NOVEMBER 2022

WELCOME TO BILBAO!

Genefloc ABF

Algaecide Biocide Flocculant

Piedmont GENESYS PWT™

DISTRIBUTOR SUMMIT

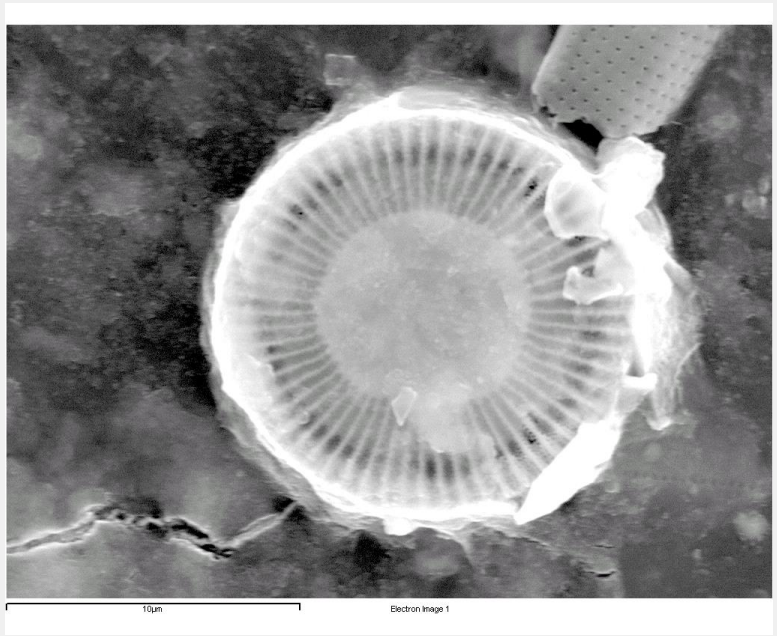
NOVEMBER 13-17, 2022

Fernando del Vigo

Genefloc ABF

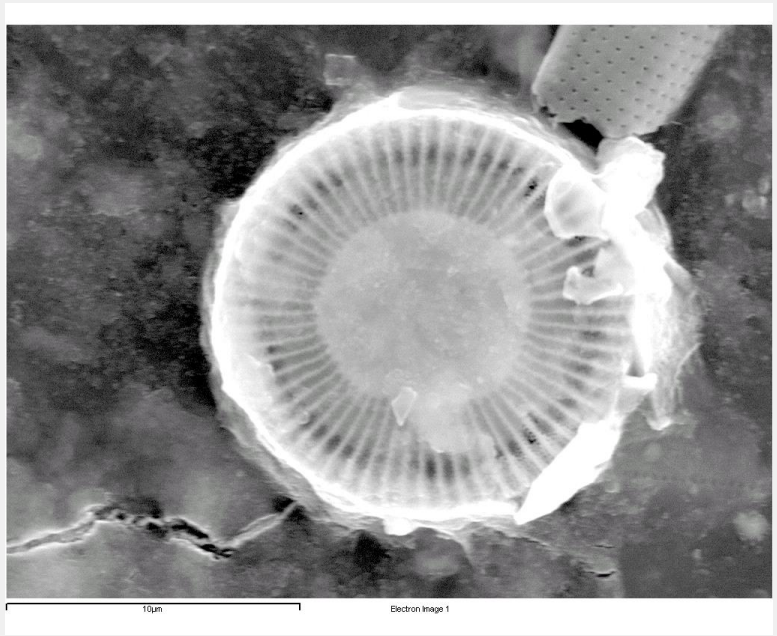

DISTRIBUTOR SUMMIT
BILBAO

Genefloc ABF



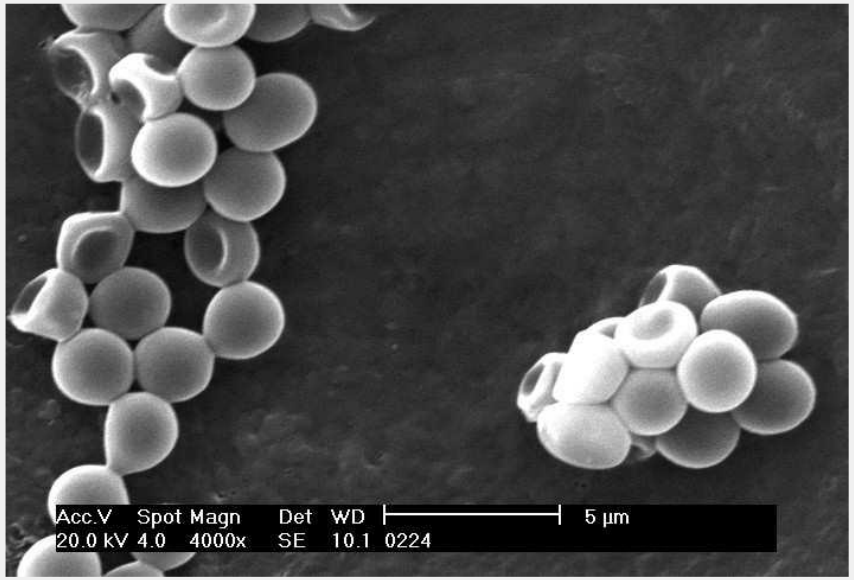
Algaecide

Genefloc ABF

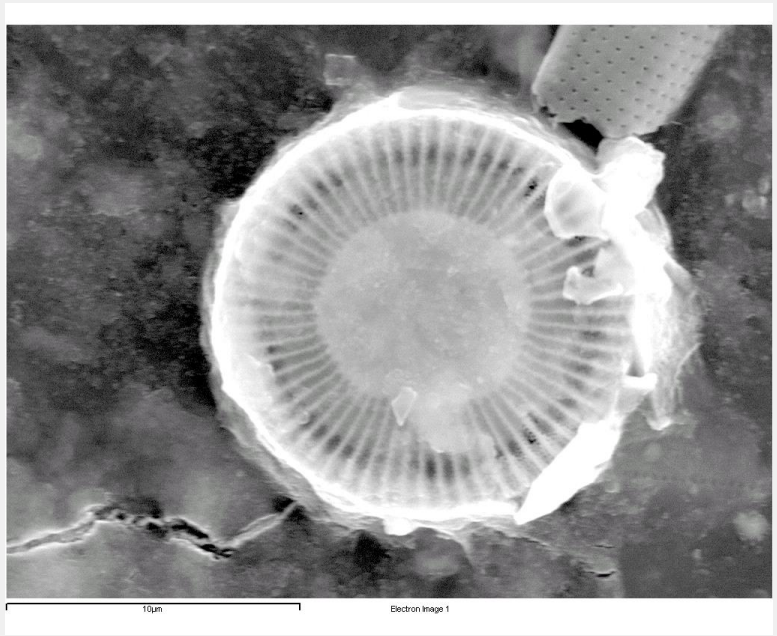


Algaecide

Biocide

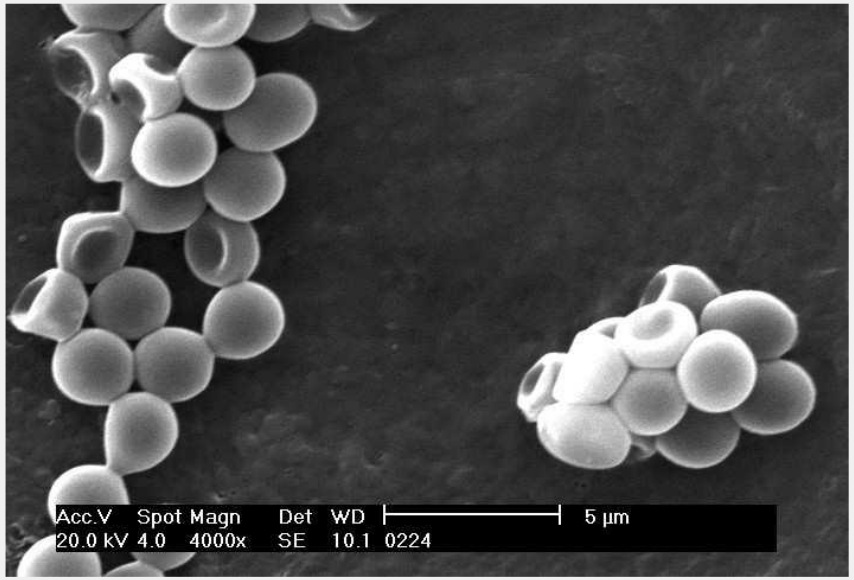


Genefloc ABF

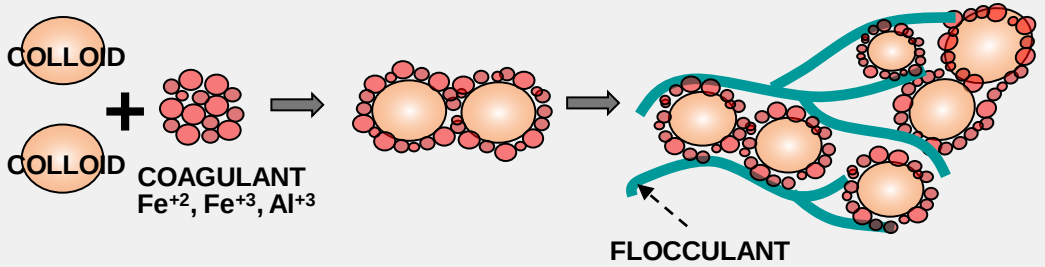


Algaecide

Biocide



Flocculant



Genefloc ABF

Genefloc ABF

- Kills algae (feed and concentrate).
- Avoid eutrophication.
- Avoid problems found at reservoirs, open deposits...etc.
- Surface Active Agent-Decreases the water surface tension and acts on the normal functions of cell membranes preventing growth.
- MIC test. Minimum inhibitory concentration is the lowest concentration that will inhibit the growth of a microorganism.

Genefloc ABF

Genefloc ABF

- Metabolic poison with enzymatic activity.
- Broad spectrum biocide (aerobic, fungi and Anaerobic/SRBs).
- MIC test. Minimum inhibitory concentration is the lowest concentration that will inhibit the growth of a microorganism.

Genefloc ABF

Genefloc ABF

- Cationic flocculant .
- Effective protection from colloidal fouling.
- Reduces the Silt Index Density (SDI).
- Neutralizes the charge of the colloid which increases the floc size, making it easier to remove in the pre-treatment.
- Jar-test/SDI/Turbidity.

Genefloc ABF – cationic flocculant

- ✓Approvals from: DOW + Hydranautics + LG + others
- ✓Genefloc product range → designed for RO plants → SAFE!!!
- ✓The safe use of cationic flocculants with reverse osmosis membranes. S.P. Chesters, E.G. Darton, Silvia Gallego, F.D. Vigo

GENESYS INTERNATIONAL

AG4 – RO Pre-treatment – safe use of cationic flocculant

Extract from the paper "The safe use of a cationic flocculant with RO membranes", to be presented at the EDS Conference on Membranes in drinking water production and waste water treatment, Toulouse, France, October 2008.

Authors: Mr Stephen P Chesters, Mr Edward G Darton, Ms Silvia Gallego, Mr Fernando del Vigo

Genefloc GPF is a membrane compatible low dose, poly amine cationic flocculant. The effectiveness of cationic flocculants is well known but due to the perceived danger of membrane fouling they are not widely used. This paper dispels some of the myths.

Membrane Compatibility

It is a widely held view that cationic flocculants can foul reverse osmosis membranes. This view is supported by those of the major membrane suppliers, as seen from their technical bulletins, product data sheets and web-sites.

Dow – Form No. 609-02027-1004

"The membranes in RO plants have been heavily fouled by a gel formed by the reaction between cationic poly-electrolytes and anticscalants."

"To minimise the risk of direct or indirect interference with RO membranes, anionic or non-ionic flocculants are preferred rather than cationic flocculants."

Form No. 609-02024-1004

"In addition cationic polymers easy co precipitate with negatively charged anticscalant and foul the membrane."

Hydranautics – TSB107.15 Page 2

"Common examples of foulants are: man made organic material (e.g.) anticscalant/dispersants, cationic poly-electrolytes."

Koch – TFC-HR® Product data sheet

"TFC-HR membrane may be irreversibly fouled if exposed to cationic positively charged polymers or surfactants. Exposure to these chemicals during operation and cleaning is not recommended."

Inorganic Coagulants/Flocculants

Inorganic coagulants are usually based on multivalent cations such as iron (ferric or ferrous) and aluminium salts. These positively charged molecules interact with negatively charged particles to assist in charge aggregation. At the correct pH, temperature and salinity these chemicals form insoluble hydroxides which, link together to form long chains or meshes, physically trapping small particles into the larger floc.

Organic Flocculants

Cationic polymers become positively charged when dissolved in water. They can be copolymers of acrylamide with a cationic monomer, cationically modified acrylamide or a polyamine. The cationic charge in these polymers is derived from nitrogen in the form of a secondary, tertiary or quaternary amine group. Those containing secondary or tertiary amines are sensitive to pH, and the charge on these polymers drops off at a pH >8.0. Polyquaternary amines are not pH sensitive and function well across a wide pH range. In these polymers, the charge can be located on a pendant group as shown in Figure 2.

Fig 2: Polyacrylamide molecular structure showing cationic sub branches.

The pendant groups act like hooks trapping particles but also importantly potentially attaching to the anionically charged membrane surface rather like velcro. Once attached cationic polyacrylamides would be very difficult to remove.

Poly Quaternary Amines – are long and wrap flocs together. The cationic charge is positioned down a central backbone Figure 4. This means the molecule is much less likely to become permanently attached to the membrane surface.

Fig 3: Polyamine with charge on backbone

Membrane Fouling

There are four primary mechanisms of coagulant and flocculant fouling:

- Any soluble iron or aluminium in the feed water present naturally or due to excess coagulant or flocculant dosing will oxidize to form iron and aluminium hydroxides and oxides on the membrane surface. This reaction can often be inhibited or retarded by using the chelating properties of phosphonate based anticscalant.
- An acrylic acid based anticscalant may react with iron and aluminium to form meta-acrylate salts which can irreparably foul the membrane as shown in Figure 5.
- Aluminium or iron based coagulants that do not form flocs are not soluble and will form preflocs which attach to any surface to neutralise its charge. This includes multi-media filters, cartridge filters and ultimately the membrane surfaces as well (Figure 4).
- Oil or latex present in some flocculants can cause direct adherence to the membrane surface.

Fig 4: Aluminium flocculant fouling on a membrane

Fig 5: Iron acrylate

Genefloc GPF Compatibility

GPF has operated successfully in over 100 plants for five years despite being a cationic flocculant. This is due to:

- Molecular structure – the charged backbone means any excess flocculant reaching the membrane will straddle the pores and will be removed by shear forces
- Solubility – GPF will readily absorb on both filter media as well as flocs
- Anticscalant Pick-up – any residual flocculant will react with anionic phosphonate anticscalant

Case Study – Glen Rocky Gibraltar

This 1,400 m³/day sea water RO plant has a feed blend of open seawater and a seawater well supplying a feed tank with a 2-3 hour settling time to remove sand. Genefloc GPF flocculant is dosed at 2 mg/l with 0.3 mg/l of chlorine prior to three pressurised dual media filters with 90cm of sand and 30cm of anthracite. Sodium bisulphite for chlorine removal and Genesys LF anticscalant are dosed to a common manifold before the cartridge filters for each RO train. The results from a study conducted by Leparc et al concluded that: "Overall the pre-treatment process appears to be effective to provide high water quality to the reverse osmosis units". The Silt Density Index readings showed a dramatic reduction after the dual media filters and cartridge filters with the use of Genefloc GPF.

21-24 June 2005	Sea intake	Well Sea-water	Raw water	DWF Effluent	Cartridge Filter Effluent
SDI15min	5.8	2.6	4.4	2.3	2.0

No major fouling events have occurred since the beginning of operation (September 2003). Satisfactory results have continued and a membrane autopsy conducted in 2008 showed there was no cationic flocculant present on the membrane. New particle counting techniques showed the effectiveness of the Genefloc GPF in increasing the particle size distribution.

Fig 6: Particle reduction using GPF

Conclusions

- Although it is generally believed that the use of cationic flocculants pose a risk to membrane operation, long term practice indicates that certain cationic flocculants can be used safely.
- There are several theories as to why some flocculants damage membranes and others do not. At the time of writing the authors feel a combination of factors are contributory.
- Poly quaternary amine flocculants are safe to use.
- Poly quaternary amine flocculants should be dosed early in the pre-treatment system prior to the filtration equipment.
- The use of phosphonic acid based anionic anticscalant has always been used in conjunction with Genefloc GPF.

GENESYS INTERNATIONAL

www.genesysro.com

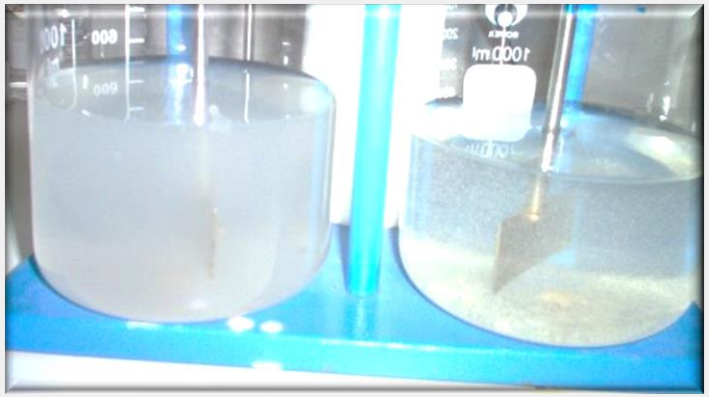
Genefloc ABF – Dosage calculation

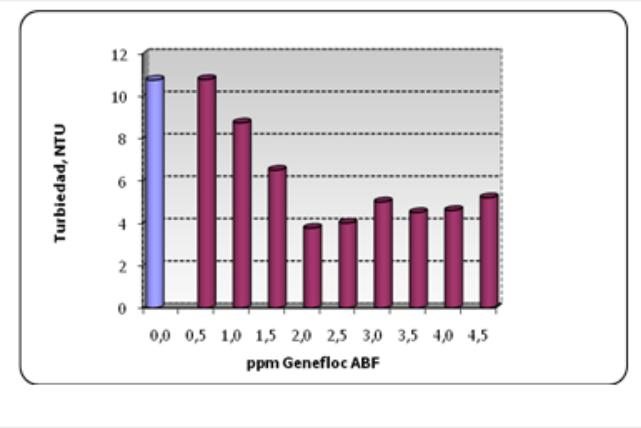
- As Algaecide??? → MIC
- As Biocide??? → MIC / dP
- As Flocculant??? → Easy!!!

- MIC test. Minimum inhibitory concentration is the lowest concentration that will inhibit the growth of a microorganism.

Genefloc ABF – Dosage calculation

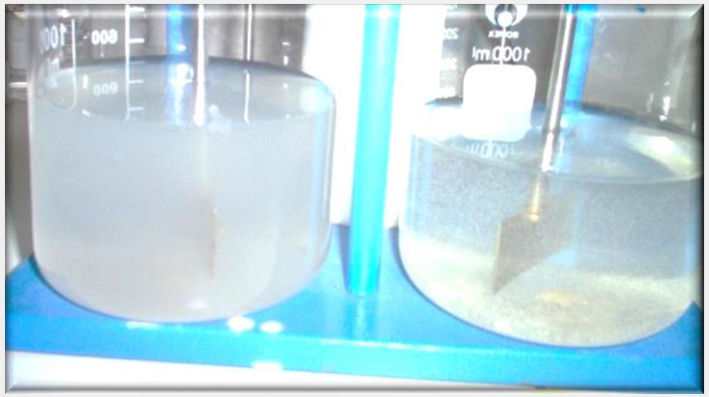
- Laboratory – Jar test

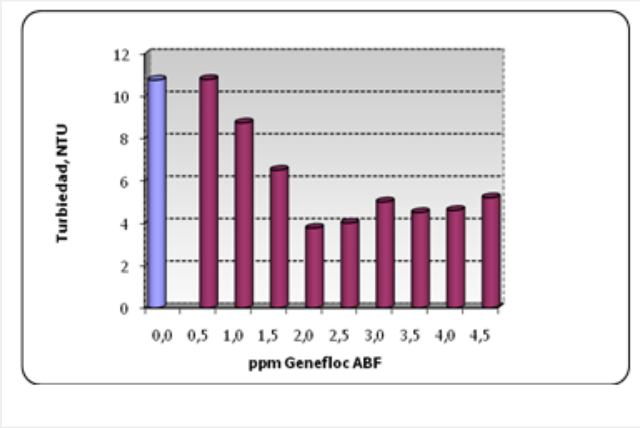




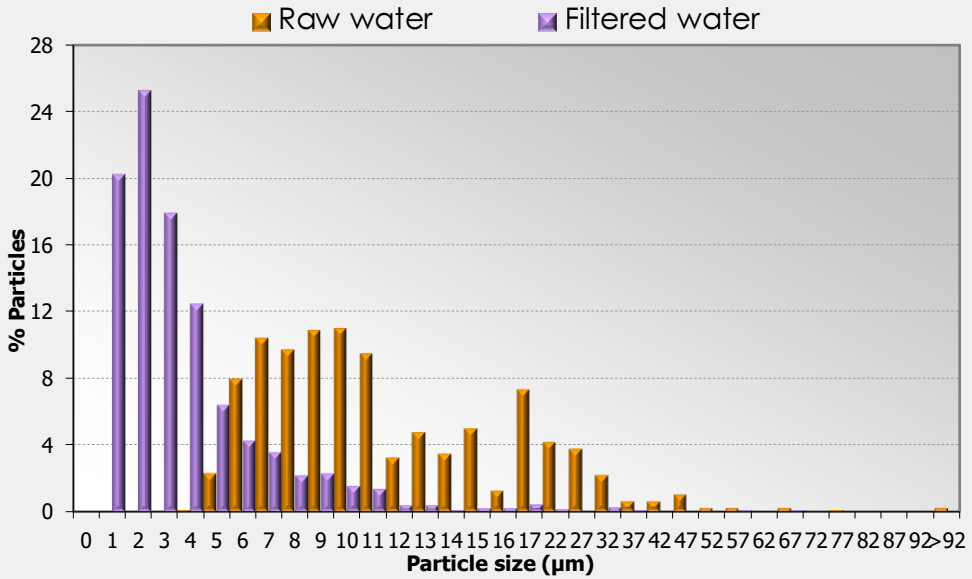
Genefloc ABF – Dosage calculation

- Laboratory – Jar test



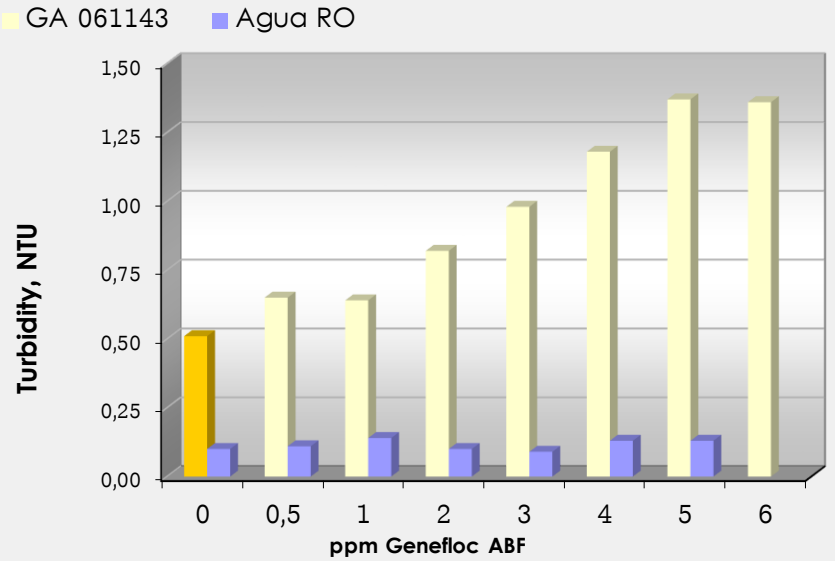


- Laboratory – Laser particle counter



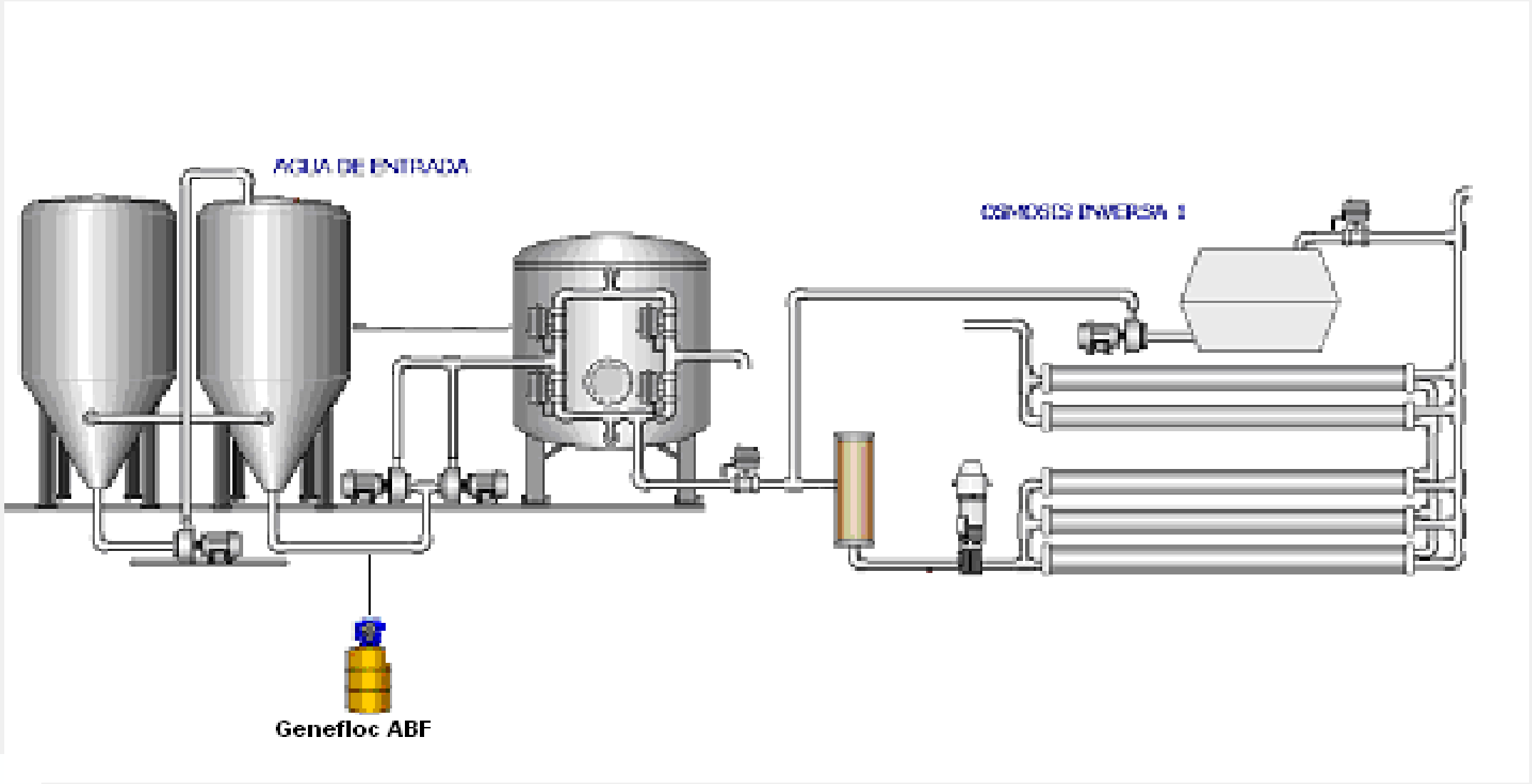
Genefloc ABF – Dosage calculation

- On site – checking SDI/turbidity after MMF



$$SDI = \frac{100 \times (1 - t_0/t_t)}{T}$$

Genefloc ABF – Dosage point



EventMobi

Genefloc ABF can be dosed:

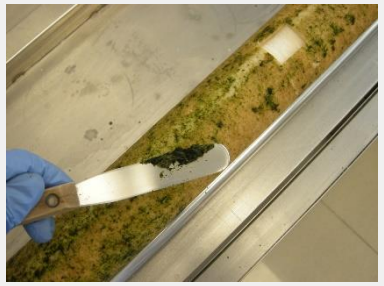
1. Before sand filter?
2. Before zeolites filter?
3. Before AFM filter?
4. Before activated carbon filter?
5. Before UF?
6. Before MBR?
7. Before cartridges filter?

Case study – Genefloc ABF – waste water

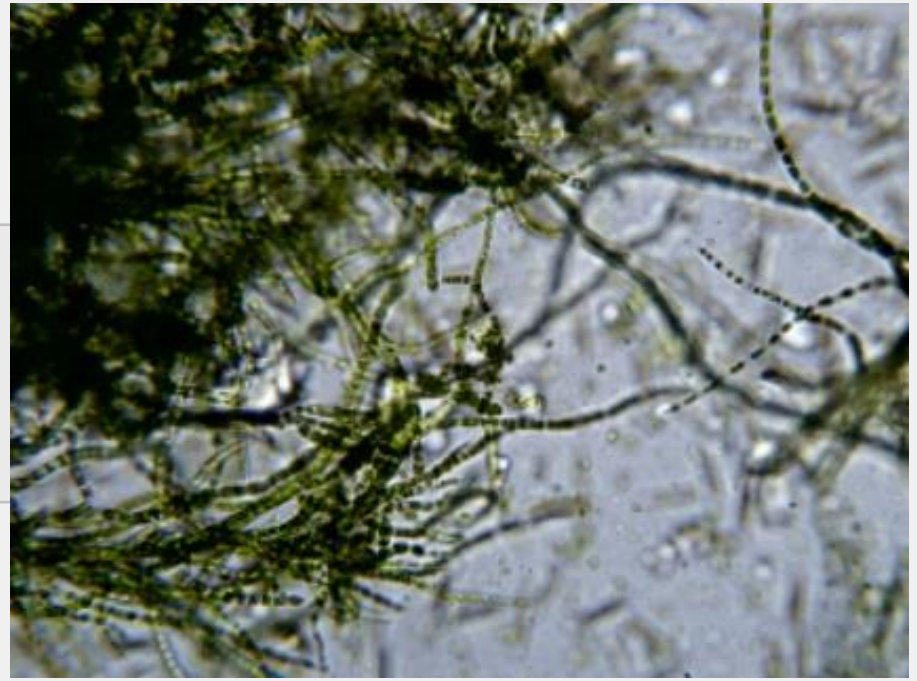
Waste water– 13000 m3/day BWRO

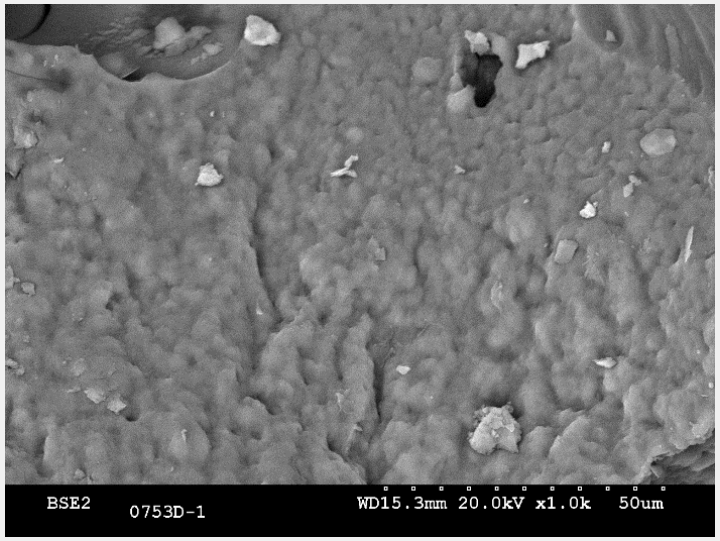
Case study – Genefloc ABF – waste water

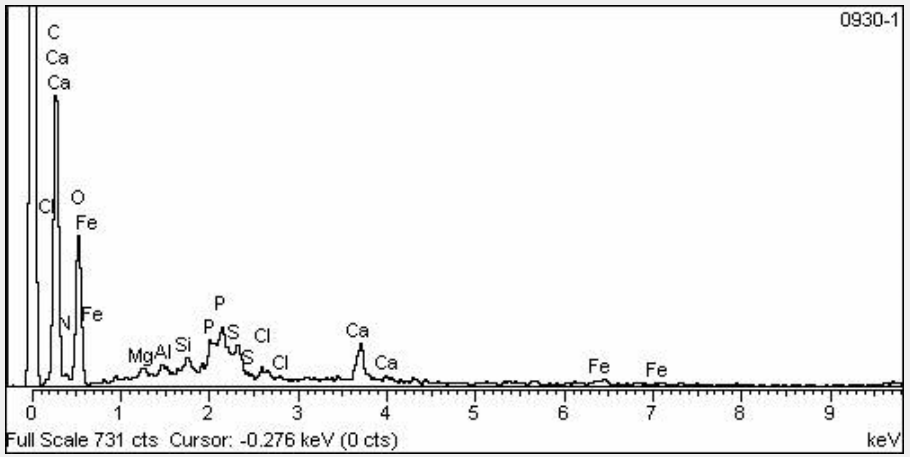
Fast fouling of the cartigde filters



- Quickly organic fouling
- 237 hours useful life (360 units)



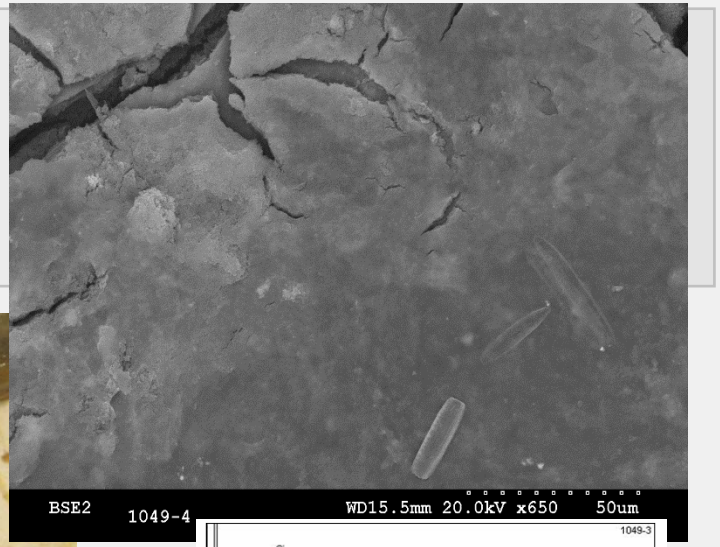


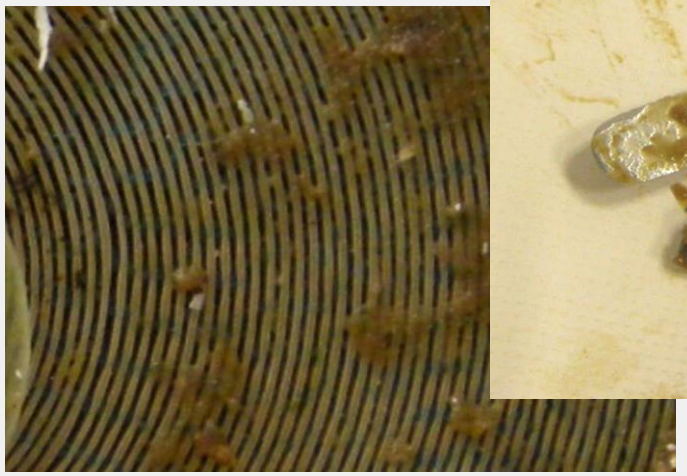


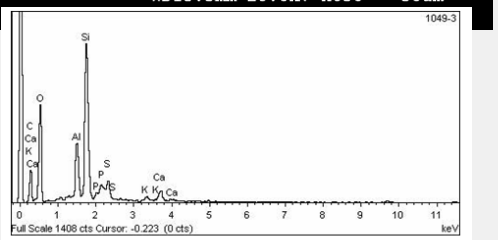
Case study – Genefloc ABF – waste water

RO membranes fouling

- Quickly organic fouling
- Cleaning in two months







	Element	Weight%	Atomic%
Carbono	C K	35.78	45.47
Oxigeno	O K	48.46	46.24
Aluminio	Al K	3.28	1.86
Silicio	Si K	8.99	4.88
Fosforo	P K	0.60	0.29
Azufre	S K	1.58	0.75
Potasio	K K	0.32	0.13
Calcio	Ca K	0.99	0.38

Case study – Genefloc ABF – waste water

MIC DATA

Referencia muestra:			GA 140761-63
Cliente:	EMARASA	Fecha toma:	--
Instalación:	ARROYO CULEBRO	Fecha recepción:	24/07/14
Tipo muestra:		Fecha análisis:	28/07/14
Ref. cliente:	Agua Decantada (GA140761), Agua Ultrafiltrada (GA140762) y Alimentación RO (GA140763)	Fecha informe:	06/08/14

Resultados análisis

Recuento de Microorganismos aerobios a 22ºC (ufc/mL) I.S.O. 6222:1999	GA140761 "Agua Decantada"	GA140762 "Agua Ultrafiltrada"	GA140763 Alimentación RO"
Agua bruta	$5{,}3 \times 10^4$	5×10^4	$1{,}2 \times 10^4$
Bruta + 20ppm ABF	-	$<10^2$	$<10^2$
Bruta + 40ppm ABF	-	$<10^2$	$<10^2$
Bruta + 60ppm ABF	6×10^2	-	-
Bruta + 80ppm ABF	$<10^2$	-	-

Comentarios:

Conclusiones:

Como puede observarse, en las tres muestras recibidas se confirma la presencia de microorganismos, siendo el agua decantada la que mayor concentración de ellos presentaba.
Por otro lado, puede observarse como en el agua ultrafiltrada y en el agua de alimentación a RO, una dosis de 20 ppm de ABF sería suficiente para inhibir el crecimiento. Sin embargo, en el agua decantada se observa como es necesario recurrir a una dosis mayor de biocida, de al menos 80 ppm de ABF, para inhibir totalmente la proliferación de microorganismos.

DISTRIBUTOR SUMMIT BILBAO

Previous treatment

- NO biocide
- hypochlorite.
- bisulfite.
- Cartridges replacement 10 days
- higher operating cost.

With Genefloc ABF

- 20 ppm Genefloc ABF
- no hypochlorite.
- not bisulfite.
- Cartridges replacement: 80 days
- lower operating cost

Case study – Genefloc ABF – Murcia

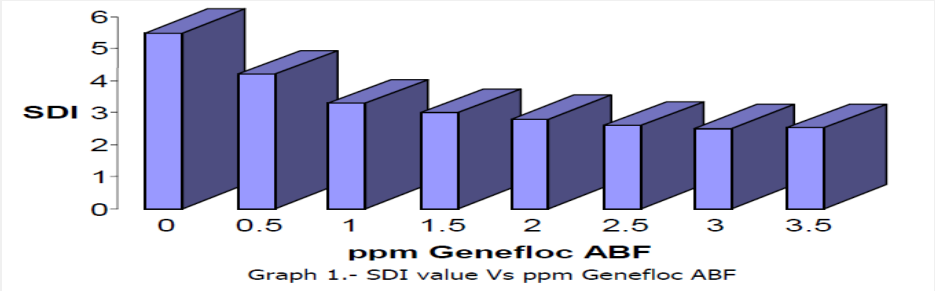
Agricultural Plant – 2400 m3/day BWRO

Previous treatment

- 30 ppm NaClO + 8 ppm SBS + 46 ppm HCl + Shock biocide
- SDI 5,5
- Membrane cleaning: 40 days
- Membrane replacement: 1 year
- Cartridges replacement: 4 days

With Genefloc ABF

- 3 ppm Genefloc ABF (no NaClO, no SBS, no HCl)
- SDI <3,0
- Membrane cleaning: 120 days
- Membrane replacement: ???
- Cartridges replacement: 35 days



Graph 1.- SDI value Vs ppm Genefloc ABF

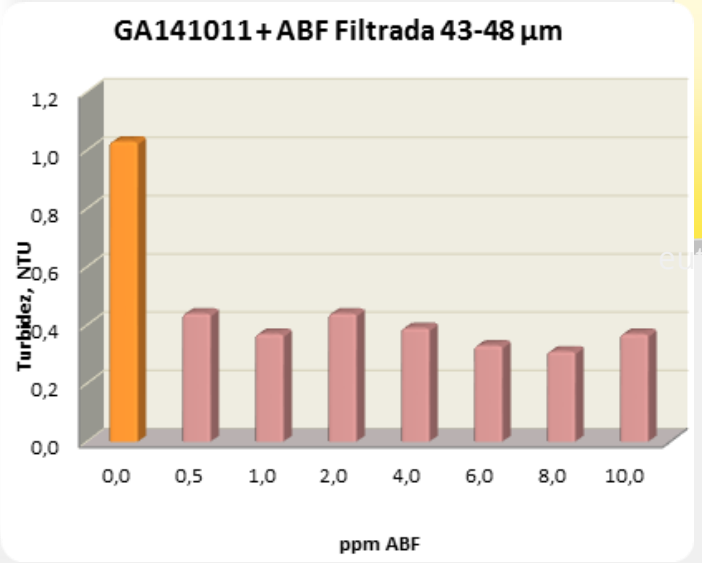
Case study – Genefloc ABF – solar plant

Solar Plant 50 MW – 1900 m3/day BWRO

Case study – Genefloc ABF – solar plant

Resultados análisis

Determinaciones	Resultado	Unidades	Método
Turbiedad	**3,0**	UNF	Nefelometría
pH / Ta	**9,52/19,2**	u. pH / ºC	Electrometría
Conductividad	**1.203**	µS/cm	Electrometría
TDS	**732,2**	mg/L	Cálculo
Dureza total	**321,7**	mg/L $CaCO_3$	Cromatografía Iónica
Calcio	**64,8**	mg/L Ca^{2+}	Cromatografía Iónica
Magnesio	**38,8**	mg/L Mg^{2+}	Cromatografía Iónica
Sodio	**142,8**	mg/L Na^{+}	Cromatografía Iónica
Potasio	**4,9**	mg/L K	Cromatografía Iónica
Hierro total	**0,39**	mg/L Fe	Espectrofotometría
Hierro disuelto	**0,09**	mg/L Fe	Espectrofotometría
Aluminio	**0,009**	mg/L Al^{3+}	Espectrofotometría
Manganeso total	**0,033**	mg/L Mn	Espectrofotometría
Manganeso disuelto	**0,017**	mg/L Mn	Espectrofotometría
Sulfatos	**204,1**	mg/L SO_4^{2-}	Cromatografía Iónica
Cloruros	**233,4**	mg/L Cl^{-}	Cromatografía Iónica
Fluoruros	**0,16**	mg/L F^{-}	Cromatografía Iónica
TA	**1,6**	º F	Volumetría
TAC	**4,9**	º F	Volumetría
Bicarbonatos	**20,7**	mg/L HCO_3^{-}	Volumetría
Carbonatos	**19,2**	mg/L CO_3^{2-}	Volumetría
Hidróxidos	**0,0**	mg/L OH^{-}	Volumetría
Nitratos	**<0,4**	mg/L NO_3^{-}	Cromatografía Iónica
Sílice	**3,1**	mg/L SiO_2	Espectrofotometría
o-Fosfatos	**<0,01**	mg/L PO_4^{3-}	Cromatografía Iónica



PT=49 µg/L

Cl-a = 11 µg/L

Case study – Genefloc ABF – solar plant

Previous treatment

- Shock dose biocide
- ↑ P 2,6 bar-40 days.
- hypochlorite.
- bisulfite.
- 8 cleanings per year
- Cartridges replacement 20 days
- higher operating cost.

With Genefloc ABF

- 8 ppm Genefloc ABF
- ↑ P 1,2 bar-90 days.
- no hypochlorite.
- not bisulfite.
- 2 cleanings per year
- Cartridges replacement 50 days
- lower operating cost (12%)

EventMobi

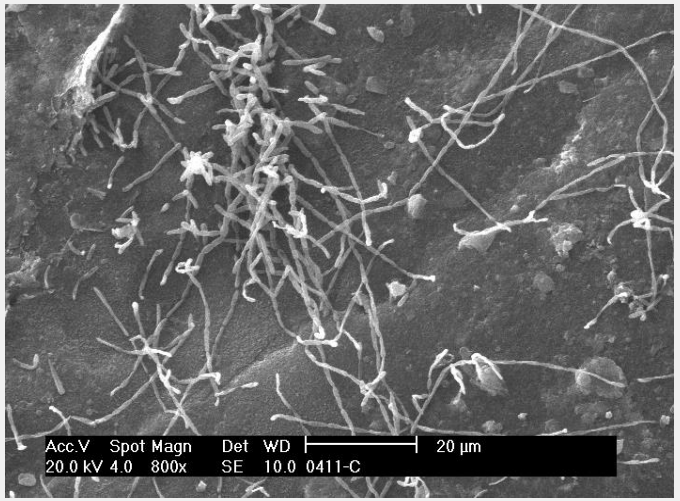
Can Genefloc ABF be dosed:

1. Online?
2. Shock dose?
3. As membrane cleaner?

Advantages

- Multifunctional product
  - Algaecide
  - Biocide
  - Flocculant
- Can replace NaClO / SBS / coagulants / flocculants
- Compatible with Genesys antiscalants
- Effective at a wide pH range (5 to 9)
- Improves performance of:
  - Multimedia filters
  - Cartridge filters
  - Membranes
- Reduce operational costs
  - Avoid/minimize biofilm on membranes
  - Extends the cartridges life
  - Allow multimedia to avoid biofilm formation
- Unique at the market – no competition
- 100% membrane compatible
- Low dosages (1-5 ppm)

Disadvantages

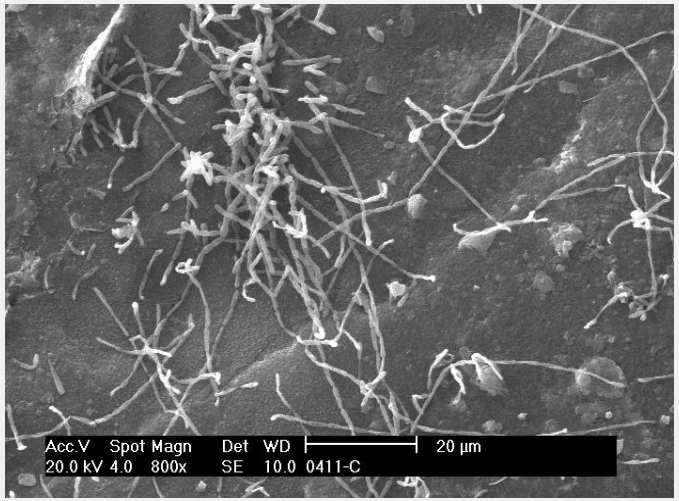


Advantages

- Multifunctional product
  - Algaecide
  - Biocide
  - Flocculant
- Can replace NaClO / SBS / coagulants / flocculants
- Compatible with Genesys antiscalants
- Effective at a wide pH range (5 to 9)
- Improves performance of:
  - Multimedia filters
  - Cartridge filters
  - Membranes
- Reduce operational costs
  - Avoid/minimize biofilm on membranes
  - Extends the cartridges life
  - Allow multimedia to avoid biofilm formation
- Unique at the market – no competition
- 100% membrane compatible
- Low dosages (1-5 ppm)

Disadvantages

- ???????

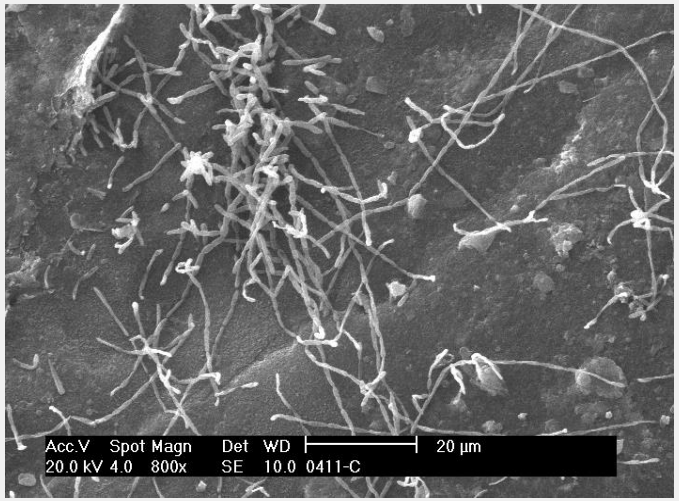


Advantages

- Multifunctional product
  - Algaecide
  - Biocide
  - Flocculant
- Can replace NaClO / SBS / coagulants / flocculants
- Compatible with Genesys antiscalants
- Effective at a wide pH range (5 to 9)
- Improves performance of:
  - Multimedia filters
  - Cartridge filters
  - Membranes
- Reduce operational costs
  - Avoid/minimize biofilm on membranes
  - Extends the cartridges life
  - Allow multimedia to avoid biofilm formation
- Unique at the market – no competition
- 100% membrane compatible
- Low dosages (1-5 ppm)

Disadvantages

- Not for potable use
- Hazmat for transportation (biocide)



Advantages

- Multifunctional product
  - Algaecide
  - Biocide
  - Flocculant
- Can replace NaClO / SBS / coagulants / flocculants
- Compatible with Genesys antiscalants
- Effective at a wide pH range (5 to 9)
- Improves performance of:
  - Multimedia filters
  - Cartridge filters
  - Membranes
- Reduce operational costs
  - Avoid/minimize biofilm on membranes
  - Extends the cartridges life
  - Allow multimedia to avoid biofilm formation
- Unique at the market – no competition
- 100% membrane compatible
- Low dosages (1-5 ppm)

Disadvantages

- Not for potable use
- Hazmat for transportation (biocide)

- **So why not replace commodities (NaClO/SBS/CoagualInts) for a unique product?**
- **So why are you not ordering Genefloc ABF for your stock????**


h2o innovation®
Piedmont
GENESYS
PWT
WATER COMPANY
OF THE YEAR 2020
GLOBAL
WATER
AWARDS