

POLYCERA[®]

Membrane Brochure

Making Membrane Systems More Effective and Efficient



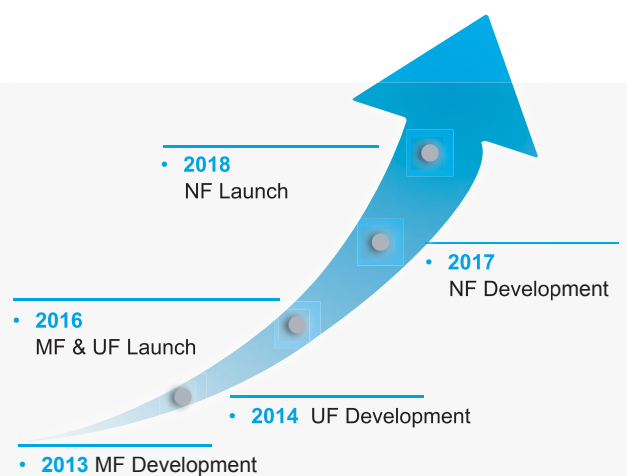
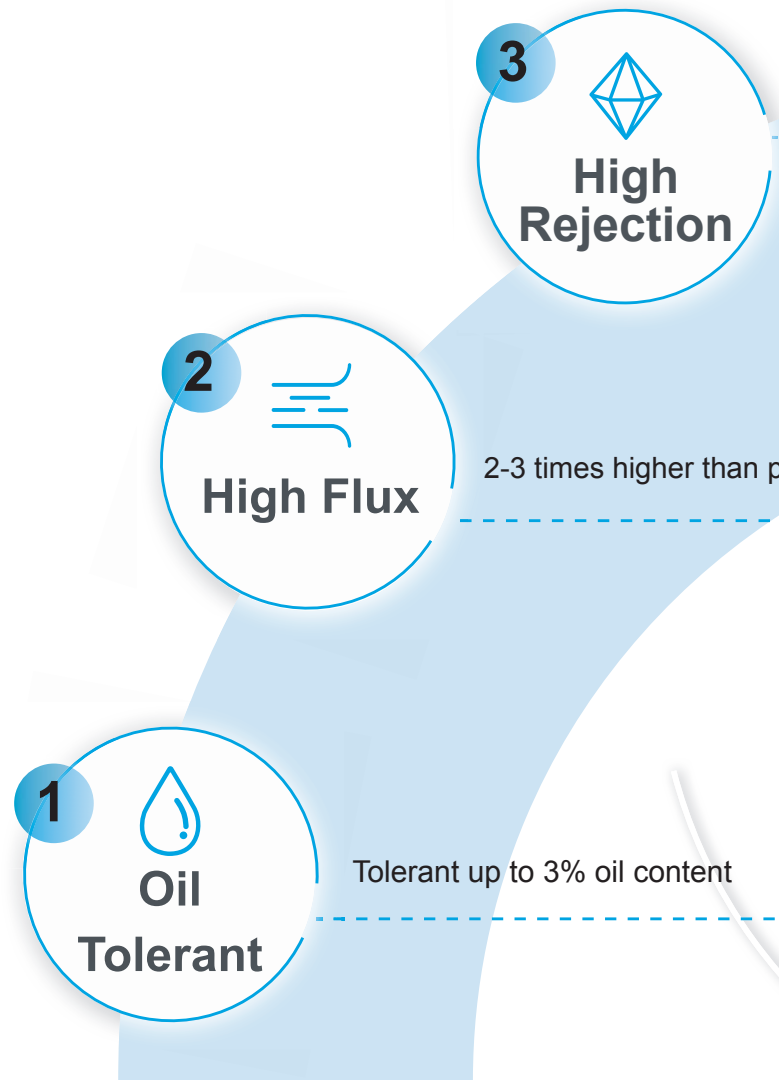
www.polyceramembranes.com

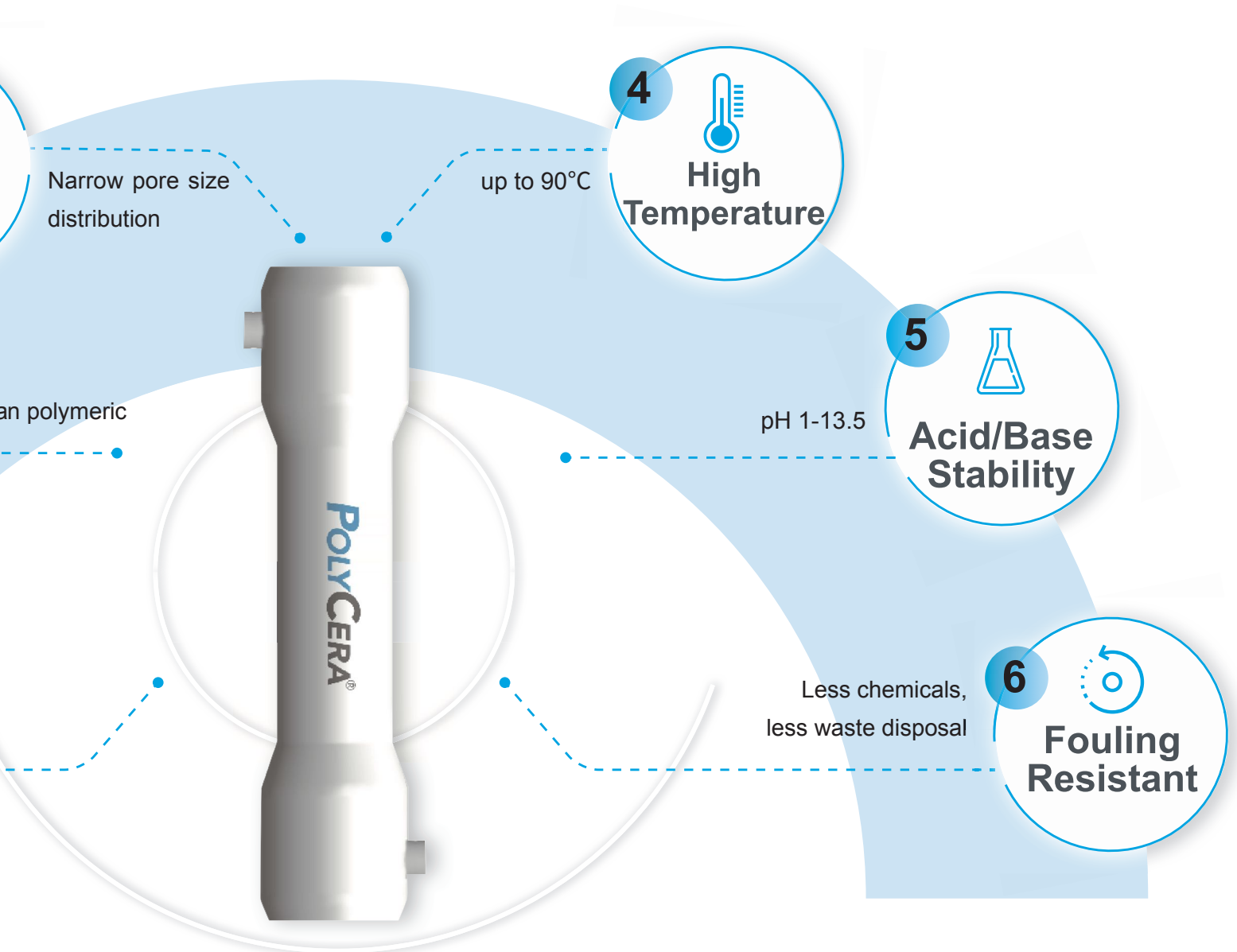
About PolyCera®

In response to an oil spill clean up in the Gulf of Mexico in 2010, a research team from UCLA developed PolyCera® membranes based on organic metal materials that won the Nobel Prize in Chemistry in 2000.

PolyCera® membranes break the boundary between conventional polymeric and ceramic membranes. The novel membranes offer excellent oil, temperature and chemical tolerances, as well as high sustainable flux and backwashable functionality. PolyCera® membranes combine ceramic membrane performance with polymeric membrane economics.

PolyCera® membrane products have achieved over 80 installations on 3 continents, across a range of industrial wastewater and process separations, e.g. oil and gas produced water, water reuse in power industry, food and beverage process separations.





- In 2016, PolyCera® ultrafiltration products were launched. The Hydro product line delivers high fouling tolerance and chemical resistance, which serves to treat municipal and industrial water. The Titan product line delivers high oil tolerance, high temperature operation and chemical resistance, which assists in oily wastewater treatment applications, such as use in oil and gas production and refineries.

- In 2018, the PolyCera® nanofiltration product was launched. This membrane, which rejects organics while allowing passage of salts, was developed and launched for process separation and COD reduction.

- Other types of PolyCera® membrane products are under development and will be launched in the near future.

PolyCera® Fouling Resistant UF

▼ **PolyCera® Hydro Series:** PolyCera® Hydro fouling resistant UF membranes are suitable for industrial wastewater treatment for suspended solids removal, with up to 10,000 mg/L suspended solids. PolyCera® Hydro UF membranes offer features, that include a high sustainable flux, fouling resistance and ease to cleaning. PolyCera® Hydro UF membranes provide a low-cost, stable process opportunity that yields high-quality treatment product for OEMs, integrators and owners/operators.

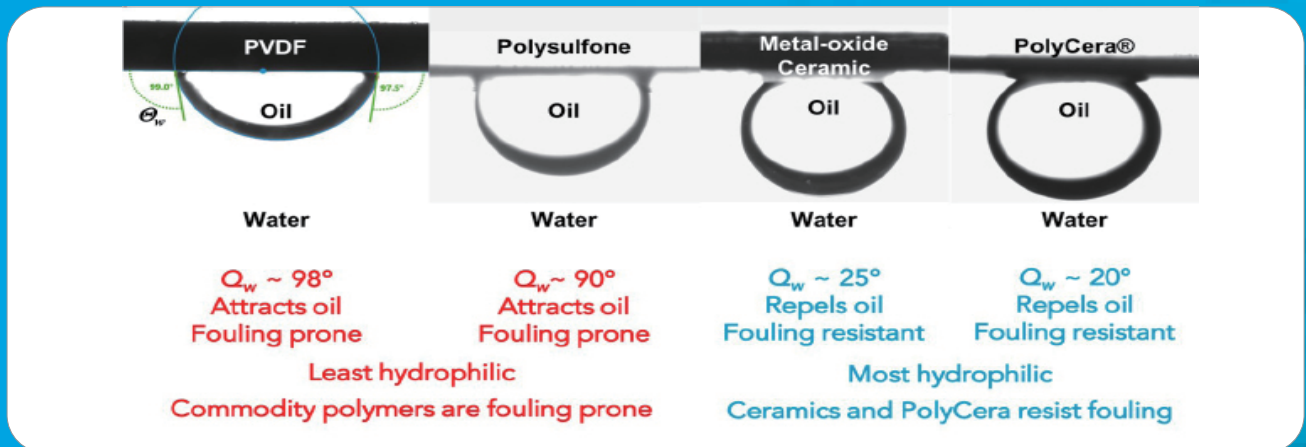
▼ PolyCera® Fouling-Resistant UF Membrane Benefits

Hydrophilic

Hydrophilic means more water production and lower OPEX, due to less frequent cleaning.

PolyCera® membranes are constructed from a material that is intrinsically hydrophilic yielding:

- Maximum sustained flux
- Improved organic fouling resistance
- Low energy requirements
- Easy to clean surface and pores



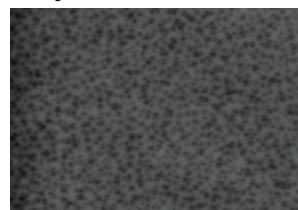
High Water Permeability

PolyCera® membranes produce 2 to 3 times more water than conventional polymer membranes at the same applied pressure due to high surface porosity.

PVDF 100kDa-Surface

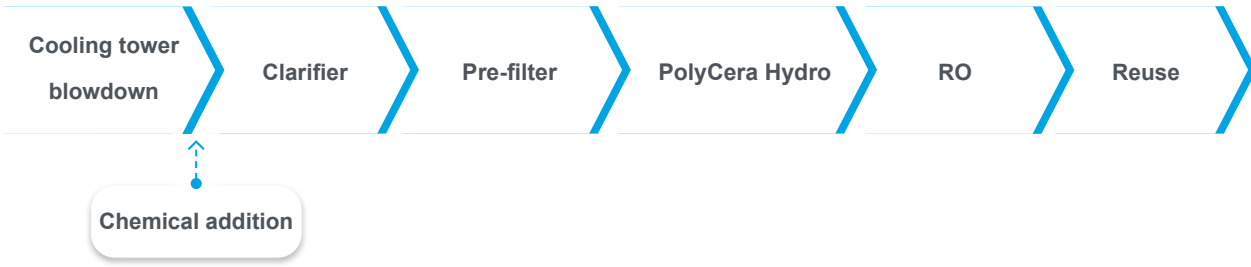


PolyCera 100kDa-Surface



Hydro Fouling Resistant UF Membrane Case Study

Process:



▼ **Case Study:**

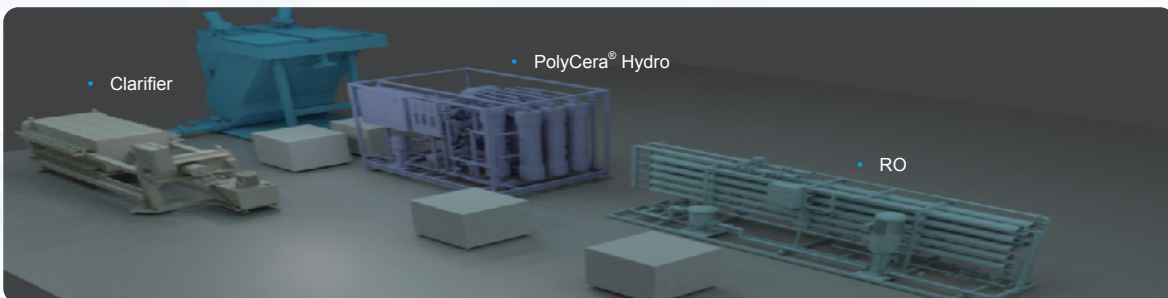
Cooling tower blowdown reuse

PolyCera Hydro UF was used for RO pretreatment, removing turbidity and lowering SDI.



Feed quality:	Filtrate (Recovery > 90%) quality:
Turbidity: 40 – 60 NTU	Turbidity: < 0.1 NTU
Silica: 100 – 160 mg/L	Silica: < 18 mg/L
SDI: > 5	SDI: < 3

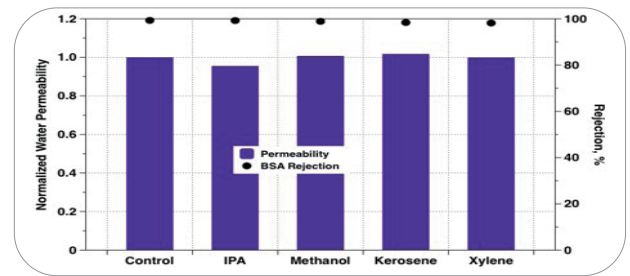
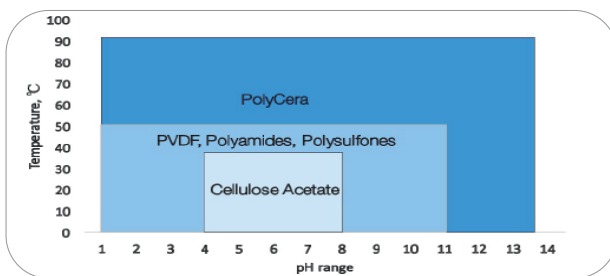
Process Scheme:



PolyCera® Oil Tolerance UF

▼ PolyCera® Titan Series:

PolyCera® Titan series UF membranes are designed for oily water treatment, due to their oil tolerance of up to 3% oils. PolyCera® Titan membranes enable a shorter treatment process, a smaller footprint and better treatment efficiency. PolyCera® Titan membranes have been used in a variety of oily water treatment regimes, e.g. produced water and industrial process condensate.

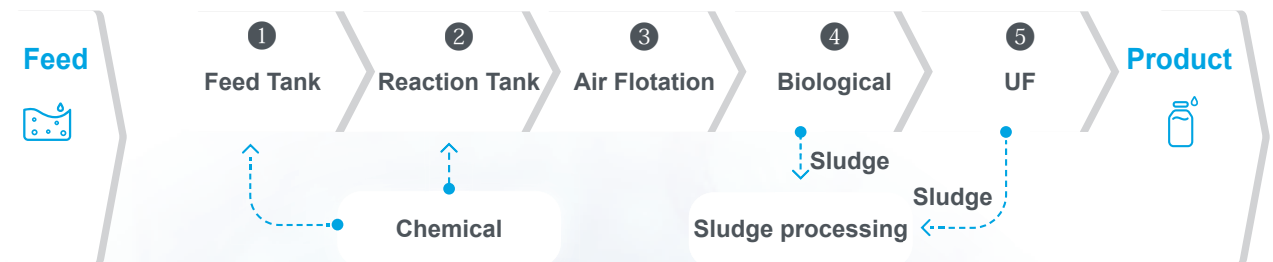


- PolyCera® Titan operation temperature: up to 90° C
- PolyCera® Titan operation pH: 1-13.5

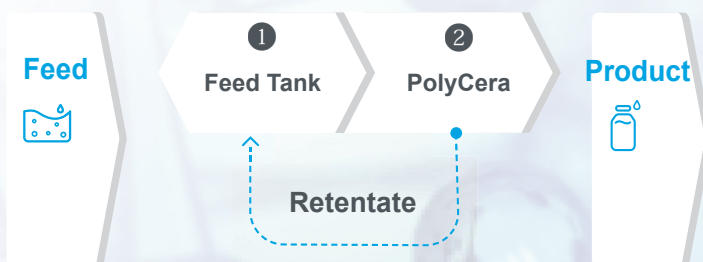
- PolyCera® Titan tolerance to pure organic solvents (alcohols, kerosene, BTEX, etc.)

PolyCera® Titan allows for a "Short Process" Oily Water Treatment

Conventional Dissolved Air Flotation Process



PolyCera® Titan Process



The PolyCera® Titan oil tolerance UF process effectively shortens oily water treatment, requiring less chemicals and generating less sludge.

▼ Case 1:

Produced water

PolyCera® Titan membrane is used for RO pretreatment of produced water for agricultural use. Protected by Titan membrane, the RO membrane requires cleaning only once a year.



Feed Quality	
Oil	up to 500 mg/l
TSS	up to 500 mg/l
Turbidity	up to 300 NTU
pH	5-10
TDS	Brackish to brine

Process:



▼ Case 2:

Offshore flowback treatment

Titan off-shore offers stable operation accommodating high temperature, high oil and solids, organic solvents (e.g. BTEX), while being lightweight with a small footprint.



- Feed: oil ~ 2000 ppm (BTEX~500 ppm)
- 80° C
- pH < 5

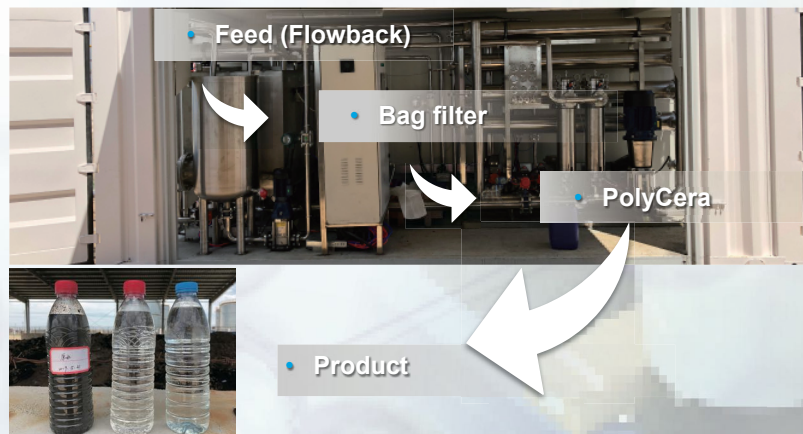


▼ Cass 3:

Fracking flowback water reuse

Fracking flowback water directly feeds into PolyCera® Titan after bag filter pretreatment. No CIP needed for 30-day operation.

Process:



PolyCera® Organic Removal NF

▼ PolyCera® Titan NF:

PolyCera® Titan NF membranes, engineered with Nobel Prize winning chemistry, have sub-nanometer pore size with MWCO of 500 Da to 1,000 Da. Titan NF is designed for chemical-free color removal (typical rejection >99%) while allowing ~0% salt rejection, due to its low charged surface.

- MWCO :500 Dalton
- Pore size < 1 nm
- Application: chemical-free color removal, dye molecule concentrate and reuse, COD/BOD reduction, etc.
- ~0% inorganic salt rejection which enables a high recovery and low energy process

Performance and Operating Parameters		Cleaning and Chemical Exposure Guidelines	
Membrane Material	Titan	Dye (Rose Bengal) rejection	> 99%
Nominal Pore Size/MWCO	500 Da	Monovalent ion rejection	< 1%
Operating pH Ranges	1 – 10.0 @ T≤70° C 1 – 13.5 @ T≤50° C	Divalent ion (Hardness) rejection	< 5%
Operating Temperature Ranges	5 – 70° C	Free Chlorine Instantaneous/Total	50 ppm/100,000 ppm hour @ pH 11
Max Inlet Pressure	20.7 bar	Max Cleaning Temperature	85° C @ 1 < pH≤10 50° C @ 10 < pH≤13.5
Max Pressure Drop Per Element	1.7	Max Cleaning pH	1 < pH < 13.5 @ 50° C 1 < pH < 10.0 @ 85° C
*Max Total Suspended Solids	≤100 mg/L	Hydrochloric Acid	≤0.4% (pH > 1.0)
Continuous Free Chlorine	≤5.0 mg/L	Citric Acid	≤20% (pH > 1.0)
Typical Operating Flux	5 - 40LMH	Sodium Hydroxide	≤4% (pH < 13.5)
Recommended Pre-Filter	100µm	Peroxide/Ozone	Not compatible
Notes	*Max Total Suspended Solids means the max concentration at concentration side.		



0%
Salt Rejection

High
Temperature

Acid/base
Tolerant

PolyCera® Applications

PolyCera® Membrane Major Applications



- Oil and gas produced water treatment for reuse or discharge
- DAF effluent polishing (to remove O&G and TSS)
- Industrial wastewater reuse
- Industrial process water reuse
- Traditional filter cartridge replacement
- High strength dairy wastewater treatment
- Slaughterhouse wastewater treatment
- Landfill leachate treatment
- Power plant water and wastewater treatment and reuse
- Industrial laundry wastewater treatment

- Greywater and blackwater treatment and reuse
- RO membrane pretreatment
- Cooling tower/boiler blowdown water treatment
- Electroplating wastewater treatment
- E-coat paint recovery
- Whey protein concentration
- POU/POE
- Surface water treatment
- Textile dye wastewater treatment
- Oily wastewater treatment



PolyCera® Awards and Certificates

PolyCera® Awards



2013

PolyCera awarded the Distinction for Technology Idol at Global Water Awards.



2014

Oil & Gas Awards West Coast Water Management Company of the Year.



2015


Water Planet was selected for Global Cleantech's 2015 list of 100 Ones to Watch.



2018

Global Water Awards Breakthrough Water Technology Company of the Year.

PolyCera® NSF/ANSI 61 Certificate of Compliance by UL

CERTIFICATE OF COMPLIANCE	
Certificate Number	20160426-MH61477
Report Reference	MH61477-20160426
Issue Date	2016-APRIL-26
Issued to:	POLYCERA, INC. 721 Glasgow Ave, Suite D Inglewood CA 90301
This is to certify that representative samples of	DRINKING WATER SYSTEM COMPONENTS Membrane, PolyCera BE100FS
	Have been investigated by UL in accordance with the Standard(s) indicated on this Certificate.
Standard(s) for Safety:	NSF/ANSI 61, Drinking Water System Components - Health Effects
Additional Information:	See the UL Online Certifications Directory at www.ul.com/database for additional information
Only those products bearing the UL Certification Mark should be considered as being covered by UL's Certification and Follow-Up Service.	
Look for the UL Certification Mark on the product.	
 Bruce Mahweh, Director North American Certification Program UL, LLC <small>Any information and documentation involving UL Mark services are provided on behalf of UL, LLC (UL) or any authorized licensee of UL. For questions, please contact a local UL Customer Service Representative at www.ul.com/about/localize.</small>	
	
Page 1 of 1	

PolyCera® FDA Compliance



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February 5, 2019

Via Electronic and U.S. Mail

Dr. Jinwen Wang
Director of Product Development
PolyCera, Inc.
721 S Glasgow Ave., Suite D
Los Angeles, California 90301

RE: FDA Status of PolyCera Hydro Flat Sheet Membrane; Our File No. PO17080-1

Dear Dr. Wang:

The purpose of this letter is to respond to your request for our opinion regarding the U.S. Food and Drug Administration (FDA) status of PolyCera, Inc.'s Hydro flat sheet membrane when used in food processing applications. The finished membrane will be used in applications such as dairy processing, fat and caseins removal, and whey protein concentration at temperatures of 55°C and below.

Based on the information you have provided to us, we have no hesitation in providing our opinion that the Hydro flat sheet membrane may be used as intended in full compliance with the Federal Food, Drug, and Cosmetic Act and all applicable food additive regulations.¹

* * *

¹ Prior to the first use, the Hydro flat sheet membrane should be subjected to a clean-in-place (CIP) procedure consistent with your manufacturing or customer requirements.

Washington, D.C. Brussels San Francisco Shanghai Paris
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KELLER AND HECKMAN LLP

Dr. Jinwen Wang
February 5, 2019
Page 2

We trust that you will find this letter fully responsive to your request for our opinion. Should you have any questions, or if we may be of assistance in any other way, please do not hesitate to contact us.

Cordially yours,

Devon Wm. Hill

This document was delivered electronically.



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