Postvertriebsstück, Entgelt bezahlt!

EDM
EUROPEAN DAIRY MAGAZINE

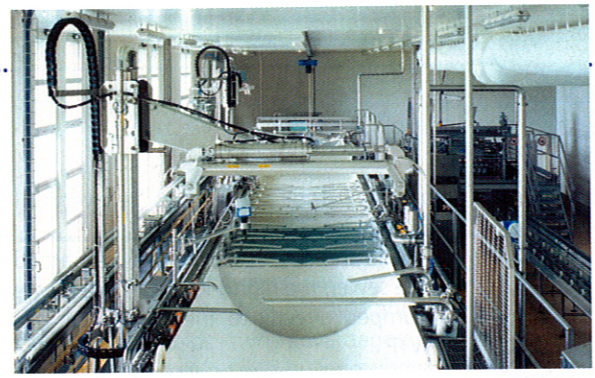
PROFILES

K 10189

Dezember
December
Décembre
2005
6

Dairy & Fluid Foods Technology

www.th-mann.de



for a maximal throughput of 10,000 l/h. Various cheese types can be produced on the machine with the positions of rennet dosing and cutting tools being adapted to the product. The Coagulator guarantees for a microbiological safe production. Also smaller cheesemakers can now benefit from the advantages of continous production, i. e. improved yield and continuous product quality.

PFM presented the new Comet Steelo Pack High Speed with an automatic feeding system for Mozzarella cheese: this continuous-motion vertical packaging machine is capable of producing stable-based packages at high speeds, sealed along the whole length of the four side corners (Steelo Pack). The innovative Super Long Dwell sealing system increases the machine's packaging speed and guarantees hermetic sealings. Comet operates at 180 packaging cycles a minute. The machine is driven by two independent brushless motors with motion control; a touch screen panel simplifies parameters settings while the teleservicing system has been developed for on-line programming and diagnostics. The machine presented at CibusTec was constructed entirely by AISI 304.

Scirocco Servo: 200 hermetically-sealed packages a minute, maximum format flexibility, completely sanitisable and designed to work in critical environments, these are the main features of the new machine developed for the flow pack packaging of cheese portions. The machine is also equipped with the Super Long Dwell sealing system, it is constructed entirely of AISI 304 with a cantilevered structure and rounded corners especially designed to satisfy the dairy industry requirements. MBP launched the 10-Head Multi-Head for Mozzarella with integrated weighing and piece-counting system. The new system has been developed by MBP and PFM, in collaboration with major international research centres and guarantees an extremely high level of weighing accuracy and piece counting. Particular attention has been paid to construction details in order to prevent damage to the cheese during the weighing stage.

The range of machines on exhibition was completed by Bora, a horizontal flow pack type packaging machine which produces closed packages with three sealings starting from a reel of heat-sealing material. The infeed conveyor is two metres long and is fitted with completely sanitisable interchangeable pushers.

Zenith Inox is a vertical FFS machine, specially dedicated to hermetically-sealed three-sealing packages, for the dairy industry in particular, starting from a reel of heat-sealing film. A major new feature of this machine is its combination with the Automatic Clipping Machine, which is used in particular for the packaging of Mozzarella in brine. The materials from which it is constructed (AISI 304 and Anticorodal aluminium) and the special "Ermetic Box" structure guarantee protection of the internal mechanical components. EDM

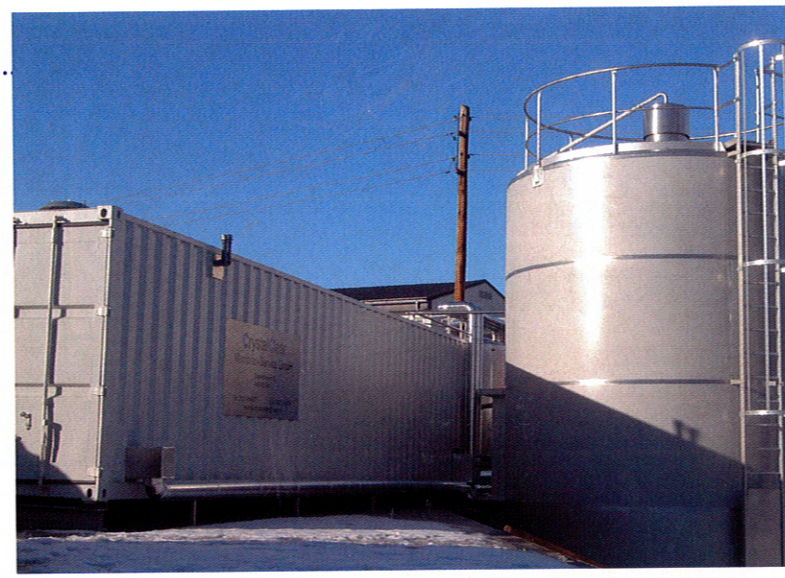


Figure 1: Container ultrafiltration unit – the membrane racks have been installed in one container

Bernhard Bonapace, Mils, DI Dr. Bernhard Mayr, Graz, Austria

Waste water management

Reduction and utilization of organic load

Membrane technology is steadily increasing its share in the water treatment market, regardless if drinking, process or waste water.
The main goal of the presented project was to demonstrate that it is feasible to split up the dairy waste water in a highly loaded fat and COD enriched fraction, namely the concentrate and a purified fraction called permeate. The operational costs of the membrane filtration unit amount to approximately € 2/m³.
With this innovative approach of membrane filtration it was possible to solve the problem of floating and bulking sludges in the WWTP and simultaneously gain approximately 100 kW of power. On the other hand the membrane filtration unit also needs roughly 35 kW, so altogether there remains a net energy plus of approximately 65 kW.

Increased production capacity has forced the dairy plant in Freistadt, Austria, to make an innovative approach to ensure waste water emission limits will be kept. The dairy waste water which is highly loaded with lipophilic matter is treated with a cross-flow UF unit. The filtrate (roughly 85 %, nearly free of lipophilic substances) is discharged to the communal aerobic waste water plant while the concentrate (15 v%, containing all larger lipophilic molecules) is added separately to the anaerobic digester, also placed at the site of the communal waste water treatment plant (WWTP). Biogas and consequently bioenergy is generated in a co-fermentation process and energy for aerating the aerobic waste water process is saved.

The task to find an optimal solution in terms of economy and ecology at the interface between dairy plant and WWTP was carried out in co-operation of the Austrian engineering consultants EnviCare Dr. Mayr, Graz, Lohberger, Thürriedl & Mayr, Freistadt, and Crystal Clear Membran Service, Mils.

After preliminary lab scale tests, a pilot unit was installed and operated on site for several months. A diploma thesis from the University of Agriculture, Vienna (BOKU) has

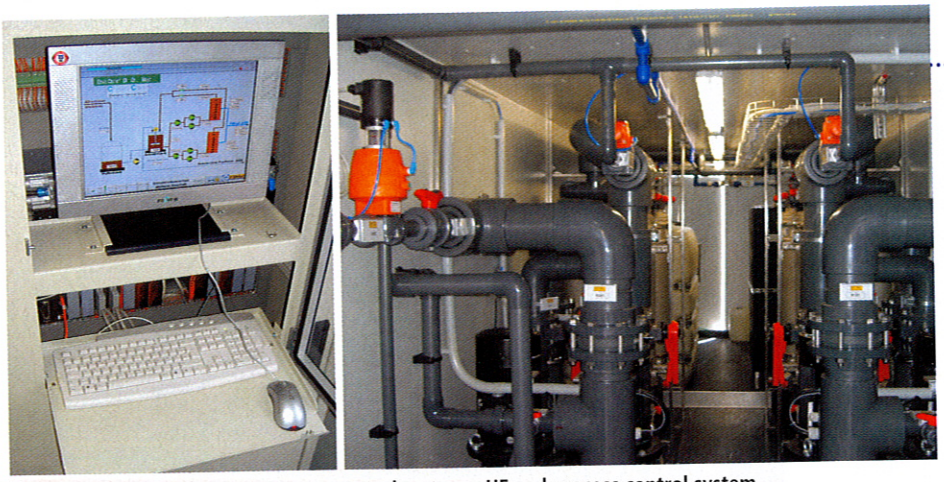


Figure 2: Ultrafiltration and process control system – UF and process control system

supervised the pilot phase. The construction of the membrane unit was completed in September 2003. The test period ended in December 2003.

Membrane treatment plant

Due to the installation of the membrane racks in a container (figure 1) it is possible to install and test the whole equipment before shipment to the costumer. Time for connecting the container module to on-site installations like tanks or sewer were reduced to a minimum.

The UF unit

The waste water is collected (see block scheme) in a small basin and then pumped to the 80 m^3 storage tank where lipophilic substances and larger particles float or sediment.

The pH is controlled in the range between 8 to 9. Due to the biological degradation, the process tends to turn acidic which requires the addition of NaOH.

A so-called "working" tank of 9 m^3 is fed from the storage tank and operated in batch mode until a pre-defined concentration is reached.

From the "working" tank, the waste water is pumped through a screen-filter to the UF module system. The mean cross-flow velocity is apprimately 2 m/s.

Trans membrane pressure and flux are controlled by frequency regulated pumps and a valve in the concentrate pipe. Concentrate is fed back to the "working" tank until the pre-defined recovery of permeate is reached.

While the clean permeate is discharged to the sewer, the highly loaded concentrate is pumped directly to the digester of the WWTP.

Technical data

Freistadt's cross-flow UF with polymer hollow-fibre modules has the following characteristics:

raw water feed flow:	10 m^3/h
permeate recovery:	85 %
membrane area:	272 m^2
cut-off:	30 KD/0,03 µm

All process equipment including pumps and membrane modules are installed in a 40' standard sea container. Operational data are collected, analysed, visualised and documented by a process control system (Figure 2).

As can be seen from numerous analytics, the retention of COD is larger than 90 %, in terms of lipophilic substances > 98 % are withdrawn by the membrane (figure 3).

During a test period which lasted three months, the interfaces to the existing facilities were optimised and operational experience, mainly to define the best cleaning strategy, could be gathered.

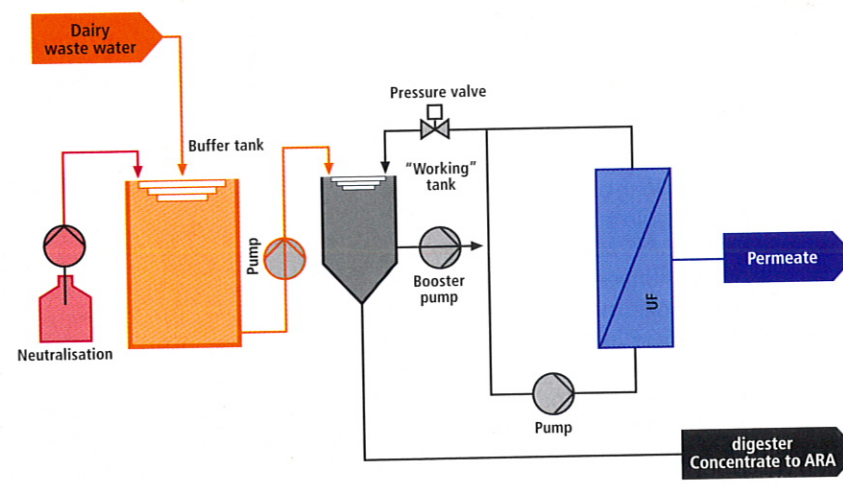
The plant was handed over to the dairy company in December 2003 and has been in successful operation since then.

The goal – to install a reliable and economically efficient, innovative treatment system with a high retention of lipophilic substances and organics was achieved by the intelligent implementation of a well-proven membrane process at the interface between dairy plant and WWTP.

Figure 3: Analytical results for filtrate and concentrate

Parameter	Unit	Raw water UF	UF Filtrate	Reduction
COD	mg/l	6390	726	89 %
Lipophilic substance	mg/l	177	< 5	> 97 %
Parameter	**Unit**	**UF Raw water daily sample**	**UF Filtrate daily sample**	**Reduction**
COD	mg/l	4972	446	> 91 %
Lipophilic substance	mg/l	1010	< 16	> 90 %

Figure 4: The visio process at a glance



Co-fermentation of the concentrate

The separation of dairy waste water into 85 v% pre-cleaned and nearly fat free permeate and 15 v% highly loaded concentrate yields two advantages: on the one hand the formation of floating and bulking sludge in the aerobic system is eliminated and on the other hand the gas production in the digester is enhanced. The concentrate is pumped to a 80 m^3 storage tank at the site of the WWTP. The dosage of the concentrate into the digester is controlled by the operator of the WWTP in order to avoid peak loads. The lag phase of the biocoenose in the digester took approximately three months, then the culture adapted and a significant increase of biogas formation could be gained (see table 1). Looking at the figures it can be concluded that the specific production of biogas increased by approximately 40 per cent. At this point it is important to notice that also before the implementation of the membrane process the dairy waste water was treated in the communal WWTP. The important difference is now that highly energetic substances are not oxidised any longer in the aerobic zone but yield biogas and consequently (renewable) energy in the fermenter.

Table 1: Mean values of specific gas production

time interval		specific gas production [1/PE.d]
	September – December 2002	19,1 1/PE.d
	September – December 2003	21,1 1/PE.d
(start up period)	April – May 2003	19,9 1/PE.d
(regular operation)	April – May 2004	28,3 1/PE.d

Energy balance

Looking at the energy demand before and after the installation of the membrane unit the following conclusions can be drawn.

Table 2: Mass flow and COD in the dairy waste water

	flow m^3/d	COD concentration mg/l	COD load kg/d
Raw water	210,0	5.000,0	1.050,0
filtrate	178,5	500,0	89,3
concentrate	31,5	30.500,0	960,8

Energy recovery in the anaerobic digestion

spec. biogas yield	350	l_{Biogas}/kg_{COD}	
Properties of biogas		CH_4	68 Vol %
		CO_2	27 Vol %
		Calorfic value H_u	24,48 MJ/Nm^3
Amount of biogas	336,3	m^3/d	
Energy content	8.231,7	MJ/d	
	2.286,6	kWh/d	
Equivalent power	95,3	kW	

Energy demand for aerobic process

Oxygen demand	1.234,0	kg/d
Air demand	650,0	m^3/d
Energy demand for aeration	10,6	kW

The theoretical estimation confirms the measured increase in biogas production of roughly 40 per cent and leads to the conclusion that due to the installation of the membrane filtration unit at the interface dairy – WWTP a net gain of approximately 106 kW of power is possible at the site of the WWTP.