even during the recent pandemic, Buckman was able to keep this high level standard thanks to digital features installed in the dosing unit, online monitoring and bulk tank level sensors.

Focused on continuous improvement and innovation, Buckman has recently launched its Ackumen™ Platform and implemented it in this mill.

The benefit of having the Ackumen Platform link with the application is to collect a lot of different and more data, all in context.

The purpose of the Ackumen Platform is not to simply gather data but to deliver actionable insights. What is an insight? It's the detection of a pattern of anomalous behavior; the analysis of its root cause in measurable, rational terms; and finally, a recommended course of action to resolve the issue. Due to increasing challenges affecting the packaging industry, Ackumen will help to identify additional opportunities to further optimize the system to save even more water, energy and money.

The partnership with Buckman and this leading packaging group was celebrated in their Sustainability Report 2020. The Company stated how Buckman helped them to achieve their sustainability goals related to climate change mitigation.