

Nalco Water, an Ecolab Company uses automation and on-line real time monitoring to help on productivity, water and energy conservation



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ABSTRACT

In today's modern world, technology upgrades and new technology introductions in industries, means that it is more vital to maintain quality, productivity improvement and cost performance. Energy and water conservation in process industries will help to maintain their competitive advantages and environmental sustainability.

Nalco Water, an Ecolab Company, has several innovative automation and digital solutions, aligned to Industry 4.0 adaptation. This allows an improvement in customer process conditions through real time 24x7 monitoring and control with the use of digital platforms.

OxiPRO™ microbial control technology, is a patented and integrated program that effectively controls microbial growth and deposit formations in paper making systems. The real time 24x7 monitor helps with continuous monitoring of microbial activity and quantitative fouling of the paper machine. OxiPRO is a proactive approach; controlling and improving operational efficiency of the paper machine system before deposits develop into downtime.

PEM - Press Effluent Monitor is a unique technology helping papermakers to understand more about the paper machine press felt conditioning cycle and achieving desired felt cleaning program cycles and durations. This can help papermakers to improve overall machine efficiency, with improved quality and energy conservation by developing data driven decisions to optimize felt condition programs.

3D TRASAR™ Technology for DAF controls clear water solids by managing coagulant and flocculant dosages accordingly. It is intended to maximize compliance, reliability and minimize the operating costs associated with DAF operations. Continuously measuring key system parameters, when upsets occur, 3D TRASAR takes immediate corrective actions using a complex control algorithm, preventing wastewater compliance problems and maximizing DAF performance.

Keywords: • 3D TRASAR™ • ETP – Effluent treatment plant • OxiPRO™ Monitor • OFM- Optical Fouling Monitor • PEM – Press Effluent Monitor

A. Introduction– 3D TRASAR™ Technology for DAF

3D TRASAR Technology, has been a proven automation monitoring technology in Cooling Water for many years. With continued success, 3D TRASAR has been extended to many other applications and industries; now including dissolved air floatation clarification (DAF) in pulp and paper. 3D TRASAR for DAF offers automation monitoring and control, with complex algorithm to dynamically manage incoming water and effluent quality.

3D TRASAR for DAF provides continuous monitoring and control insuring regulatory

compliance through a multi-step, automated cleaning process for sensors delivering reliable turbidity measurement, regardless of the quality of the DAF influent.

3D TRASAR™ for DAF Provides:



Working Mechanism

3D TRASAR Technology for DAF uses advanced sensors to effectively automate DAF chemical control. The technology analyzes the influent flow rate and effluent turbidity

in real time. By optimizing the dosage of treatment chemistry to improve overall system performance with advanced proprietary feed forward and feedback control algorithms. It comes with built in logic to detect over dosage of coagulant and flocculant to optimize chemical dosage in the system. 3D TRASAR for DAF has advanced ultrasonic cleaning, air purge, and acid cleaning to ensure reliability of turbidity measurement and pH measurement. DAF pH is key to achieving its desired operation; 3D TRASAR for DAF measures and controls pH effectively and sends data to the web wirelessly to provide real-time visibility on DAF operation in System assurance center. 3D TRASAR for DAF comes with 24x7 monitoring and alert protection service through the Global System Assurance Center located in Pune, India.

Commercial Application of 3D TRASAR™ Technology for DAF

A North American Paper mill wanted to reduce fresh water consumption by reusing the effluent from the dissolved air flotation unit (DAF) as vacuum pump seal water. Inconsistent solids removal by the DAF was limiting the ability to reuse the effluent. DAF performance was severely limited as a result of the varying levels of furnish and hydraulic flow rate of the treated streams causing significant turbidity and total suspended solids – TSS – load swings. As turbidity increased, chemical pumps were manually adjusted

to compensate for the increased solids loading. These manual operations often led to periods of inadequate chemical treatment which resulted in poor effluent water quality, prompting the mill to send all DAF effluent water to the Effluent treatment plant.

3D TRASAR for DAF was implemented to improve control and reduce variability in the effluent water quality. Additional DAF operational data can be monitored with automated alarming capability to notify the operations staff of sudden process changes.

3D TRASAR™ Technology for DAF provided the mill with the following benefits:

- Improved control and reduced variability in DAF effluent water quality allowing the water to be reused as a vacuum pump seal water
- Chemical treatment program optimization was achieved through a combination of feed forward and feedback control.
- Alarm notification was established to notify the operations team of critical process changes.
- This reuse of the DAF effluent reduced fresh water consumption at the mill by 16% 750,000m³/year – an annual savings of 388 lakhs INR or US \$535,000.

effluent and the data is sent to a secure Nalco Water website to generate historical trends and drive decisions to optimize of the chemical cleaning/conditioning program before, during and after specific cleaning/conditioning events.

PEM schematic diagram



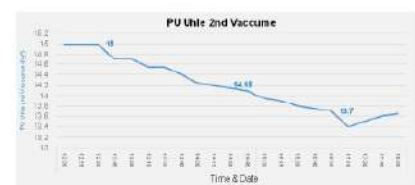
Commercial Application of PEM – Press Effluent Monitor

A machine producing 525T/day of lightweight coated paper at 750 m/min was using a batch on the fly alkaline and acid felt conditioning program.

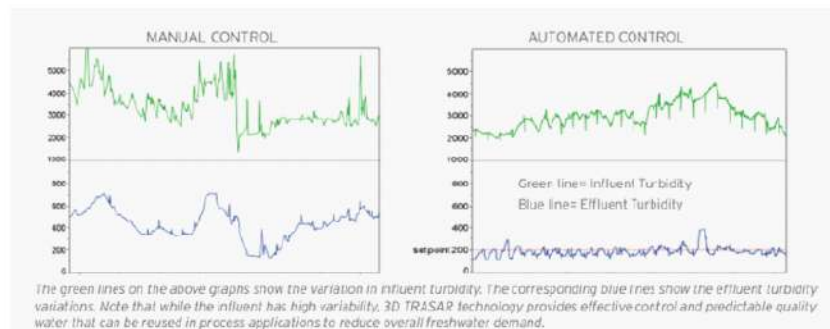
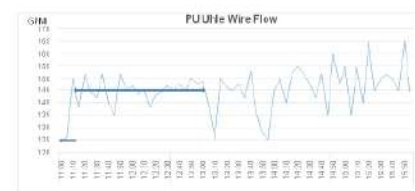
The PEM– Press Effluent Monitor was installed and after a few days the program was optimized to deliver:

- An increase in water removal of 110 l/min
- Lost time from breaks reduced from 4.5% to 3.1%
- Reduced low pressure steam required by 4.9%

Uhle Box Vacuum dropped around 1.3”



Water removal in press section increased to 30GPM or 110l/min



B.PEM - Press Effluent Monitor

INTRODUCTION

The press section is a critical area for papermakers to maintain productivity and quality. Press section fabric cleaning and conditioning plays a major role in dewatering in press sections, delivering a uniform profile of the sheet, and affecting machine speed and energy demand.

Working Mechanism

The Press Effluent Monitor – PEM – is an on-line monitoring technology that has the capability to quantitatively measure press fabric cleaning and conditioning programs by continuously analyzing the press section effluent water and press pans. By continuously monitors five variables – pH, temperature, ORP, conductivity and turbidity in the press

OxiPRO™ Technology

OxiPRO Microbial Control Technology controls microbial growth and deposit formation in the papermaking system. This technology helps papermakers to act proactively on biocide dosing strategy,

boilout requirement, and to prevent unnecessary downtime and product defects.

Working Mechanism

The system continuously monitors microbial activity, surface fouling, and oxidation reduction potential (ORP) levels in papermaking process waters providing critical measurements needed to optimize deposit control programs.

Part of the OxiPRO monitor directly measures the fouling rate in the paper machine system using an Optical Fouling Monitor – OFM. The OFM measures and records the accumulation of deposits on a transparent disk that is partially immersed in a flowing sample of system water that is a representative of the fouling trend in the paper machine. The ORP value of the system water is also monitored, so the effect of adjustment to the deposits control program can be assessed.

The ORP value for the sample is measured to help correlate the results to oxidant dosage levels. Data gathered by the OxiPRO monitor is transmitted wirelessly to an internet web page to optimize the deposits control programs.

Commercial Application of OxiPRO

Paper Machine details

- Machine Type: Twin-wire gap former
- Paper Grade: Uncoated freesheet
- Production: 250,000 T/year
- Speed: 1,230 m/min
- Basis Weight: 66 – 100 g/m2
- Filler: 15 – 20%

The following benefits were achieved by using OxiPRO monitor in the deposit control program.

- Being able to see the results with higher resolution and without the delay of traditional monitoring methods, the Nalco Water team was able to implement program changes faster with more effective results. The team was able to identify process upsets and optimize with 24-hour real-time data collection that was available to them both locally and on-line.

- Better monitoring of system fouling tendencies, enabling prediction of chemical boil-out requirements
- Extension of the scheduled boil-out period from 60 to 98 days was possible due to improved system cleanliness



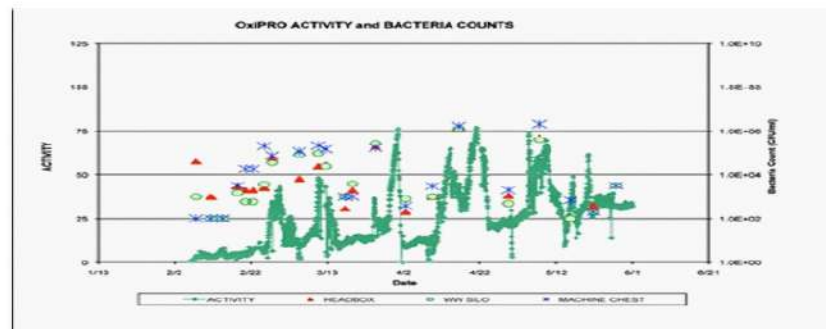
Figure 9. OxiPRO Bio Index captures system fouling tendency allowing for a six month extension of the boil-out period without any negative impact on basis or quality.

CONCLUSION

As the paper industry moves to install bigger, faster and more sophisticated papermaking systems, there is an increasing need for automation and control to manufacture better quality and productivity demands on the systems. Specialty chemical applications also need to meet these challenges by monitoring critical process parameters with a view to provide better control on various speciality chemicals applications, while enhancing efficiency of the manufacturing process.

The technologies presented above not only provide on-line monitoring and control for various processes in the papermaking systems, they provide avenues for water and energy conservation. The internet based capabilities also provide remote information gathering for alarms and real-time troubleshooting to be possible.

These technologies are based on platforms that can be expanded to other areas and various furnishes and grades of papers.



- Reduced microbial activity was observed immediately with the OxiPRO monitor.

