



IWA Winery 2009

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HERA



Design and performance of
full-scale MBR plants
treating **winery wastewater** effluents
in Italy and Spain

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1. Kubota MBR Technology
 2. Kubota MBR in European wineries
 3. Design aspects
 4. Performance aspects
 5. Conclusion

0. Activities of Kubota Corporation

Agricultural, Industrial machineries related division



Water, Environmental, Infrastructure related division



Wastewater treatment plant



Teshima waste melting plant

KUBOTA CORPORATION

Founded in Japan, 1890

24,400 employees

Turnover: US\$ 11.5 Billion

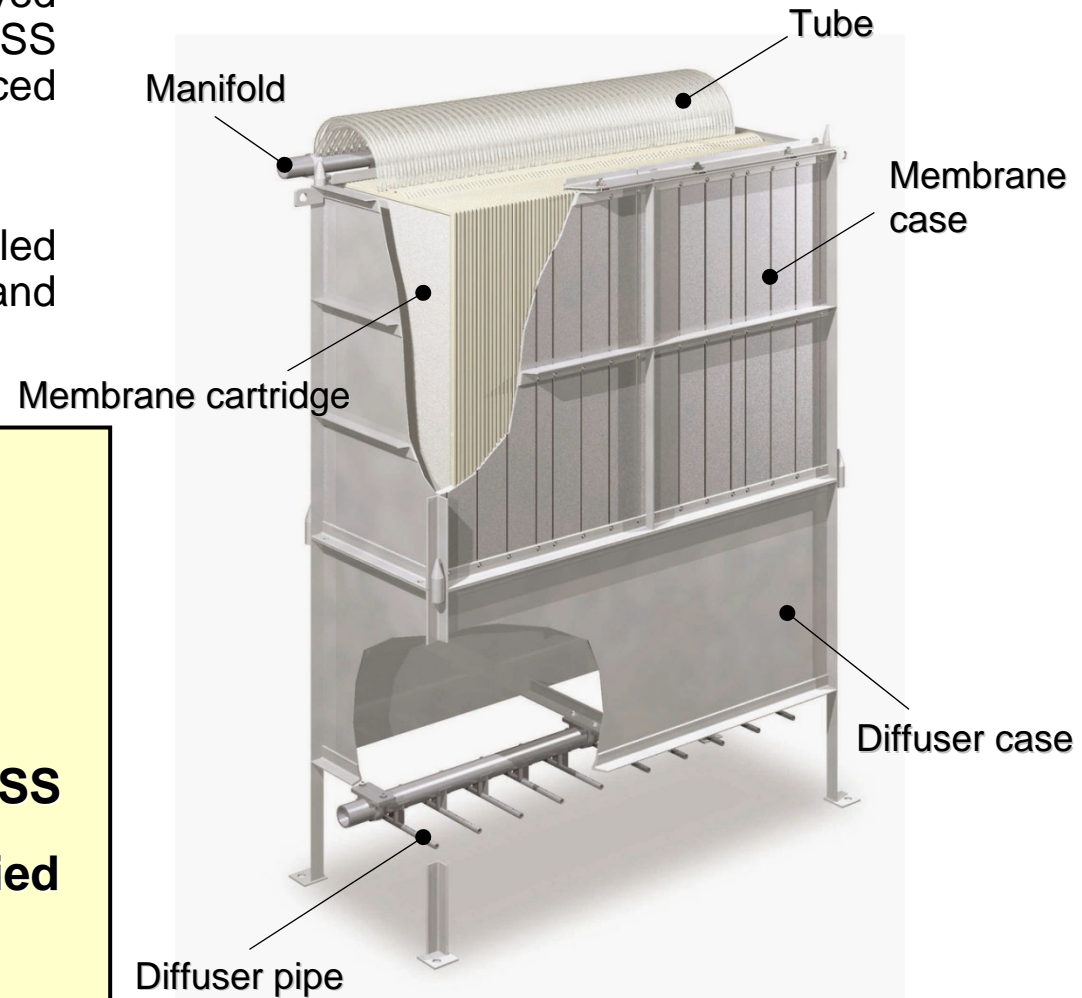
(as of March 31st 2008)

1. KUBOTA Technology: Submerged Membrane Unit[®]

- Solid-liquid separation equipment employed in activated sludge method. The effluent is SS free and coliforms are significantly reduced (~log 4-5)
- The membrane units can be directly installed in the aeration basin, saving tank space and related civil works.

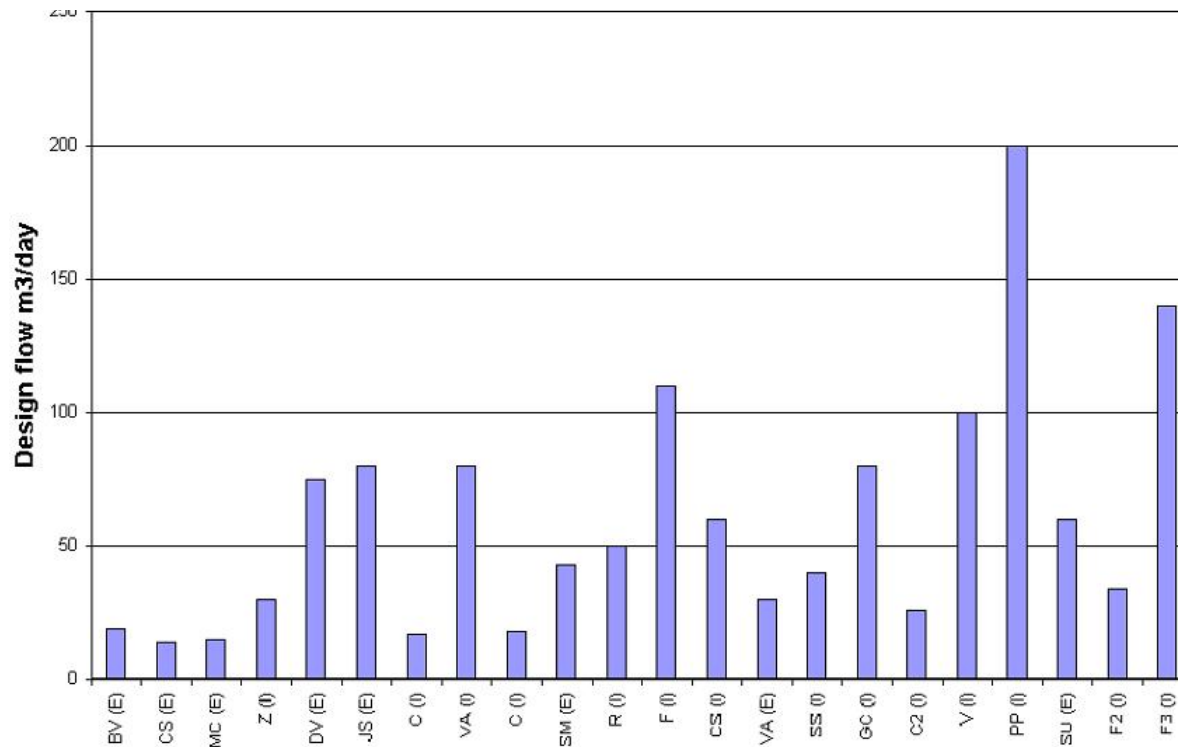
Characteristics

- **Easy maintenance of the wastewater treatment facilities**
- **Space saving**
- **Highly purified water quality with no SS**
- **Title 22 and IMO MEPC 159(55) certified**
- **Complies with EU Bathing Water Directive and WHO standards for Unlimited Irrigation**



2. Kubota MBR in European wineries

- 400 MBR plants in Europe from which approximately 60% are industrial (2008)
- Food and beverage industry accounts for 45% of the industrial references, the largest contributor being Wineries (22).
- All winery references located in Italy (14) and Spain (8) since 2003



3. Design aspects

- Spanish and Italian discharge consents can be met with a wide array of technologies – in most cases winery wastewater treatment plants (WWTP) discharged into municipal sewerage collectors.
- Observed Spanish discharge limits were 160mg/L for COD, 40mg/L for BOD5 and 5 or 80mg/L for SS, with no mention to pathogens.
- Drivers for MBR technology in winery applications are NOT discharge quality: scarce available space, capacity enlargement of conventional treatment plants, minimisation of visual and odour impact, need for reduced civil engineering, treated effluent reuse for on-site cleaning or irrigation, etc

3. Design aspects

CHALLENGE 1: presence of solids (i.e. seeds, filtration media, diathomea sand)

Pre-treatment

MBR plants generally do not have gravity settling tanks,

Install a 1mm screening at the head of works in order to avoid abrasion problems with grape seeds circulating between the membranes,

Avoid screen by-passes with sound designs especially during high flow events.



3. Design aspects

CHALLENGE 2: daily and seasonal variable loads (hydraulic and organic)

Equalization / Balancing tank

- Designs in Spain were provided with 24 hours' equalization volume at peak flow conditions ,
- pH neutralization at the equalization tank prior to the biological treatment can contribute to remove part of the organic load.
- Even without sludge seeding, aeration can help to reduce COD due to stripping of volatile compounds.

3. Design aspects

CHALLENGE 3: nutrient deficit

Biological treatment

- High BOD5/TN and BOD5/TP ratios
- Need to dose N and P to complete biological digestion
- For WWTP MBR systems, nutrient addition is in the form of urea and phosphoric acid, dosed at the balancing tank with either automated dosing pumps or, more often, manually. BOD5 levels are reduced to below 25 mg/L at the effluent.

3. Design aspects

CHALLENGE 4: membrane filtration dimensioning



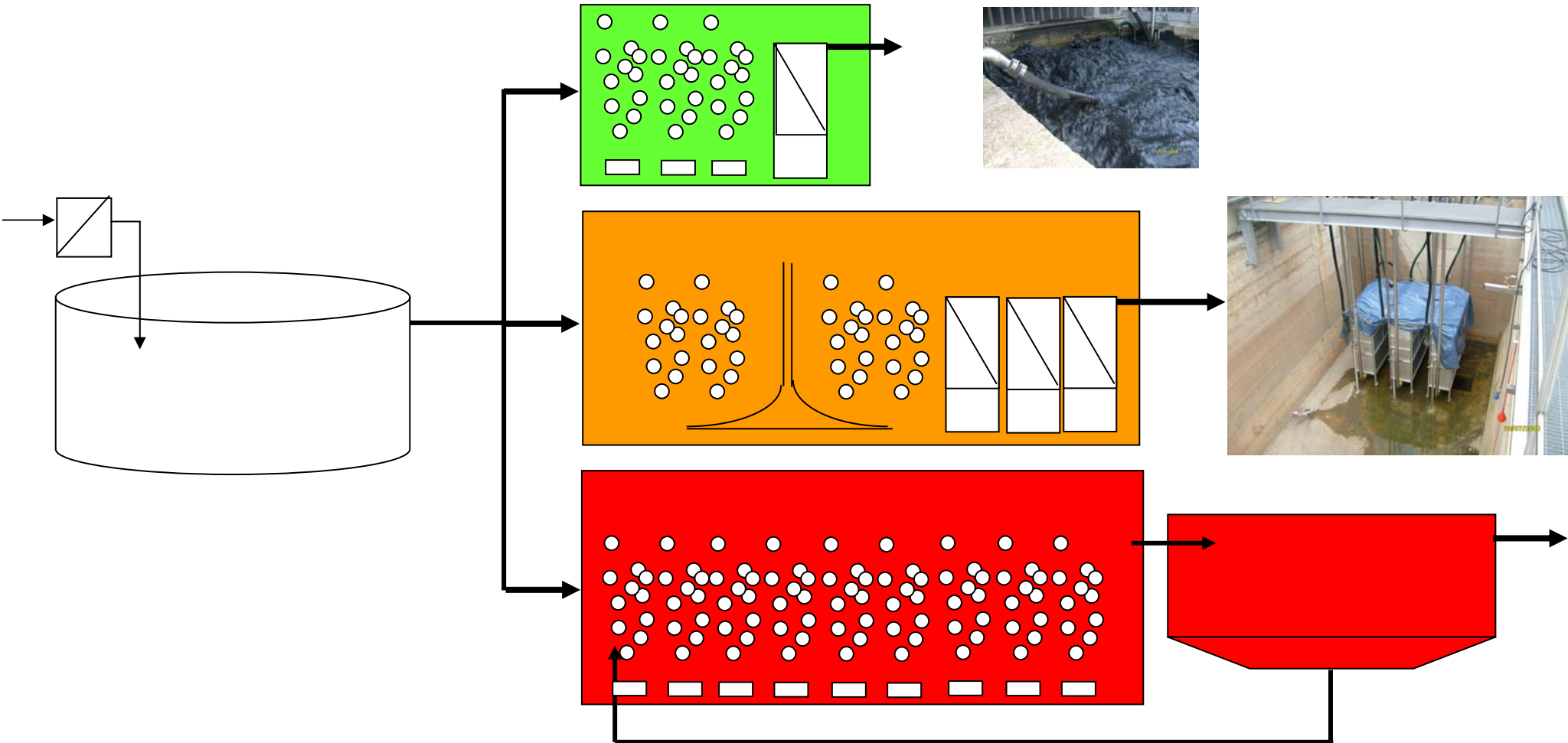
Average flows differ by a factor of 3 between harvesting season and low season

Design flux is dependent on liquor temperature, viscosity and sludge conditions

Reference	Membrane area	Peak Flux	Average Flux
	m ²	m ³ /m ² /d	m ³ /m ² /d
BV	60	0.76	0.33
DV	240	0.75	0.3
JS	240	0.80	0.3
MC	40	0.90	0.38

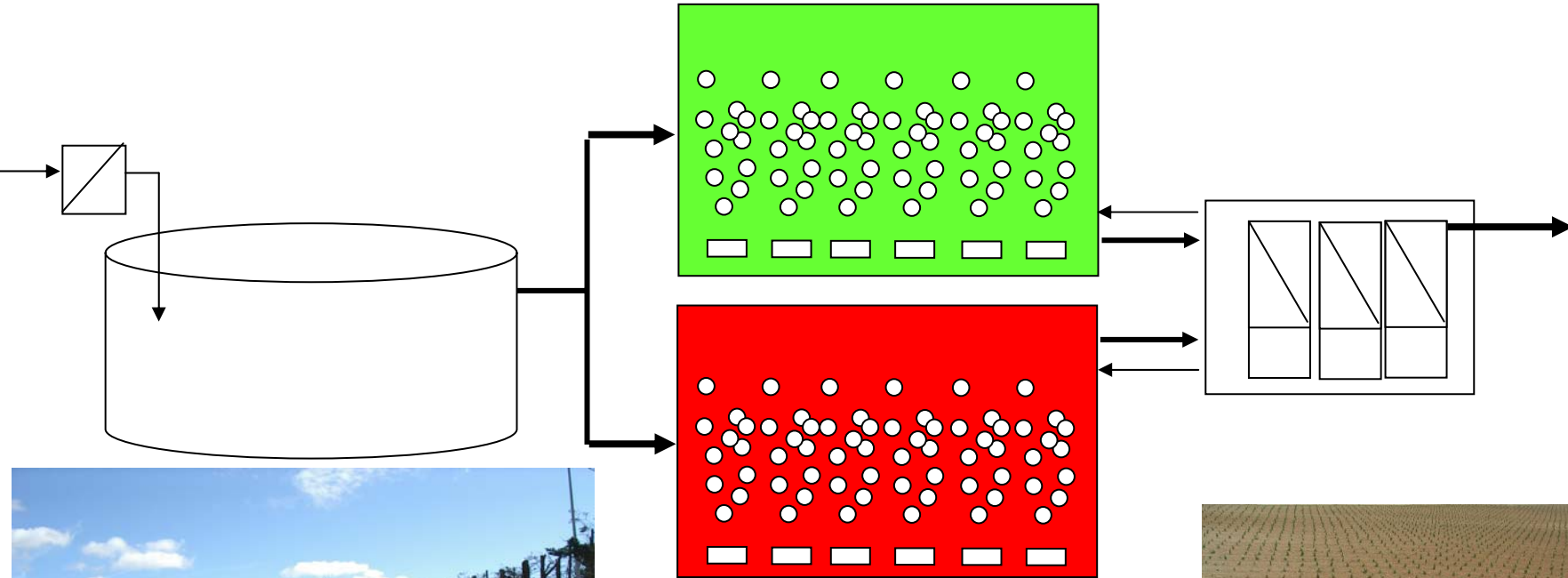
3. Design aspects

Configuration 1: RETROFIT Hybrid MBR plant (40 – 140 m³/day)



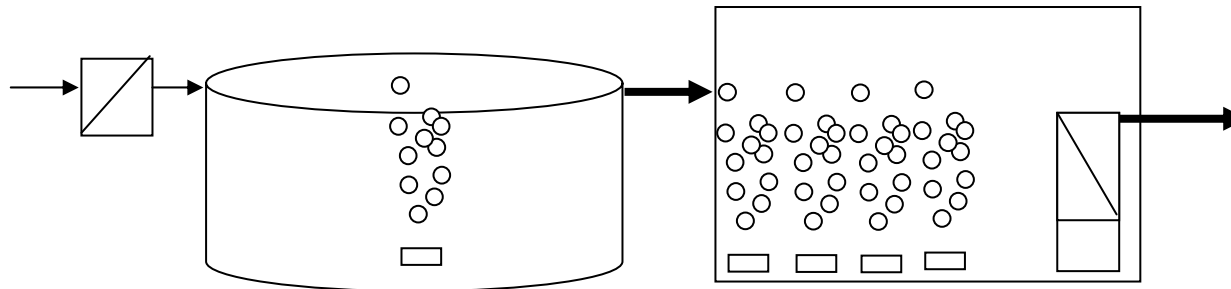
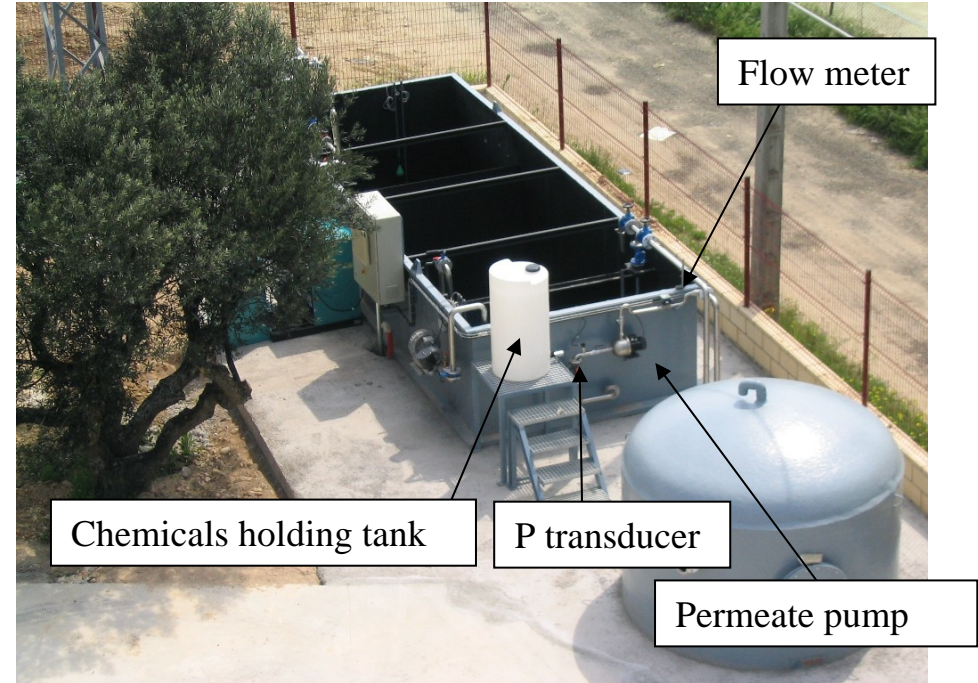
3. Design aspects

Configuration 2: NEW BUILD Modular MBR plant (70 m³/day)



3. Design aspects

Configuration 3: NEW BUILD Buffered compact MBR plant (15m³/day)



4. Performance aspects

PROCESS STABILITY



Lack of nutrient dosing:

Viscous bulking as a result of sudden increases of the organic load

Peak flow management:

Chemical cleans every 2 - 6 months with NaOCl @ 0.5% by weight concentration.

Sparse purges:

Successful operation for extended periods above 20g/L MLSS and long sludge ages with estimated VSS/MLSS ratio down to 60%

4. Performance aspects

EFFLUENT QUALITY AND REUSE

Consistently compliant with the usual discharge consents for wineries

Suitable for reuse applications. In Spain 2 plants reuse for crop irrigation, with

COD 50 – 300mg/L,
BOD5 <10mg/L
SS<2mg/L

Depending on the reuse application and local regulations it may be necessary to provide additional safety barriers such as UV or residual chlorine disinfection.

4. Performance aspects

COST TRENDS AGAINST CONVENTIONAL BIOLOGICAL SYSTEMS

Civil. MBR very cost-effective for retrofits

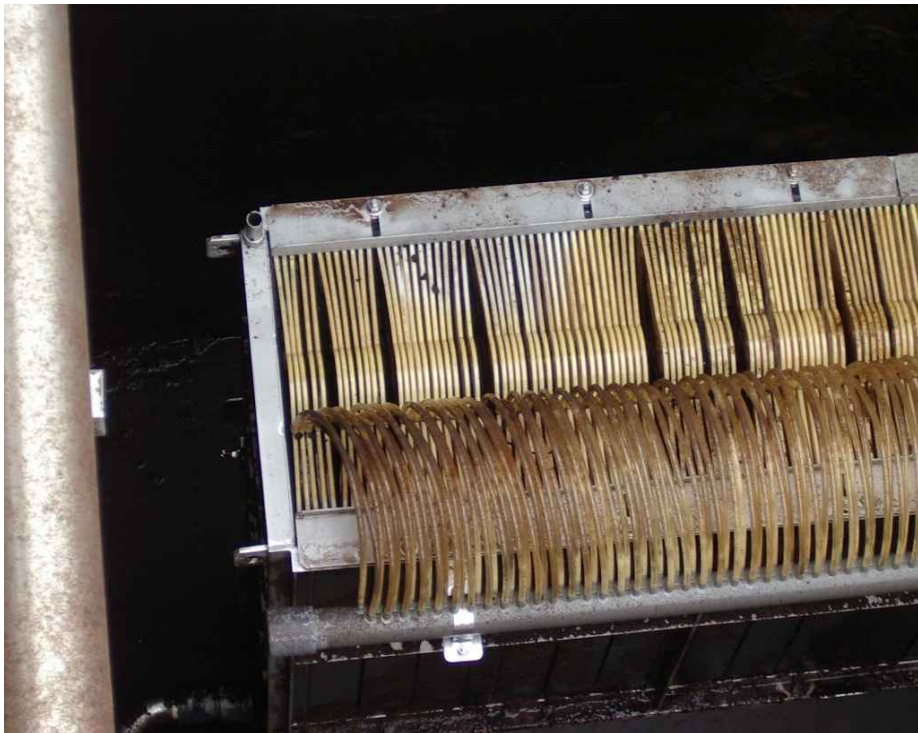
Energy. Higher influent concentrations help towards MBR economical viability. Favourable “kg BOD5 removed / m² membrane filtration area” ratio as compared to municipal.

Sludge disposal. Less dependence on sludge settleability and more sludge stabilization should have a positive impact on the cost of sludge conditioning, however there were no field data available to back this up.

4. Performance aspects

OPERATIONAL PROBLEMS

Inadequate use of equipment (diffuser flushing, membrane relaxation cycles, silicon-based antifoaming agents, etc)



No operational feedback

No preventive maintenance (blower failure)

No requests for technical assistance

Seldom sampling and sludge characterization

Sludge bulking due to:

- deficient pH adjustment due to dirty electrodes,
- wrong nutrient dosing,
- shock load due to equalization tank level kept too low.

4. Performance aspects

MEMBRANE REPLACEMENT RATES

Up to today:

1.6%. total replacement of Kubota cartridges for the European winery industry

Only one winery had required membrane replacements due to improper use of foaming control agents which caused irreversible damages on the membrane surface.

USUALLY: Full permeability recovery is achieved after physical and chemical cleaning

5. Conclusion

Kubota membranes for MBR have been successfully applied in 22 European winery wastewater treatment plants since 2003.

Experience shows MBR as a reliable solution for the wine industry

Easy retrofit to existing plants,
Flexibility against seasonality,
Process stability,

High effluent quality and possibility to reuse the treated effluent.

Main operational problems are identified and considered avoidable

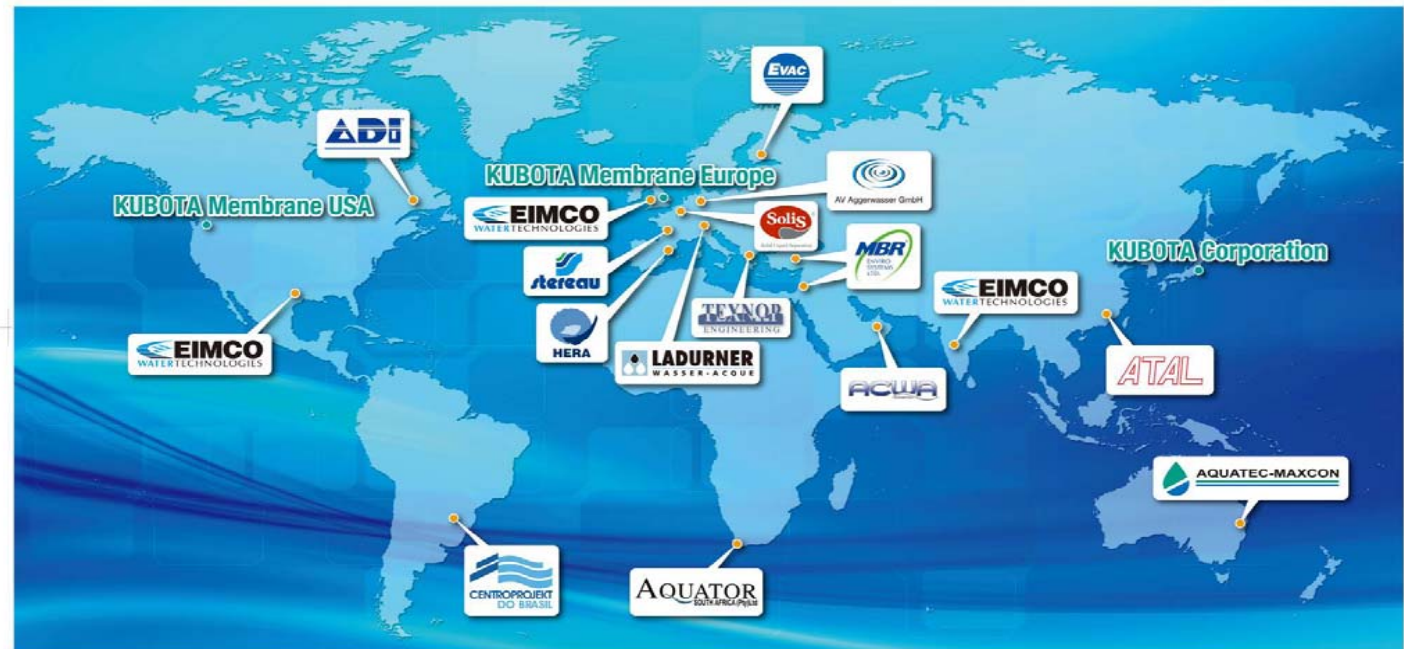
Kubota's membrane replacement rate across the European wineries was less than 2% of the total installed today.

Experts within reach



Pioneers in MBR FS membrane tech, leaders with
> 2,900 (>620 overseas and >2,300 in Japan)

Kubota KUBOTA MBR Direct Service Global Network



"Benefit from our expert advice
through the KUBOTA MBR Technology Licensee in your region."

GRAZIE MILLE!!

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