Manufacturer of Membranes for Water and wastewater treatment Applications

Isabelle Duchemin (Marketing and Sales Manager) and Olivier Lorain (Director R&D)

Polymem

- The experience of the Pioneers in Manufacturing Membranes for water treatment: **more than 200 plants worldwide**
- The proven experience of Innovative New Products: **Neophil™ PVDF fiber & Gigamem® housing and modules (patented)**
- The capacity for **high quality mass production**
2003 – Ultramem Modules

- UF PSF 0.01 µm membranes working pressurized Out/In
- UF120 module and ULTRAMEM range (from 4 to 114 m²)

UF 120: 114 m² of filtration surface in a 315 mm diameter, 930 mm height module
Initial Market – Drinking Water

✓ Sales 2003 – 2014 in the municipal market
✓ 100 drinking water plants worldwide (50 in North America), 2-10 MGD

✓ Lac La Ronge (Saskatchewan) – Canada
  ✓ Capacity: 400 m³/h (2 MGD)
  ✓ Lake water

✓ Brie (Charente) – France
  ✓ Capacity: 100 m³/h (0.5 MGD)
  ✓ Underground water

✓ Masseube (Gers) – France
  ✓ Capacity: 250 m³/h (1.25 MGD)
  ✓ River water
2013 – Introducing GIGAMEM® Modules

✓ GIGAMEM® modules range: the largest pressurized UF module
✓ 540 m² filtration area (high packing density)
✓ PVDF, PSU NSF61 approved, hollow fiber

A design adapted for very large water treatment plants with requirements > 1MGD
✓ Small footprint
✓ Optimized maintenance
✓ Up to 20% cost saving
GIGAMEM® Module Benefits

- **Cost savings on headers and frame:**
  self supported vessel, direct connection to the headers
- **Easy handling and maintenance:**
  only the bundles are installed /uninstalled at the site
- **Cost saving on membrane replacement:**
  membrane bundle replacement only: easy and cost effective
GIGAMEM® System compacity

**✓ system footprint reduction**

- **GIGAMEM**
  - Foot Print: 6.72 m²

- **ULTRAMEM**
  - Foot Print: 8.37 m²

- **COMPETITION**
  - Foot Print: 9.90 m²
GIGAMEM® Municipal installations

- Gignac (Hérault) – France
  - Capacity: 250 m³/h (1.25 MGD)
  - Underground water with turbidity peaks up to 100 NTU

- Saint Cloud EAU DE PARIS – France
  - Capacity: 560 m³/h (3 MGD)
  - Source water with PAC

- Vaujany (Isère) – France
  - Capacity: 250 m³/h (1.25 MGD)
  - Spring and surface water
**GIGAMEM® Industrial installations**

- Consolidated Fabrics – Ile Maurice
  - Capacity: 800 m³/day
  - Process water production from river water

- 3A – Saint Mamet – France
  - Capacity: 800 m³/day
  - Process water production from river water

- Circuit Foil – Luxembourg
  - Capacity: 750 m³/day
  - Process water treatment for reuse
GIGAMEM® Installations – Oil & Gas

- **OFON (Total) offshore platform** – injection water, Angola
  Capacity: 40,000 m³/d (10.5 MGD), 48 GIGAMEM UF240 modules
  Sea water

- **SHENZI (BHP) offshore platform**, injection water, Gulf of Mexico
  Capacity: 30,000 m³/d (8 MGD) 40 GIGAMEM
  Sea water

- **AKAL (PEMEX) offshore platform**, injection water, Gulf of Mexico
  Capacity: 8,000 m³/d (2 MGD) 18 GIGAMEM UF240
  Sea water
Polymem today - High Quality Mass Production
Polymem today – Process Design and Unit Building: UF/MF/RO
Polymem today - R&D Department
R&D Activities

- 6 peoples full time (3 PhD)
- Mini and pilot spinning lines NIPS-TIPS
- Scaling-up to industrial spinning lines
- Membrane characterizations in our “Common Lab” with the European Membrane Institute of Montpellier (IEM):
  - Permeability, tensile tests
  - Scanning Electron Microscope, TEM
  - Gas-liquid and liquid-liquid porometry
  - Chemical analysis: ATR-FTRI / Raman / ATG
- Ageing tests (mechanical and chemical) at lab scale and full scale plant
- Important pilots float for demo: UF and MF pilot plants from 0.5 to 20m$^3$/h, MBR plants, RO-NF pilot plants
R&D Activities

Lab-spinning line (Polymer dopes of 0.5 kg for hundreds meters of fibers)

Pilot spinning line (Polymer dopes of 0.5 to 50 kg for kilometers of fibers)
R&D Activities

Pilots float

- UF 4*500L/h
- MBR 2*80L/h
- MC 100Nm³/h
- MBR 2*80L/h
- UF 25 m³/h
- UF 3m³/h
- UF 6*500 l/h
Some examples of R&D results

Morphology and mechanical strength improvement of hollow fibers
Some examples of R&D results

Neophil = New PVDF membrane with durable hydrophilicity
Benefit of Neophil vs other membranes

**Conventional PVDF membranes**
- Porogenous and hydrophilic additives
- Polymer PVDF alone

**Additives**
- Chemical cleaning
- Water

↘ hydrophilie with time
↗ irreversible fouling

**New PVDF membrane Neophil**
- Porogenous and hydrophilic additives
- PVDF Kynar® DH100
  + Durable hydrophilic bloc copolymers

**Polymer**
- Bloc miscible au PVDF
- Bloc hydrophile

**Chemical cleaning**
- Water

↓ Durable hydrophilicity
↓ Low fouling
The membrane Neophil

- External diameter
  0,74mm
- Available in other sizes
  0,45 – 2,50 mm
- Pure water permeability
  400 – 500 l/h.m².bar@20°C
- Mechanical strength
  ~6,0 MPa
- Average pores diameter
  15 – 25 nm
- Virus surrogate MS2-phages
  > 4 log new fibre
  > 4 log after chemical soaking
  (100 000ppm.h/200 000 ppm.h)
Demonstration Neophil n°1

• WWTP of Magny en Vexin (North-west suburbs of Paris)
• Collaboration between Polymem, Arkema, Veolia, IEM et ESPCI
• Demo size = 3000 people-equivalent 18m³/h
Demonstration Neophil n°1

• Parallel tests of Neophil and a conventional membrane (B)
• Trials of 4 months + ageing of membranes simulating 0 / 2.5 / 5 years of the membranes lifetime

→ Neophil effect demonstrated with a loss of only ~30% while the membrane B decrease of 80%.

![Diagram of membranes performance decline as a function of ageing time]
Demonstration Neophil n°2

- WWTP of Ginestous-Garonne at Toulouse
- Collaboration between Polymem, Arkema, Veolia, IEM and ESPCI
- Demo size = 3000 équivalent/habitant
Demonstration Neophil n°2

Accumulated volume of ultrafiltrated water

TSS (#/week)

Suivi de la DCO (1 analyse/semaine)

Suivi des coliformes totaux (1 analyse/semaine)
Neophil™ development summary

- Neophil™ is available in large batches
- First reference in USA (Amherst) starting in February 2017
- First reference in France (Cap Sicié) to start in September 2017
- Neophil™ was developed first for wastewater but is used as well for drinking water production and seawater filtration (before RO or for oil reservoir injection)
- Neophil™ has NSF-Ansi 61 agreement
- Neophil™ available in large range of size from 0.5 mm to 2.5 mm
- Neophil™ trails are carried out in MBR as well (Cugnaux France and Ssambra, Lequia)
R&D Activities

Scientific collaborations

- eDF
- LLT LE ROUX & LOTZ TECHNOLOGIES
- CAMERON
- Schlumberger
- LISBP
- THO
- Fraunhofer
- TU Delft
- Arkema Innovative Chemistry
- Lequía Eco-Innovative Water Solutions
- IFP Energies Nouvelles
- Universitat de Girona
- KAUST
- Veolia Eau
- ITM-CNR
- Leibniz Universität Hannover
- CNRS
- University of St Andrews
- University of KwaZulu-Natal
- Tecnalia Inspiring Business
- NTNU
- University of Technology, Sydney
- Nanyang Technological University
- Saur

polyMEM
MEMBRANE MANUFACTURER
Thank you for your attention

Questions?