



Dryden Pool Academy SESSION 5

AFM® Activated Filter Media



1

AGENDA 9:30 – 10:30 am




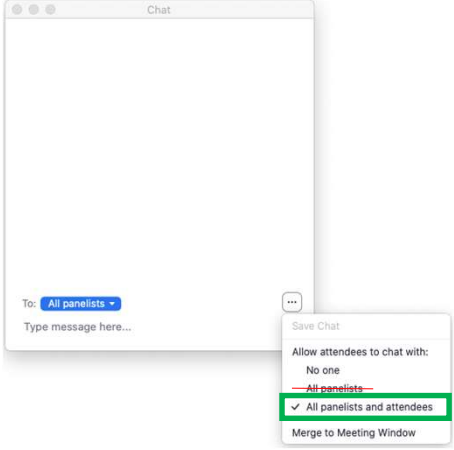
- 9:30** AFM Introduction
 - What is AFM® and what does activation mean?
 - New AFM® ng: the game changer!**
 - AFM® filtration and backwash performance
 - The new 50/50 layering
- 10:30** Q&A : Questions / Answers




2


2


Questions & Answers

Prepare and send us your questions during the meeting using the chat!

 Chat

 Raise Hand

 Q&A

3

Dryden Pool Academy presentations and replays





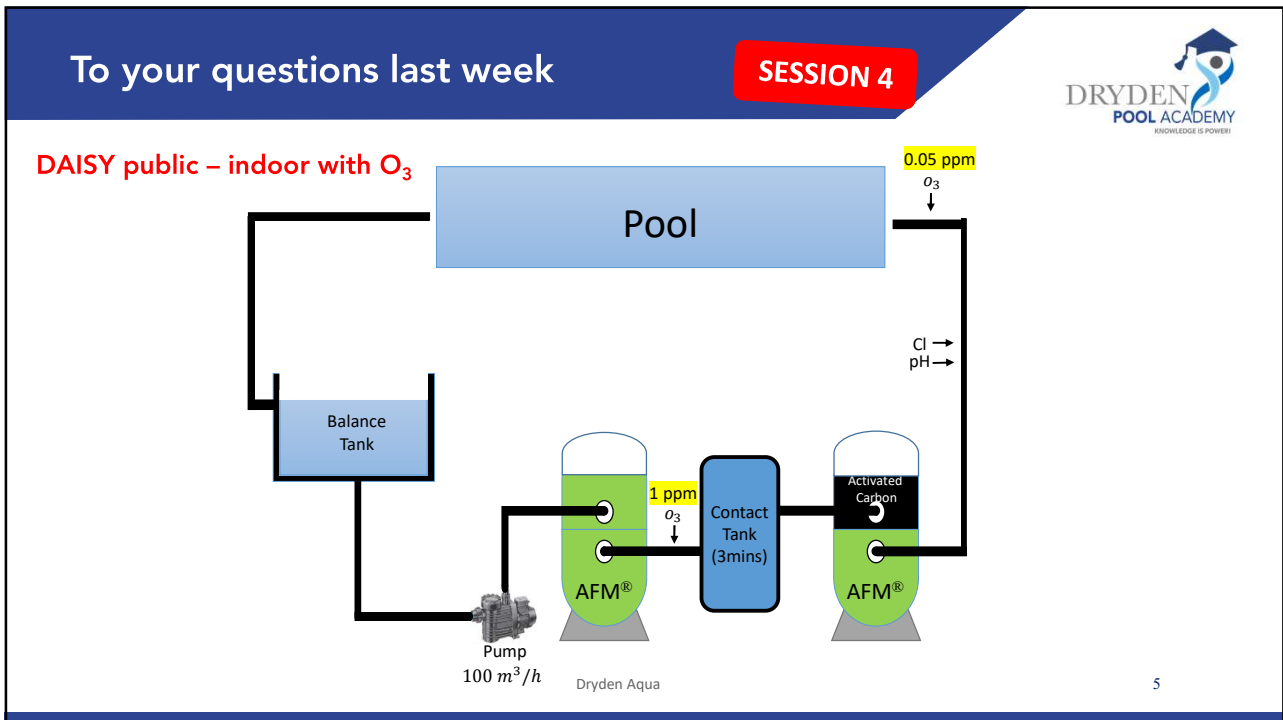

www.drydenaqua.com

Replay available for 7 days after each session (EN, DE, FR, US)

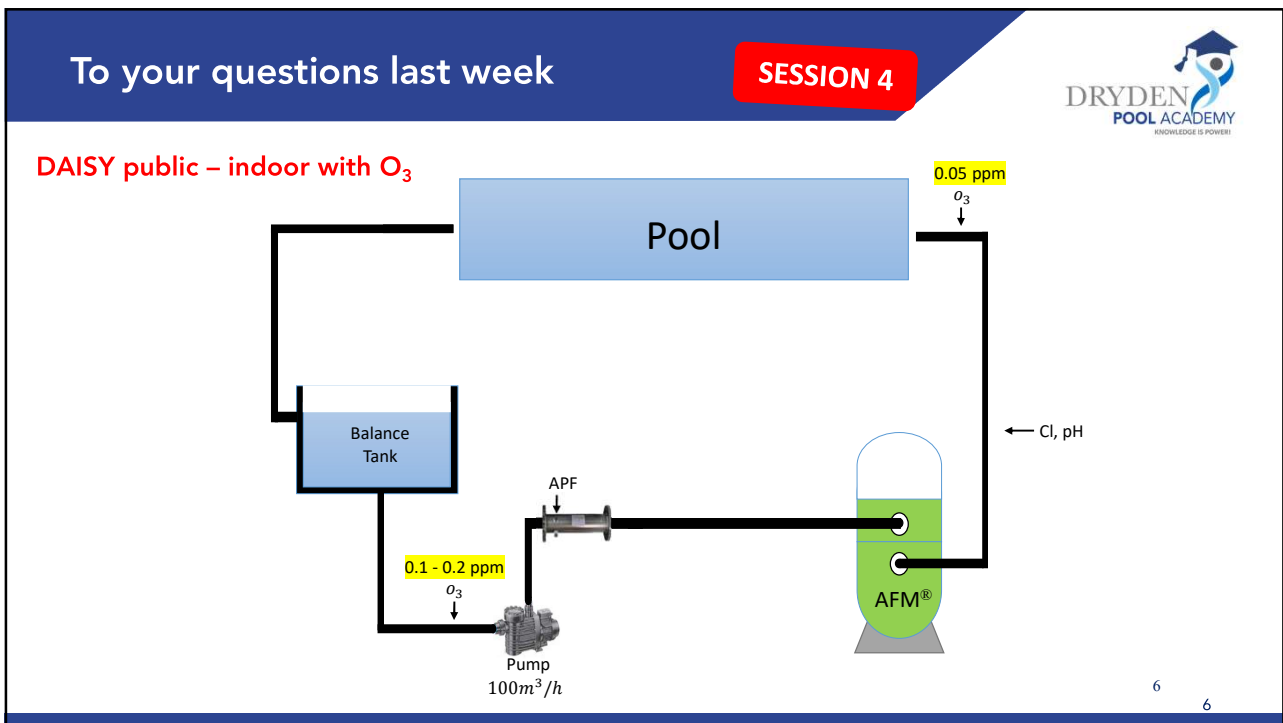
PDF Presentation available for download 24 hr before each session (every Thursday)





4



5




6

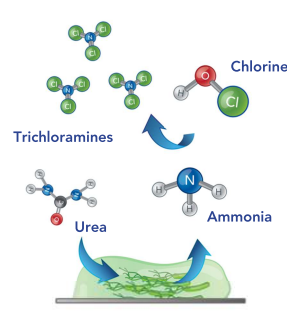


3 simple steps!

SESSION 4



1



Trichloramines

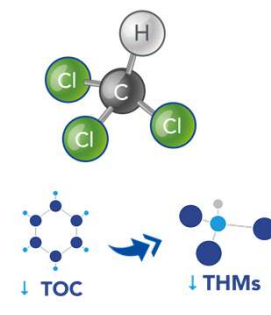
Urea

Ammonia

Chlorine

No biofilm in the filter bed
=> Significantly less formation of toxic trichloramines

2




↓ TOC


↓ THMs

Less organics in the water
=> Less formation of chloroform and other THMs

3



For the lowest chlorate concentration =>
Use calcium hypochlorite or a DAGEN



7



DRYDEN POOL ACADEMY

AFM® Activated Filter Media INTRODUCTION




8



AFM® : How it all started...





**Marine biologist
Dr. Howard DRYDEN**

PHD in sand and zeolite filtration - specialized in water treatment for over 35 years.



Lung infections due to toxic volatile trichloramines and THMs in the air just above the water surface



His 1st mission: Develop a technology to eliminate toxic chlorine by-products

**AFM®
Activated Filter Media**






Replaces sand in all types of sand filters

9



Dryden Aqua today...




Two "state-of-the-art" AFM® factories




3 industries



AQUARIA & AQUACULTURE





WATER TREATMENT



SWIMMING POOLS
+ 500'000 pools equipped

CAPACITY 50'000 tons of filter media / year



10



AFM[®]
ACTIVATED FILTER MEDIA

Sustainable product & manufacturing process



DRYDEN
POOL ACADEMY
KNOWLEDGE IS POWER!



AFM[®]
CIRCULAR ECONOMY



AFM[®] is manufactured from 100% recycled bottle glass sourced locally



100% energy and water self-sufficient, using rainwater and up to 850,000 kWh self-generated solar power per year



Zero waste: Waste are separated and recycled or used in other industries. Sludge is responsibly disposed of.




The life cycle of AFM[®] is many times longer than quartz sand.




AFM[®] can be returned to Dryden Aqua where it will undergo the same process of cleaning and decontamination and will be re-manufactured into new AFM[®]

11

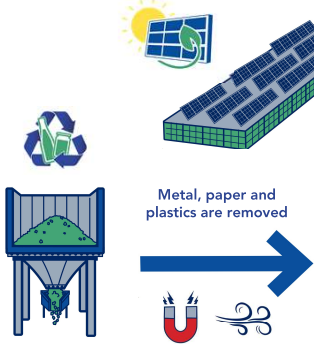


AFM[®]
ACTIVATED FILTER MEDIA


World's most sophisticated glass manufacturing process



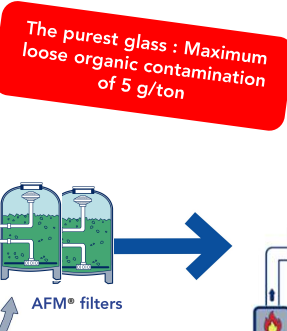
DRYDEN
POOL ACADEMY
KNOWLEDGE IS POWER!




Metal, paper and plastics are removed



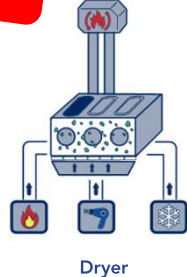
100% Rainwater
Clean water




The purest glass : Maximum loose organic contamination of 5 g/ton



Decantation




Dryer





Sludge sent to biogas company


12




World's most sophisticated glass manufacturing process



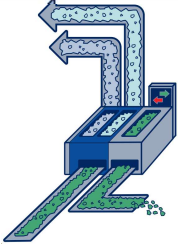




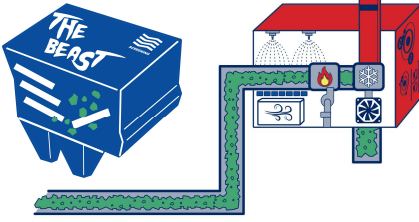
Optimal size & shape
3 grades for pools (G1,G2,G3)
No sharp edges, no splinters




Quality control & certifications
Manufactured under ISO9001-2015 conditions
Certified under DWI EC Reg31, NSF50 & NSF61 for swimming pools and potable water use.
HACCP certified for food and drinks markets.
Tested by independent and best-known European laboratory for filtration tests IFTS




+98% green and brown glass
We remove clear glass which does not contain the necessary metal oxides for activation




3-step chemical & thermal activation process
The structure and the chemistry of the glass are modified
The glass becomes self-sterilizing & acquires advanced adsorption properties







13

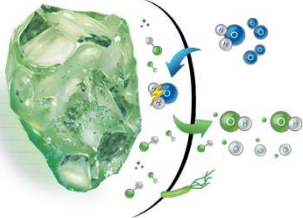


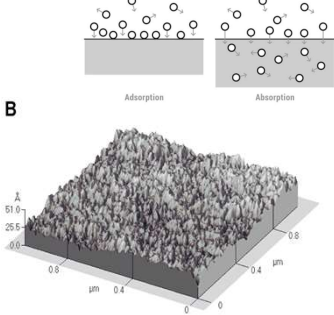
Activation process => 3 unique features
Two types of AFM[®] produced: AFM[®] and AFM[®] ng





2 common features





1

Self-sterilizing surface
resistant to bacterial growth

2


Increased surface area
Superior mechanical filtration
Larger surface for adsorption

14

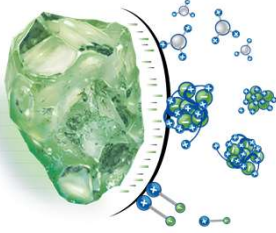
AFM[®]
ACTIVATED FILTER MEDIA

Activation process => 3 unique features
Difference between AFM[®] and AFM[®] ng

DRYDEN[®]
POOL ACADEMY
KNOWLEDGE IS POWER!

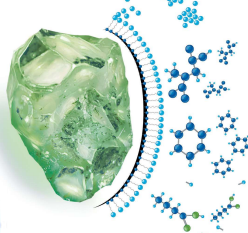


AFM[®]
ACTIVATED FILTER MEDIA



AFM[®] ng
ACTIVATED FILTER MEDIA

BEST FOR SWIMMING POOLS



3

Negative surface charge
Advanced adsorption of positively charged particles, flocs and metals (iron, manganese, arsenic...)

Hydrophobic surface
Advanced adsorption of organic substances, hydrocarbon and microplastics

15

AFM[®]
ACTIVATED FILTER MEDIA

AFM[®] production video (Swiss factory)

DRYDEN[®]
AQUA
SUSTAINABLE WATER QUALITY



YouTube




16

AFM[®]

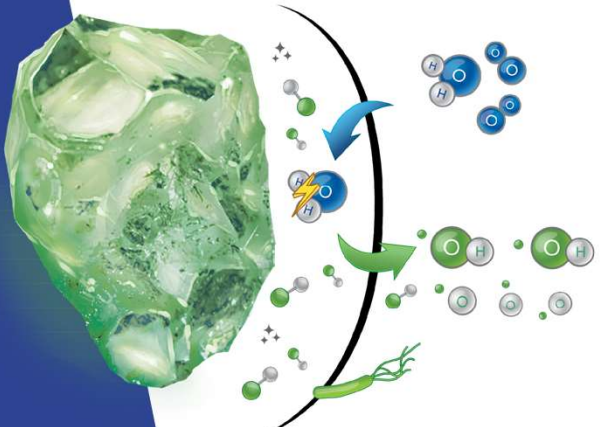
ACTIVATED FILTER MEDIA

UNIQUE 100%
BIO-RESISTANT
FILTER MEDIA

Self-sterilising surface



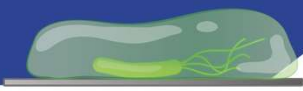
DRYDEN
POOL ACADEMY
KNOWLEDGE IS POWER!




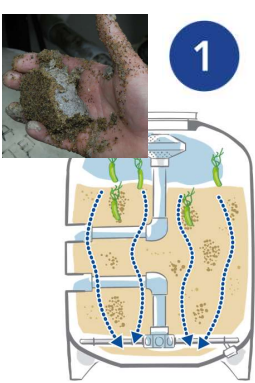
17

REMINDER
The 3 problems of biofilm

SESSION 4








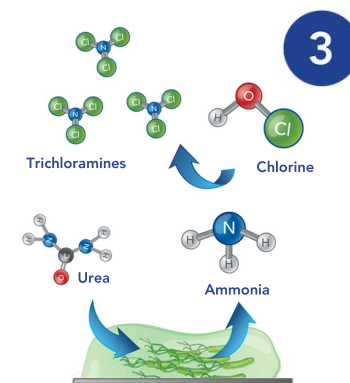
1

Inconsistent & unreliable filtration
=> Clogging, channeling...



2

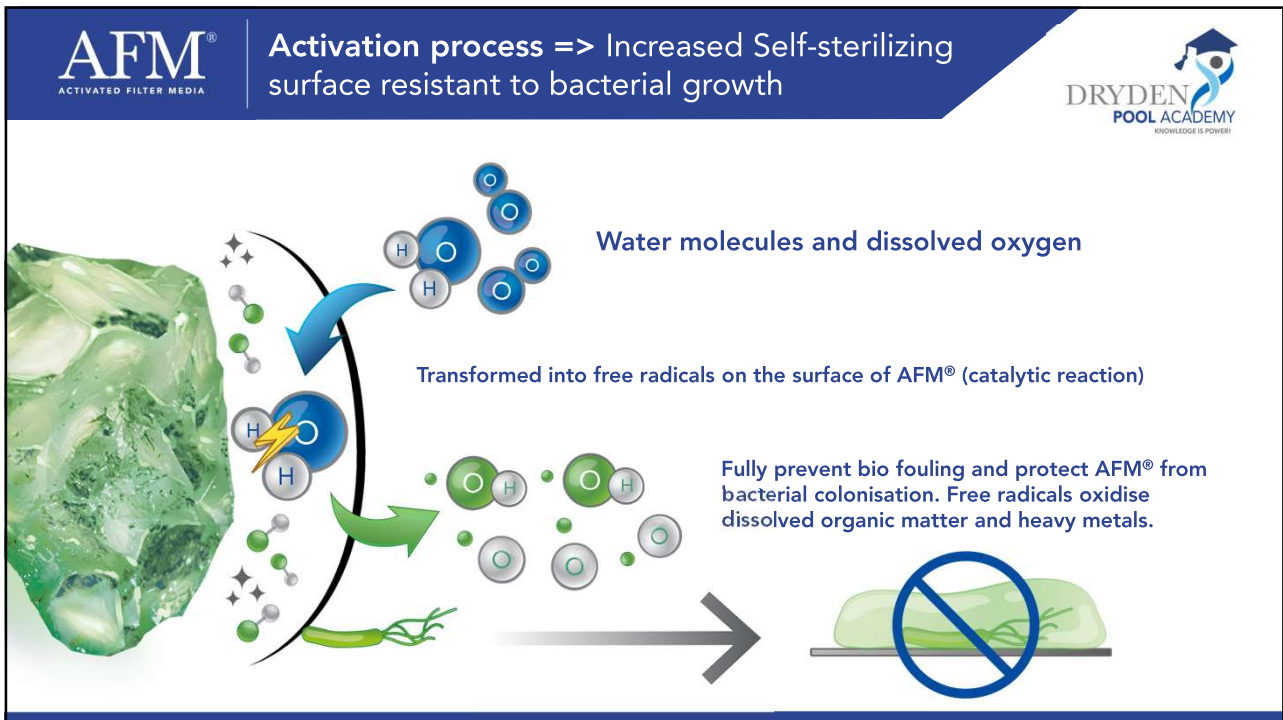
"Home" for growing pathogens



3

Responsible for the formation of trichloramines => biological conversion from urea to ammonia in the filter bed

18



19

AFM[®]
ACTIVATED FILTER MEDIA

AFM[®] after 5 years...

DRYDEN POOL ACADEMY
KNOWLEDGE IS POWER!

New sand

Used sand – after 3 days in a drinking water filter : 100% bacterial colonisation

New AFM[®]

Used AFM[®] - after 5 years in a sewage treatment system: Absence of bio-fouling

Bacterial count in 5 g of filter media at a water temperature of 37°C	
AFM	18
Sand	3,600,000

Samples were taken after backwash

20

**AFM® : 100% BIO-RESISTANT FILTER MEDIA
CONSUMER BENEFITS**

**NO BACTERIAL GROWTH - NO CHANNELING
SAFE BARRIER AGAINST PATHOGENS
CLEANER, SAFER WATER**

**NO BIOLOGICAL CONVERSION FROM UREA TO AMMONIA
50% - 80% LESS TRICHLORAMINES
NO CHLORINE SMELL – NO CORROSION (INDOOR POOLS)**

**NO LOSS OF EFFICIENCY
STABLE & RELIABLE PERFORMANCE
OUTLASTS ALL OTHER FILTER MEDIA**

AFM®
ACTIVATED FILTER MEDIA

21

AFM®
ACTIVATED FILTER MEDIA

New AFM® ng

THE GAME CHANGER!

THE BEST FILTRATION MEDIA


AFM®
ACTIVATED FILTER MEDIA

Hydrophobic surface

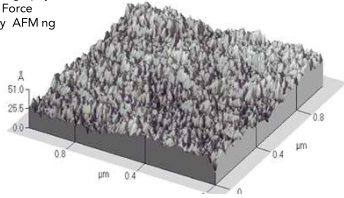
22


AFM® ng : New hydrophobic surface






Surface topography
by Atomic Force
Microscopy AFM ng






Hydrophilic vs hydrophobic



Hydrophobic
(repels water)

Non-polar

Hates water
Likes hydrophobic
molecules




Hydrophilic
(loving water)

Polar

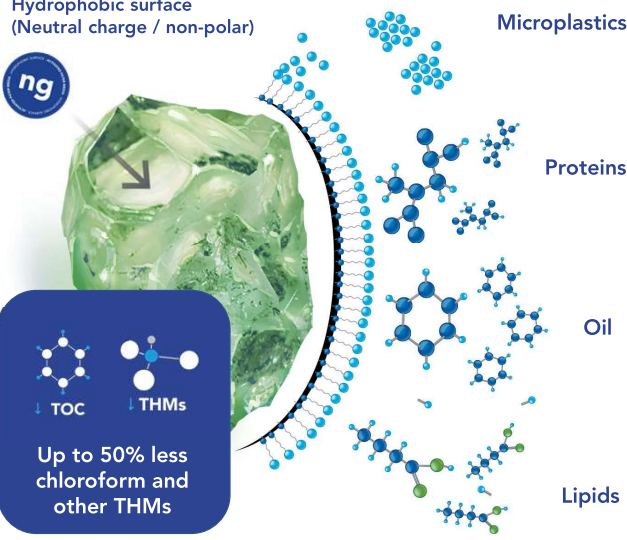
Loves water
Likes hydrophilic
molecules


23

Hydrophobic surface : Advanced adsorption of organics



Hydrophobic surface
(Neutral charge / non-polar)





Up to 50% less
chloroform and
other THMs

Microplastics

Proteins


Oil

Lipids

Microplastics, oils, lipids, fats, large amino acids are non-polar and tend to be adsorbed onto a hydrophobic surface.

Organic matters are the precursor for the formation of THMs and disinfection by-products.

Organic matter will pass the lungs to reach the blood stream and circulatory system.



Less organics = less potential to form THMs

24

AFM[®] ng : New hydrophobic surface

Hydrophilic
(LOVING WATER)
Polar

AFM[®]
ACTIVATED FILTER MEDIA

Hydrophobic
(HATING WATER)
Non-polar

AFM[®] ng
ACTIVATED FILTER MEDIA

DRYDEN POOL ACADEMY
KNOWLEDGE IS POWER!

25

AFM[®] ACTIVATED FILTER MEDIA

Filtration performance

ng
Hydrophobic surface

THE BEST FILTRATION MEDIA


DRYDEN AQUA

AFM[®]
ACTIVATED FILTER MEDIA

DRYDEN POOL ACADEMY
KNOWLEDGE IS POWER!

26

AFM® ng - IFTS Test Results – Particle size retention



1
MICRON

Certified
1 micron filtration

Test identification

Test date : 03/10/2019	Operator : ML	IFTS n. : ECH_00031256
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Customer reference

Filter ref. : AFM 21 ng (0,4 - 0,8mm) Sample 2
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Test parameters

Test fluid : Filtered water	Test dust : ISO CTD	Batch n. : 13388C
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Test results

Parameters		Contaminant injection			Particle counting					
		Concentration (mg/L)			Counter	Sensor	Flow rate (mL/min)	Volume (mL)		
		Initial	Final	Average						
Test flow rate (m3/h)	0,37	Flow rate (L/h)	10,02	202	181	191,5	PAMAS 2132	WaterViewer	25	25
Temperature (°C)	23,4									
Concentration (mg/L)	5,2									
Test duration (min)	362									


Initial cleanliness (#/mL)

Particle number/mL	Sizes (µm)							
	> 1	> 2	> 4	> 6	> 8	> 10	> 20	> 25
Upstream	110,52	75,64	33,6	12,96	7,48	5,68	2,4	1,76
Downstream	42	23,84	10,16	5,12	4,08	3,88	3,32	2,92


Filtration efficiency and Particle number (#/mL)

	Sizes (µm)							
	> 1	> 2	> 4	> 6	> 8	> 10	> 20	> 25
Upstream	12702	8737	3359	1338	559	274	20	8
Downstream	684	270	25	2	0	0	0	0
E (%)	94,6	96,9	99,3	99,9	99,9	99,9	99,9	98,9


AFM® ng removes 94,6% of >1 micron particles at 20m/h




27




IFTS Test results – Filtration velocity: 20m/h




AFM®


1  **> 1 micron**

Sand

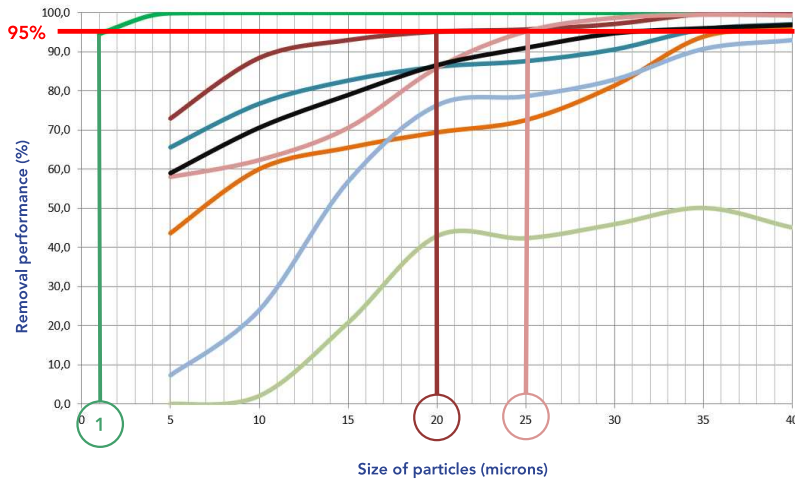
2  **> 20 microns**

Glass

3  **> 25 microns**


 Full IFTS report available on drydenaqua.com

Particle size removal performance (without flocculation)




Removal performance (%)

Size of particles (microns)



- AFM® ng 1
- Sand (0.5-1.0mm)
- Garo
- Astral
- Bioma
- EGFm
- Vitrosphere
- Nature works



28

14

Sand 0.5 – 1.0 mm- IFTS Test Results – Particle size retention



TEST RESULTS

Filter ref. SAND (IFTS : 8737)

Raw counting data (see figure 1-2-3)

Table 2 : Filtration ratio and efficiency* vs. test period

Counting period	Particle size (µm)		R ₁	R ₂	R ₃	R ₄	R ₅	R ₆	R ₇	R ₈	R ₉							
	> 5 µm	E%																
Upstream initial counts	27																	
1 Up	6623	2	1141	3	310	6	81	18	27	49	13	106	4	457	2	776		
1 Down	2960	55,30	349	69,43	48	84,47	4	94,57	1	97,95	0	99,06	0	99,78	0	100		
2 Up	62401	4	2943	9	7498	15	1438	21	320	22	118	32	32	320	21	∞		
2 Down	15696	74,85	779	89,29	499	93,35	69	95,19	14	95,52	4	96,91	0	99,69	0	100		
3 Up																		
3 Down																		
4 Up																		
4 Down																		
5 Up																		
5 Down																		
6 Up																		
6 Down																		
Average Up	34512	4	3542	9	3904	14	759	21	173	23	65	35	18	330	12	8794		
Average Down	9328	72,97	1564	88,45	273	93,00	37	95,16	7	95,71	2	97,12	0	99,70	0	100		

Reference filtration rating : S 40,63 µm (99,8%)

*Note: Efficiency value is rounded to 100% when above 99,995

«Fresh» sand (0.5 – 1.0 mm) can remove
73% of >5 micron particles at 20m/h
95% of >20 micron particles at 20m/h



29

NatureWorks «Hi-tech glass filter media» - IFTS Test results



TEST RESULTS

Filter ref. Hi-tech glass filter media (IFTS : 6566)

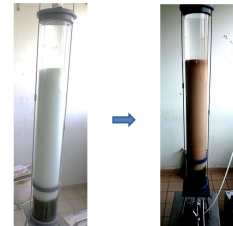
Raw counting data (see figure 1-2-3)

Table 2 : Filtration ratio and efficiency* vs. test period

Period	Δp (bar)	Cumulative counts (N/mL)		> 5 µm	> 10 µm	> 20 µm	> 30 µm	> 40 µm	> 45 µm	> 50 µm	> 60 µm															
		Up	Down																							
1	0,15	Up	E (%)	5510	55,19	653,3	79,37	22,39	0,33	98,51	2,85	0,08	97,26	0,54	0,02	95,93	0,24	0,003	98,72	0,14	0,00	100	0,05	0,00	100	
		Down		2469		134,8		0,33		98,51		2,85		0,08		97,26		0,54		95,93		0,14		0,00	100	0,05
2	0,6	Up	E (%)	13400	60,58	1761	67,62	46,71	81,22	5,03	93,39	0,62	0,01	97,62	0,25	0,01	97,67	0,12	0,00	97,67	0,12	0,00	100	0,04	0,00	100
		Down		5283		570,1		8,77		81,22		93,39		0,01		97,67		0,25		97,67		0,12		0,00	100	0,04
Average		Up	Eff.	9455	59,07	1207	70,66	34,55	86,6	3,94	94,74	0,58	0,01	96,86	0,25	0,13	98,17	0,13	0,00	98,17	0,13	0,00	100	0,05	0,00	100
		Down		3876		352,5		4,55		86,6		94,74		0,01		96,86		0,25		98,17		0,13		0,00	100	0,05

*Note: Efficiency value is rounded to 100% when above 99,995

«Fresh» Nature works can remove
59% of >5 micron particles at 20m/h
94,7% of >30 micron particles at 20m/h

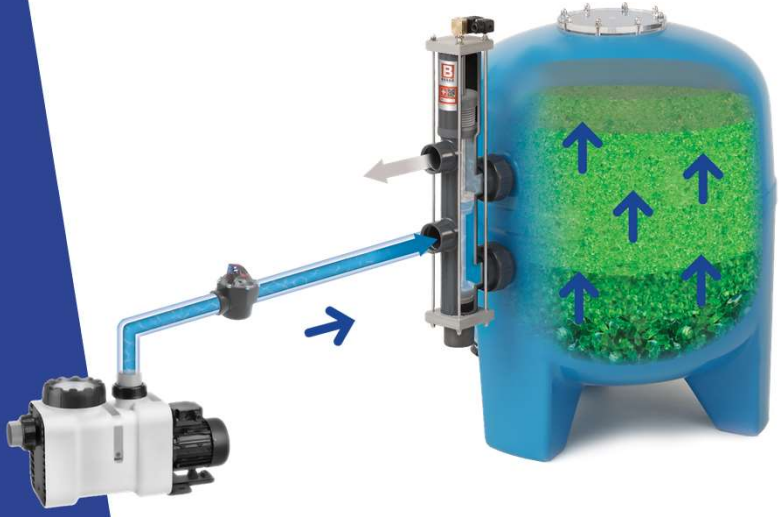



30

AFM[®]


ACTIVATED FILTER MEDIA

Backwash performance







31




Bed expansion is directly linked to backwash efficiency






With AFM[®]:
You need a velocity of ≥ 40 m/h:
Duration: 3 - 5 minutes



For the same bed expansion with sand
You need a velocity of 50-60 m/h:
Duration: 5 - 6 minutes





Up to 50% less backwash water

With AFM[®]:
Less water = less chemicals
= less energy used to heat the water


Quick return on investment
Indoor pools < 2 years
Outdoor pools < 5 years

**The min. backwash velocity should expand the bed by 15%.
Minimum : 15% => Recommended : 25%**




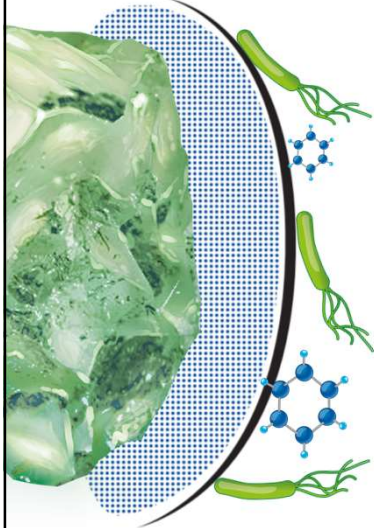


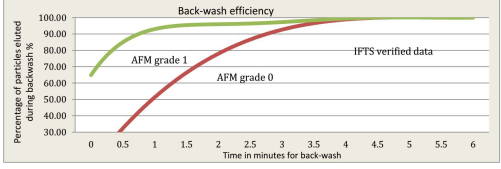
32



AFM[®] is able to release all particles out!








Time in minutes for back-wash	AFM grade 1 (%)	AFM grade 0 (%)	IFTS verified data (%)
0	65	30	30
0.5	75	40	40
1	85	55	55
1.5	90	65	65
2	92	75	75
2.5	93	80	80
3	94	85	85
3.5	95	88	88
4	96	90	90
4.5	97	92	92
5	98	94	94
5.5	99	96	96
6	100	98	98


Unlike sand, the absence of biofilm enables AFM[®] to release 100% of the filtered particles!

Material removed during backwash does not have to be oxidised:



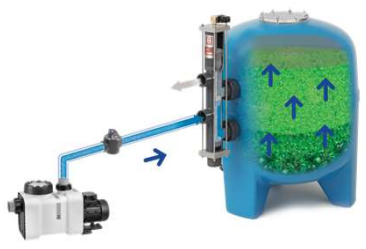
No chemical demand

↓ Cl



No disinfection by-products

↓ DBPs



33



AFM[®] E-learning video





34

AFM[®]

ACTIVATED FILTER MEDIA

AFM[®] ng
new 50/50 layering

ONE STEP CLOSER TO PERFECTION!



NEW

↑↓



DRYDEN
POOL ACADEMY
KNOWLEDGE IS POWER!

35



2019 layering



Filters < 800mm



GRADE 1

0.4 – 1.0 mm



GRADE 2

1.0 – 2.0 mm

Filters > 800mm

GRADE 1

0.4 – 1.0 mm



GRADE 2

1.0 – 2.0 mm



GRADE 3

2.0 – 4.0 mm



36



AFM
ACTIVATED FILTER MEDIA

New 2021 layering



DRYDEN
POOL ACADEMY
KNOWLEDGE IS POWER!

New AFM® ng Grade 2 => New 50/50 layering

Filters < 800mm



50%

GRADE 1

0.4 – 0.8 mm



50%

GRADE 2

0.7 – 2.0 mm



▶ **New AFM® ng Grade 2**

▶ **New layering**
Grade 2 becomes a «filtering» layer

Filters > 800mm



ng

GRADE 1

0.4 – 0.8 mm



ng

GRADE 2

0.7 – 2.0 mm



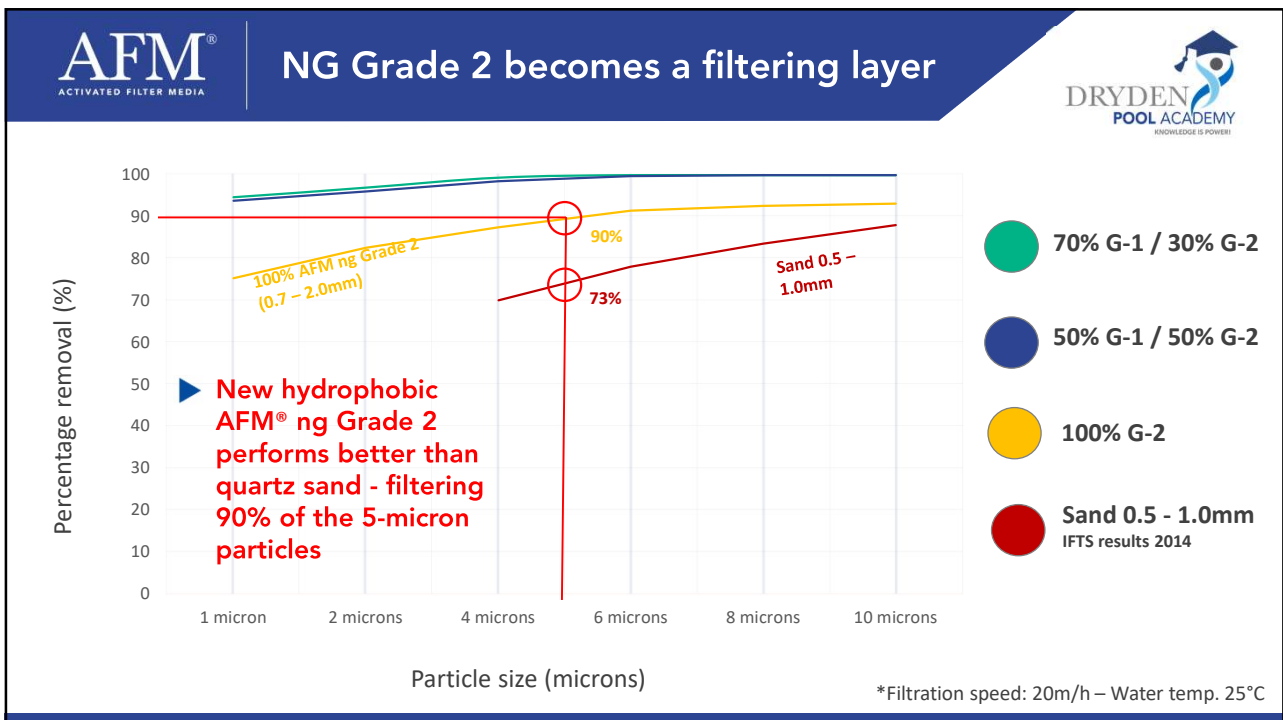
ng

GRADE 3

2.0 – 4.0 mm



37



38



AFM
ACTIVATED FILTER MEDIA

New AFM[®] ng Grade 2



DRYDEN
POOL ACADEMY
KNOWLEDGE IS POWER!

AFM ng Grade 2 becomes not only a good support layer but also an efficient filtering layer



50/50



GRADE 1
0.4 – 0.8 mm



Filtering layer



GRADE 2
0.7 – 2.0 mm




Filtering layer
+ Support layer



39

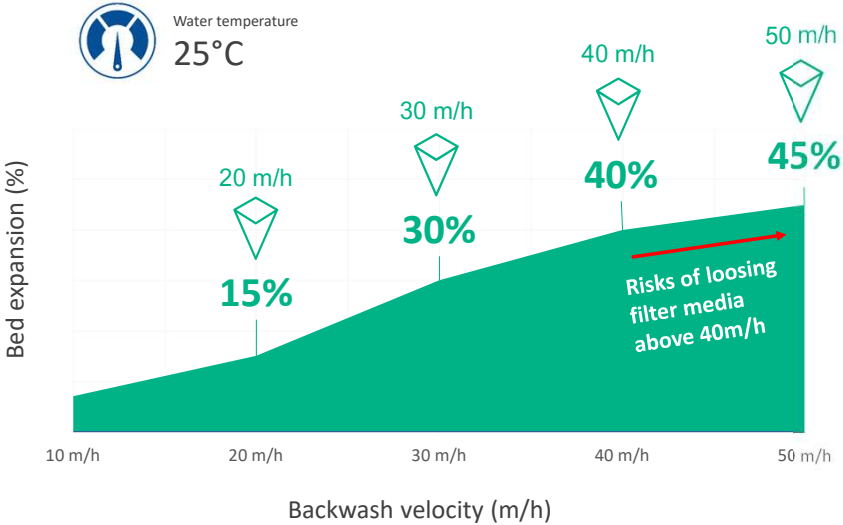
70/30

High bed expansion!




DRYDEN
POOL ACADEMY
KNOWLEDGE IS POWER!


Water temperature 25°C



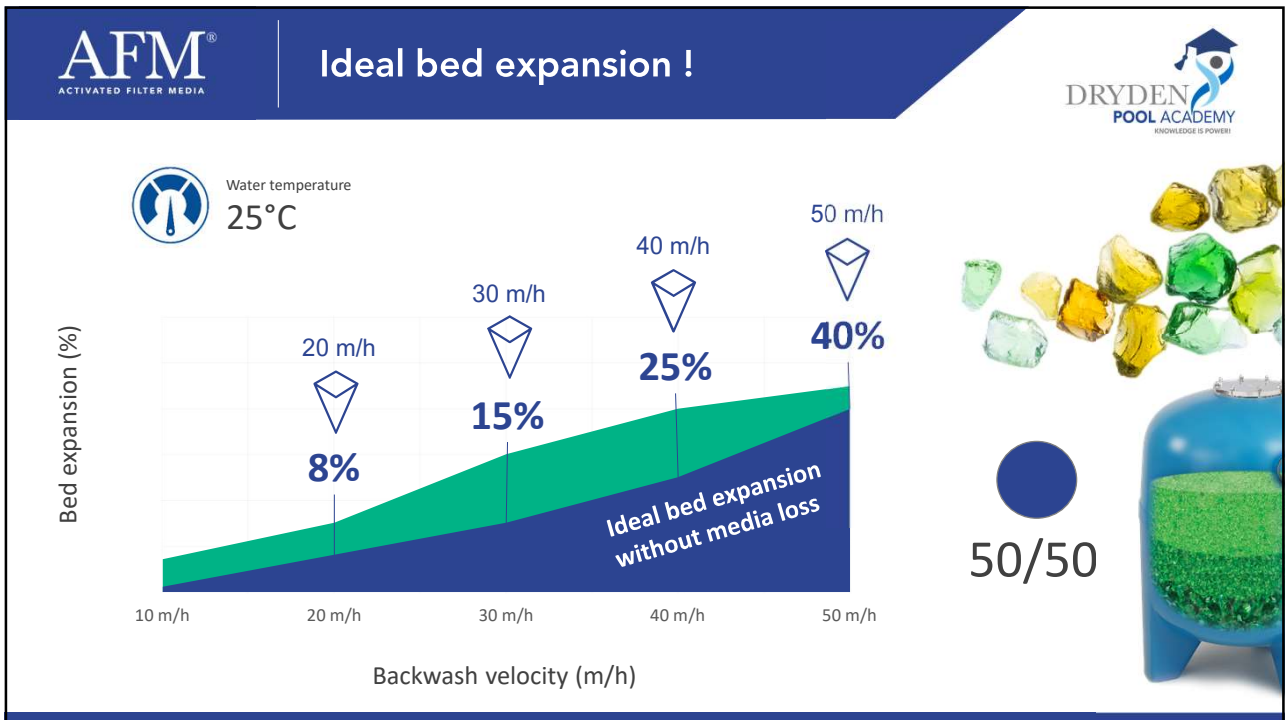
Backwash velocity (m/h)	Bed expansion (%)
20	15%
30	30%
40	40%
50	45%



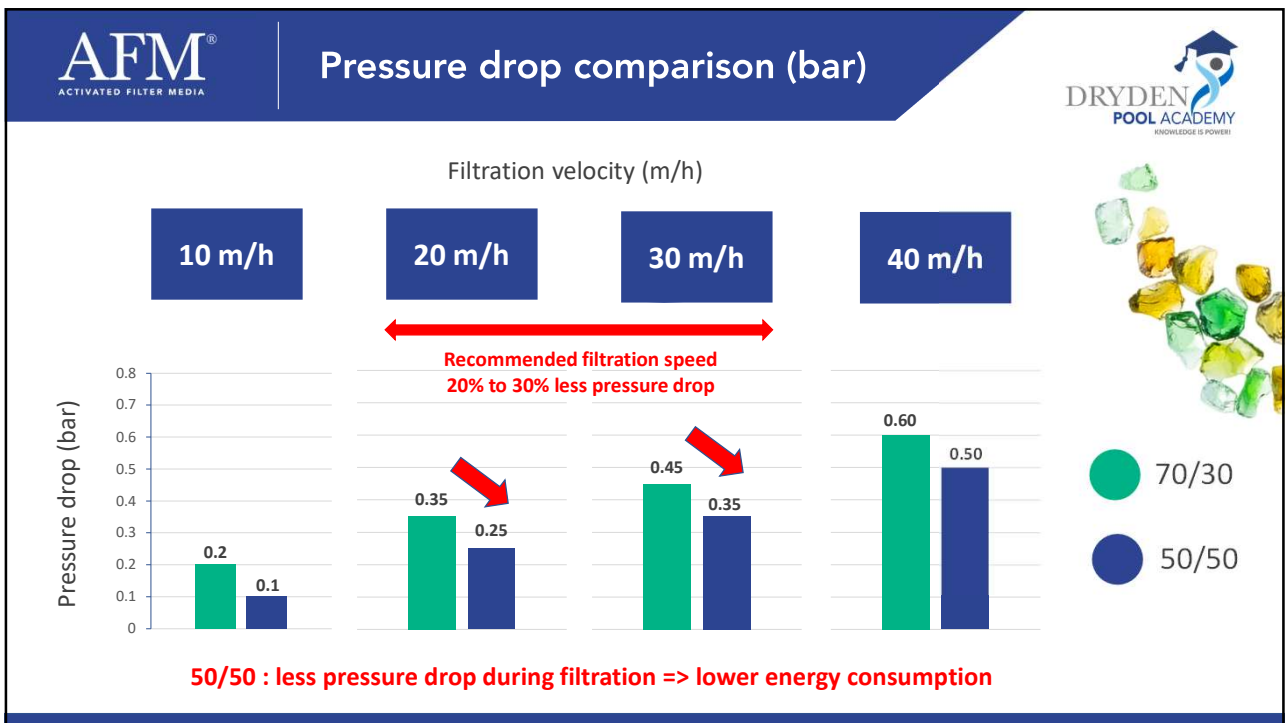
70/30



40



41



42



AFM[®]
ACTIVATED FILTER MEDIA

One step closer to perfection!



DRYDEN
POOL ACADEMY
KNOWLEDGE IS POWER!

New 50/50 Layering



GRADE 1
0.4 – 0.8 mm



GRADE 2
0.7 – 2.0 mm

▶ **Outstanding filtration efficiency !**

▶ **Ideal bed expansion with less risks of losing media**

▶ **Less pressure drop => lower energy consumption**



Installation manual




www.drydenaqua.com/downloads




New layering video

43



AFM[®]
ACTIVATED FILTER MEDIA

Promise of AFM[®] in private pools




DRYDEN
POOL ACADEMY
KNOWLEDGE IS POWER!

- 1

Much cleaner & clearer water within 24 hours
- 2

No chlorine smell – skin and eye irritations
- 3

Reduced chemical consumption and pool maintenance
Saves up to 50% of chemicals – depending on size of the filter and the quantity of filter media



A MUST WITH
CHLORINE FREE
TREATMENTS

44

But it is a lot more expensive: The EL-factor



Filter	D 520	D 640	D 720	D 840
bags	5	6	12	16
Sand (15€)	75	90	180	240
AFM (38€)	190	228	456	608
Extra costs	115	138	276	368

EL-Factor	0.7	0.8	1.7	2.2
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100ml: 164 € (Duty Free)

Dryden Aqua

45

45

AFM[®]
ACTIVATED FILTER MEDIA

Promise of AFM[®] in public pools



- 1 **No chlorine smell => Very low trichloramine levels**
Inorganic chloramines (mono-, di- and trichloramine) are **3 to 5 times lower** using AFM[®] compared to sand.
- 2 **THM's 50% lower**
- 3 **Substantial backwash water savings**
Return of investment usually < 2 years in indoor pools



Total combined chlorine can be as high as with sand because of non-volatile organic chloramines. They can accumulate in the water. They are harmless.

With 5 – 10 cm of activated carbon you can solve that problem and bring total combined chlorine < 0.2mg/l.

46

- 50 meter outdoor pool
 - 25 meter indoor pool
 - 140 m³ therapy pool
 - Spa
- 4 x Ø 2000 filters
 - 4 x Ø 1200 filters
 - 24 tons of AFM[®]



47

- Chemicals:
 - “Acid from 600 L to 225 L per month”
 - “Chlorine reduced 30 %”
- Water consumption reduced with:
 - “4,65 m³ per day in therapy pool”
 - “4 m³ in 25 meter pool”
- Air:
 - “Smell of chlorine is gone”
 - “Customers asks whether they have stopped using chlorine”
 - “We have now our coffee table in the swim hall. Wasn’t possible before because of aggressive air”
- ROI is now calculated at 2 years!!

BR. Lars Ottosen, Manager

Ugglebadet Perstorp

Kännetecken
 Skrivetår: 2020/06/04, No 27366/2020
 Över: Mätning med 200 L och 100 L på beredna efterrätt i ölfärdiga Skrivetår med 200 L per dag

Vattenförbrukning
 Skrivetår: 2020/06/04, No 27366/2020
 Över: Mätning med 200 L och 100 L på beredna efterrätt i ölfärdiga Skrivetår med 200 L per dag

Klimat
 Skrivetår: 2020/06/04, No 27366/2020
 Över: Mätning med 200 L och 100 L på beredna efterrätt i ölfärdiga Skrivetår med 200 L per dag

Notering
 Skrivetår: 2020/06/04, No 27366/2020
 Över: Mätning med 200 L och 100 L på beredna efterrätt i ölfärdiga Skrivetår med 200 L per dag

Slutsats
 Skrivetår: 2020/06/04, No 27366/2020
 Över: Mätning med 200 L och 100 L på beredna efterrätt i ölfärdiga Skrivetår med 200 L per dag

Letter from
 Lars Ottosen, Manager,
 Ugglebadet Perstorp



48

FEBRUARY 26th 2021 **zoom**

DRYDEN POOL ACADEMY
KNOWLEDGE IS POWER!

SESSION 6

DAISY: DRYDEN AQUA INTEGRATED SYSTEM

- What is DAISY® ? The biological approach
- APF® : The only multi-spectrum flocculant & coagulant on the pool market
- ACO® : The best stabilizer for all outdoor swimming pools
- NoPhos : The biological solution to prevent algae

SESSION 6



49

49

AFM
ACTIVATED FILTER MEDIA

QUESTIONS / ANSWERS

DRYDEN AQUA
SUSTAINABLE WATER QUALITY

100% BIO-RESISTANT
SAFE BARRIER AGAINST PATHOGENS
50% - 80% LESS TRICHLORAMINES
UP TO 50% LESS BACKWASH WATER
OUTLASTS ALL OTHER FILTER MEDIA

CERTIFIED 1 MICRON FILTRATION
CLEAN, CRYSTAL CLEAR WATER
REDUCED CHEMICAL CONSUMPTION

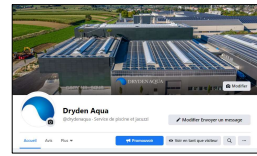
NEW HYDROPHOBIC SURFACE
50% LESS ORGANICS IN THE WATER
UP TO 50% LESS CHLOROFORM (THMs)

Q A

ng



50



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Dryden Aqua

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