



INCLINED SLUDGE PRESSES FOR THE MECHANICAL DEWATERING OF INDUSTRIAL CHEMICAL & BIOLOGICAL SLUDGE

Key Words

Sludge dewatering, mechanical dewatering, sludge treatment, DAF sludge, WAS dewatering, inclined sludge press, HUBER Technology

Abstract

Sludge produced from physical-chemical and biological processes can represent up to 40% of the wastewater treatment plant operating costs. Traditional technologies include belt filter press, solid bowl decanter centrifuges and recessed chamber filter press.

This paper discusses the use of the HUBER Inclined Sludge Press (ISP) in several Australian installations, from both full scale trial and permanent plants. In summary, it has been found that the ISP is an efficient and cost effective method for dewatering of chemical and biological sludge, as well as greasy floats produced within the F+B sector. Full scale trial work conducted in 2005 – 2007 led to a series of permanent installations being employed, and several years later the installations are offering significant benefits to the end users.

Introduction

HUBER Technology of Germany, introduced the ISP into the European market in 1992. The product represented a significant design innovation, whereby a stationary wedgewire drum and inclined shafted screw provided the means for efficient drainage of filtrate and compaction of the sludge prior to discharge.

The major advantage of the ISP was that the process requires only 25% of the wash water demand when compared to an equivalent sized belt filter press, and like a solid bowl centrifuge is totally enclosed with optional odour extraction points.

As with all dewatering technologies, central to the process is flocculation. Both powdered and liquid types are used. For some applications, cross linked emulsions are preferred.

ISP Technology

Since its introduction in 1992, over 1000 HUBER ISP's have been installed worldwide in both industrial and municipal markets.

The design of the machine has been refined over these years, and in 2005 a major innovation was added to the design to provide a higher degree of process flexibility and performance.

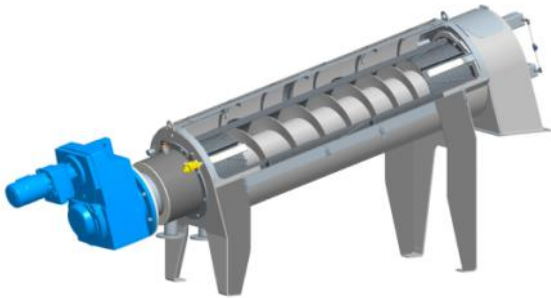
The original version, the RoS3, consists of a flocculation tank with slow speed mixer, overflow pipe and ISP. The ISP consists of a two stage wedge wire basket. The first has a larger outer diameter to allow for initial drainage and thickening of the sludge mass, the second a much narrow basket with a cone restriction on the outlet to facilitate dewatering.

A shafted screw conveys the sludge from inlet to outlet, and is the main variable for controlling throughput and output dry solids content. The screw is fitted with a brush to clear the inner side of the wedge wire, whilst a rotating spray bar system is used to wash the v-section of the wedge wire. All filtrate and washwater is collected and piped off.

The entire machine, including the internal screw is fabricated from stainless steel.

In 2005, HUBER further refined the design which led to the release of the RoS3Q series. The Q series consists of a number of innovations that increase performance and reduce capital costs. The Q Series is available in four sizes, to cater for a number of capacities.

The internal configuration of the screw and basket is very different to the original design.



RoS3 Q Series Design



RoS3 Design

Performance Data

Site trials were undertaken in Australia from 2005 – 2007, on a number of sites with both chemical and biological sludge streams. The aim was to demonstrate performance on a range of sludge types from a variety of market sectors, including DAF float with high FOG content.

Industry	Sludge Type	Process	ISP Cake Solids (% DS)	ISP Capture (%)	ISP Polymer Dose (kg/t eff)
Winery	Biological	SBR	22 - 26	95	5.5
Potato Chip	Chemical	Clarifier + DAF	32 - 36	97	None
Chicken Abattoir	Chemical	DAF	26 - 28	95	4
Brewery	Biological	UASB + MBBR	17 - 18	95	4.5
Juice	Biological	SBR	13 - 14	95	5.5
Dairy	Chemical	DAF	22 - 25	85	5.5
Meat Abattoir	Chemical	DAF	30 - 36	97	3.0

Winery Wastewater Treatment

A trial was conducted on dewatering waste activated sludge from a trade waste treatment plant comprising of covered anaerobic lagoons followed by SBRs. The activated sludge is wasted and thickened in a stationary thickener. The thickened sludge was then pumped to a HUBER RoS3 Inclined Sludge Press.

For an activated sludge, it was found that the sludge dewatered very well to 22 – 26%. Since the trial, a permanent installation has been installed since 2007, with similar results.

It was also found that the primary sludge can be dewatered within in the ISP. Critical to the operation of the ISP was solids loading, as the primary winery waste can be very high in suspended solids and grit content.

Potato Chip Manufacturing

A trial was conducted on a major potato chip processing plant in 2006, leading to the installation of a new dewatering facility comprising of 2 x HUBER RoS3Q ISPs. The new plant has been in operation since 2009.

The wastewater treatment plant comprises of a fine screen, clarification, a flocculation step and dissolved air flotation. The sludge stream produced from the clarifier and DAF are mixed and pumped to an intermediate sludge storage tank. The combined sludge is then dewatered in the ISP. The final cake is now accepted by the local water authority for use as a substrate in anaerobic digestion.

The processing plant undergoes a series of cleans involving caustic washing and general dumping of several production processes. The wastewater generated is high in pH and includes high levels of oils.

The DAF produced a sludge that contained high levels of solids, oil and grease. During this period, the existing belt press system was not able to function due to mis-tracking of the filter belt.

The HUBER ISP operated reliably under these conditions, producing a dewatered cake between 32 – 34% dry solids and filtrate capture of greater than 95%.

Chicken Processing Plant

Several HUBER ISP’s have been installed in chicken processing plants, for both primary and secondary sludge streams.

A trial was undertaken in Adelaide at a major chicken processing plant that utilised a chemical DAF for its wastewater treatment. The sludge float was pumped to a conical sludge tank and then dewatered in the trial system.

As a result of the trial work, a permanent dewatering facility was installed using a HUBER RoS3 ISP. The installation has been operational since 2009 and has lead to an annual saving of \$450,000 on disposal costs, providing a payback with less than 18 months.

Similarly, on waste activated sludge from an SBR, dewatering to 13% dry solids was achieved, against existing belt presses at 11 – 12%. The ISP utilizes 25% of the water demand of the equivalent sized belt filter press.

Brewery Wastewater Treatment

A major brewery in Queensland trialed a HUBER RoS3 in 2005 for a mixed sludge stream containing granular anaerobic sludge, thickened WAS and a small fraction of a chemical precipitate. The granular nature of the biomass presented a challenge but was managed by the ISP.

In 2006 a permanent dewatering facility was installed and has been operational as per the trial performance. The resultant volume reduction is 85%.

Juice Plant Wastewater Treatment

A major regional NSW juice manufacturer recently installed a new wastewater treatment using SBR technology. The waste activated sludge is thickened in a static thickener and the dewatered in a HUBER ISP to 14% dry solids. Volume reduction is 84%.

Dairy

Sludge produced from dairy processing applications present several challenges for mechanical dewatering processes.

Acid cracked protein sludge from a primary DAF is typically 8 – 12% dry solids. Trials have shown that ISP technology can de-water to 25%DS, with a reduced load to the machine and high polymer dose rate. Capture is generally 85% in lieu of the standard 95%.

Similarly for activated sludge, with appropriate flocculation the sludge was dewatered to 12%DS with 95% capture.



Abattoir

Red + Green Stream DAF
Float



Potato Crisps

Clarifier + DAF Float
Steams



Poultry

Biological + Primary DAF
Float



Brewery

Mixed sludge streams—
anaerobic, aerobic +
chemical



Discussion

Whilst the technology was well proven in Europe in Municipal applications, a full scale trial machine was used and tested at several sites in Australia to gain a firm understanding of its use in Industrial applications. A wealth of process knowledge and experience was gained in terms of design and performance that can be applied to any application without the need for full scale trial work.

In the permanent installations, the performance exceeded that achieved in trial work. This was due to the fact that the permanent installations had all the necessary fixtures required such as sludge storage and washwater flow.

Payback periods on installations generally vary from 12 through to 24 months. The timing is dependant upon the location of the plant and associated disposal costs, existing infrastructure and plant capacity.

The development of the new Q Series range provides an expanded capability in terms of capacity and flexibility.

For industrial applications, a clear understanding of the wastewater process is required in order to appropriately design and augment the existing plant. Consideration to the raw wastewater characteristics, hours of operation, nature of factory operations, mass balance, chemical addition and bio-process type is required to select an appropriate mechanical dewatering technology.

Municipal Applications

The Q Series has been well proven in Europe for the dewatering of primary, mixed and WAS streams. With a greater emphasis on energy minimization in Engineering Design of wastewater treatment plants, the RoS3 Q Series is an efficient mechanical dewatering technology for small to medium sized sewage treatment plants.

For several parts of Australia, the ideal technology will be the one that provides an acceptable level of volume reduction for a given energy input.

Conclusion

A great deal of process knowledge has been gained from the trial work and permanent installations of the HUBER RoS3 and RoS3Q Series Inclined Sludge Presses within Australia. The technology has demonstrated its use in both industrial and municipal applications with low life cycle costs and robust performance.

With a greater emphasis on energy, the HUBER ISP technology has been shown to be an efficient technology for mechanical dewatering of sludge streams produced from wastewater treatment.



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