Snapshot Report

AUSTRALIAN MEAT PROCESSOR CORPORATION

Zero Wastewater Discharge

Zero Waste from Site – Liquid Stream, Stage 1 concept design and unit operation identification

Project Code	Prepared by	Date Submitted
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Project Description

The availability of freshwater is one of the most critical challenges faced in today's society. Freshwater scarcity poses a major threat to economic growth, water security and ecosystem health (Tong & Elimelech, 2016). The challenge of providing adequate freshwater to the public and industrial sector is exacerbated by climate change and economic development. The industrial sector consumes huge amounts of freshwater daily and intern produces large volumes of wastewater. Reducing freshwater use and wastewater discharge has become one of the main targets in business and process optimisation systems (Deng & Feng, 2009) not only for economic reasons but also because the of industry's social and environmental responsibilities. Through reuse, wastewater is no longer considered a waste product that potentially harms the environment, but rather an additional resource that can be harnessed to achieve water sustainability (Tong & Elimelech, 2016).

This study looks at a meat processing facility which already has a dissolved air floatation (DAF) treatment plant on site as well as a reverse osmosis (RO) plant. The study will break down all the different streams of wastewater entering the treatment plant and determine which streams will be suitable for reuse without pre-treatment, and what technology is available to further treat the wastewater, post DAF treatment, to a point that it can be put back through the RO and made potable again.

Project Content

Midfield currently process 1,200 cattle and 8,000 small stock per shift. Each shift is 7.6 hours in duration and both species have dual chains, operating over the same single shift. Midfield's has a strategic intent to increase this to 2,000 and 14,000 respectively, over two shifts, with the second shift designed, where possible, to attract a new labour force non-typical of the current single shift labour force (for example, primary care givers).

To achieve this vision Midfield are undergoing an entire site wide innovation program to debottleneck the process (from livestock receivals to cartons leaving the facility), reduce waste leaving the site (including being more resource/services efficient), and to change the nature of the work to both reduce the per head/hour labour requirement (as a KPI) and ensure that those resulting jobs are designed in a way to be open to both a wider physical stature workforce and hours of operations that suit varying employment demographics within the available labour pool draw.

Project Outcome

Classification of Wastewater Streams

Several meters were placed on all incoming and outgoing water streams on all floors. An example of this can be seen in figure 1. This supplied monitors with full access of water usage on each floor.

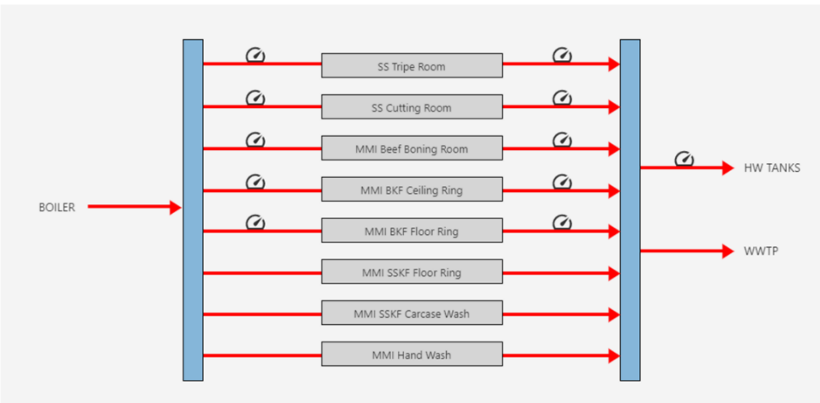

Figure 1. Hot water in and out of MMI complex

Wastewater Quality Profiling

Over several weeks daily composite samples were taken from specific streams and analysed for BOD, TSS, Ammonia and Conductivity. From this an average quality was able to be determined (tables 1).

Table 1. Average wastewater results from several streams inside the processing facility

Stream	BOD (mg/L)	TSS (mg/L)	Ammonia (mg/L)	Conductivity (µS/cm)
Steriliser Water	17	25	3	240
Hot wash cabinet water	15	15	2	160
Pre-treatment Wastewater	1500	17000	72	9000
DAF Treated Wastewater	740	450	30	14227

The results show that the Steriliser water and hotwash water are of a quality which is suitable for capture and reuse on site, where non potable water can be used, without any further treatment.

The DAF results show that the treatment system in place is reducing the organic and suspended solid load significantly. This bring the wastewater to a point where it is ideal for tertiary treatment.

Development of a Zero Wastewater Disposal Strategy

Membrane Bioreactor

The preliminary results in table one show that the DAF treated water fall within the feed water requirements for an MBR system. This is a straightforward approach and would be expected to produce high quality water post treatment.

Table 2. Ideal water conditions for MBR system

Component	Units	Feed Water	Treated Water
pH	pH	5.5 to 8.5	**6.0 to 9.0**
Oil & Grease	mg/L	20	**<1.0**
TSS	mg/L	600	**<10**
BOD	mg/L	1000	**20**
COD	mg/L	2000	**50**
Total Nitrogen	mg/L	200	**10**
Total Phosphorous	mg/L	35	**10**
Temperature	°C	35 - 55	**35 - 55**

Titanium Membrane Filtration

A titanium membrane filtration system has recently undergone trials and a rendering facility that found it reduced 98% of the suspended solids from the wastewater stream. In discussion with the company providing the technology it is believed that it would also be able to filter a significant amount of other contaminants such as BOD, oil and grease and sodium.

This technology is a true R&D project. It has never been tested in a meat processing facility and whilst the technology is sound it requires vigorous testing.

Benefit for Industry

From this study it was seen that the benefits of installing an integrated monitoring system which can be monitored and trended has upfront financial benefits. Understanding the quality of each stream and being able to capture specific wastewater streams for reuse can decrease the volume of wastewater going to trade waste significantly which also has a financial benefit.

Midfield believe that the best strategy to follow to achieve their ZWD goal is to complete a trial using Titanium Membrane technology which is an innovate approach yet to be seen working in the meat industry. The trial would cost approximately $134,000 to complete and would leave Midfield and industry with a clear pathway forward.

ZWD is the way forward which industry as a whole must adopt in order to ensure its sustainability as an industry.

Useful resources

Deng, C, Feng, X, 2009, Optimal Water Network with Zero Wastewater Discharge in an Alumina Plant, *WSEAS TRANSACTIONS on ENVIRONMENT and DEVELOPMENT, Issue 2, Vol. 5, pg. 146-156*

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Rabah, A, B, Ijah, U, J, J, Manga, S, B, Ibrahim, M, L, 2008, Assessment of Physico-chemical and Microbiological qualities of Abattoir Wastewater in Sokoto, Nigeria, *Nigerian journal of basic and applied sciences, vol. 16, No. 2, pg. 149-154*

Ranade, V, V, Bhandari, V, M, 2014, Industrial wastewater treatment, recycling and reuse: An overview, *Advanced chemical engineering, pg. 1-76*

Shengquan, Y, Siyuan, G, Hui,W, 2007, High effective to remove nitrogen process in abattoir wastewater treatment, Science Direct, *Desalination, vol. 222, pg. 146-150*

Tong, T, Elimelech, M, 2016, The Global Rise of Zero Liquid Discharge for Wastewater Management: Drivers, Technologies, and Future Directions, *Environmental Science, and technology, Vol. 50, pg. 6846-6855*

Zsirai, T, Al-Jaml A, K, Qiblawey, H, Al-Marri, M, Ahmed, A, Bach, S, Watson, S, Judd S, 2016, Ceramic membrane filtration of produced water: impact of membrane module, *Separation and purification technology, vol. 165, pg. 214-221*