DRYDEN AQUA TECHNOLOGY

SUSTAINABLE WATER QUALITY

AFM

The unique bio-resistant activated filter media

Independently tested and certified

AFM® has been tested and its performance certified by various international laboratories (WRc - NSF) and (IFTS). Beyond the physical characterisation of the media, a major benchmarking campaign at the end 2013 has served to confirm the quality and performance of AFM® and its considerable advantages when compared to media from all filter media competitors. AFM® is also Certified ISO 9001-2008 and « Drinking water » certified according to EU Directive 98/83-CE on water quality.

What is AFM®

AFM® is a granular filter media intended for optimisation of any filtration system using sand, whether it is used, for example, in swimming pools, drinking water, aquaculture or sewage treatment.

Manufactured from recycled glass, it undergoes various physical and chemical treatments which result in its unique performance. The high degree of refinement of its grains allows a filtration threshold of less than 5µ (certified performance) as well as a strong resistance to pressure preventing the formation of preferential pathways in the filter bed. On the other hand, the chemical treatment it receives prevents the accumulation of biofilm in the filter, a phenomenon that amplifies the propensity of the filter bed to fracture resulting in deterioration in performance.

Key performance characteristics

- ✔ **Crystal clear water** – AFM® allows ultra fine filtration with a certified threshold of less than 5 microns.
- ✔ **Stable performance** – No loss of efficiency during a filtration cycle in contrast to all other glass media.
- ✔ **Savings in water consumption -** Consumption of backwash water cut by 50% compared to other media. as at 45m/hr it takes about 200 seconds to remove 95% of filtered particles from the bed
- ✔ **Bio-resistant -** Resists bacterial colonisation and the operational problems that result from it.
- ✔ **No chlorine smell** – No production of trichloramines in the filter leaving fresh unpolluted air in public swimming pools and animal parks.
- ✔ **Longer lifespan** – 2 times greater longevity than sand, from 10 to 20 years.

How does AFM® work?

AFM® is an active filter media. Its grains undergo extensive physical refinement and are then subjected to a series of patented treatments that confer its activation. This unique process consists of various physical and chemical treatments that improve mechanical efficiency by optimising the physical characteristics of the grains and makes them resistant to adhesion of bacteria by virtue of their surface activation.

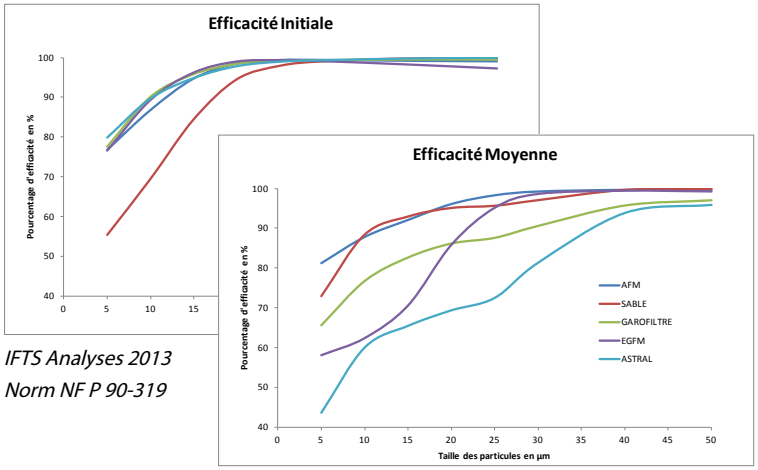
AFM® is a unique product because it combines the advantages of glass and sand. Indeed, the sand has some important advantages compared to conventional glass media, in the sense that it is much more resistant to pressure and has therefore no « mechanical » propensity to form short term preferential pathways. Conversely, glass has a natural capacity to limit bacterial adhesion whilst sand is an ideal substrate for bacteria, even in chlorine systems. In the Medium term (a few months) sand has a stronger « biological » propensity to form preferential pathways than glass.

It is the understanding of these mechanisms that has allowed Dryden Aqua to optimise the mechanical refinement of the glass grains and to amplify their bio-resistant properties activation. Use of AFM® therefore allows better filtration of pollutants whilst avoiding the excessive water consumption and major operational problems (mechanical blockage and bacterial clogging) associated with sand and other glass media on the market.

In order to more accurately quantify the performance advantages of AFM®, Dryden Aqua commissioned a range of comparative analyses with IFTS (International Filter Testing Services), an independent laboratory considered to be European reference for characterisation and testing of filtration techniques. Tests were carried out according to recognised NF-EU norms and some new protocols were developed to determine the activation level of AFM® compared to other media.

Initial and average efficiency

The effectiveness of a media is determined by two main criteria, which are initial efficiency and average initial efficiency. Thus, each media has a specific initial efficiency (clean media) that can deteriorate rapidly during the filtration cycle. This is why it should be compared with the average efficiency that takes account of the mechanical behaviour of the media, and in particular its propensity to form preferential pathways that interfere with efficiency. These two parameters depend on the size and the form of grains and therefore the quality of their mechanical refinement. Knowing that efficiency also depends on the speed of filtration, all analyses were conducted at a common filtration rate of 20 m/hr.

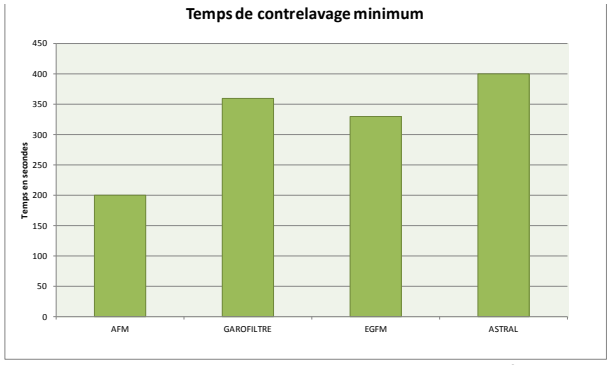


IFTS Analyses 2013
Norm NF P 90-319

The results clearly demonstrate the superiority of AFM® over all other media by exhibiting both the highest initial and average efficiency. Furthermore, only AFM® and sand are able to demonstrate no loss of efficiency resulting from the formation of preferential pathways, with pressure in the filter dropping to low level in the case of all other media. The differences between AFM® and sand become more apparent in the medium term (a few weeks/months), when the latter quickly loses its capacity because of bacterial clogging.

Backwash capacity

Above and beyond efficiency, another important characteristic that allows us to characterise the performance of a media is its behaviour during backwashing. The time required to discharge filtered particles, is proportional to the quantity of water consumed which varies substantially depending on which media is used. Following the efficiency testing, all media were subjected to backwashing (45 m/hr) and residual water was analysed.



IFTS Analyses 2013

The results show that AFM® requires up to half the time to achieve the same backwashing efficiency, resulting in a reduction of 50% in water consumption from backwashing, 2 times less than other glass media glass and up to 3 times less than sand. AFM® therefore combines optimal efficiency (< 5µ) with a backwashing capacity far superior to that of its competitors.

What is activation?

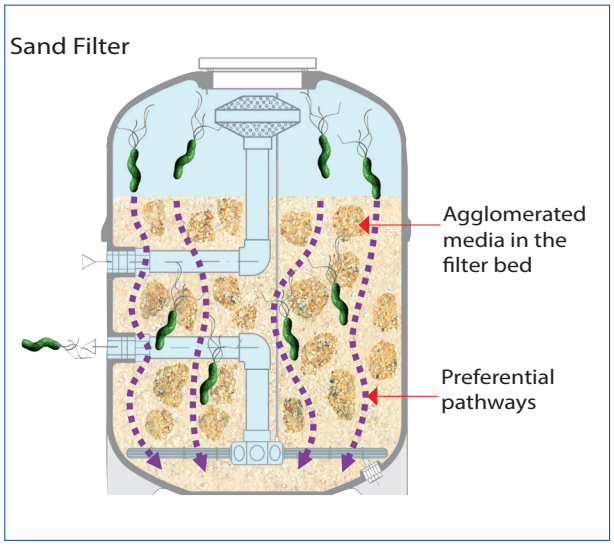
AFM® is an active filter media, its grains having undergone a physico-chemical treatment to change their surface characteristics in order to prevent the adhesion of bacteria. To do this, the surface is treated to increase its developed area as a means of exposing more of the surface to contact with the water and amplifying its negative electric charge (zeta potential) by changing the atomic structure of the glass.

Both these treatments allow exposure of much more negative charges than untreated glass, and therefore have a greater capacity to repel bacteria that are also negatively charged. By limiting the capacity of bacteria to develop they cannot form a stable biofilm on the grains of AFM® and are evacuated with each backwash.

Why limit bacterial proliferation?

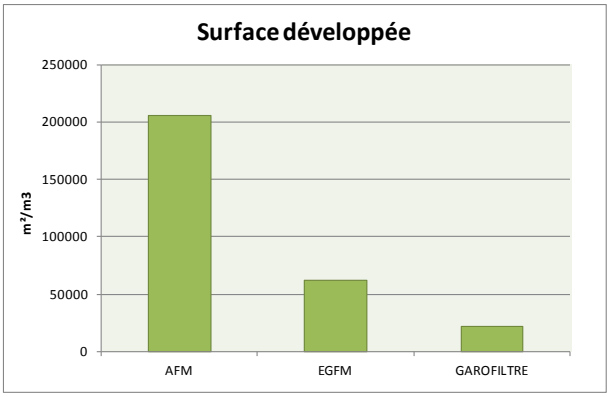
Whether in chlorinated water or not, many species of bacteria are able to adhere to grains of sand or non-activated glass. Thereafter, they produce a gelatinous substance (alginate) that protects them from their environment. This substance quickly covers all grains within the filters, eventually resulting in agglomerations of organic particles, or even in some cases, of mineral precipitates. This causes the coagulation of the bed (bacterial clogging) and in extreme cases, complete solidification of the filter bed.

Contamination of the filtering bed therefore results in a rapid decrease in efficiency, strongly increasing the propensity of the filter media to form preferential pathways. The bacterial biomass itself becomes a pollution source, liberating many pieces of biofilm via these preferential passages, as seed for new bacterial colonies.



The developed surface area

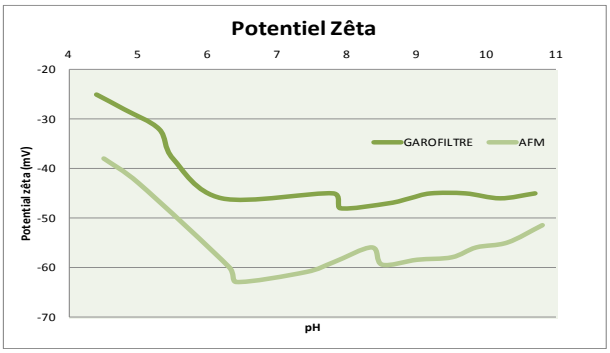
The developed surface is the total exposed surface area of the grains that is in contact with water. This value is decisive because it affects the exposure of the electric charge (zeta potential) carried by the grains. In order to amplify the effect of the power of grain activation, the AFM® manufacturing process generates a twenty fold increase in the developed surface of the glass grains, thus passing from 10 000 m^2/m^3 to nearly 200,000 m^2/m^3. This value was measured by an independent lab and compared with that offered by other glass media.



IFTS Analyses 2013

The zeta potentiel

The zeta potential of a surface corresponds to the difference in electrical charge between its atoms and the ions contained in the water. This is why zeta potential is very dependent both on pH and water quality. The more a surface exposes its negatively charged atoms the more negative its zeta potential will be, and vice versa. In the case of AFM® a strongly negatively charged surface is sought in order to repel bacteria that are themselves negatively charged.



IFTS Analyses 2012

A controlled attack (patented process) of the glass matrix of AFM® grains exposes chromium oxide (green dye in glass) and silanol (SiO)- groups which, in the presence of oxygen, carry a strong negative charge. This causes an increase of 40% in zeta potential, from approximately -30 mv for untreated glass to -65mv for AFM®. The results of independent laboratory analyses are presented in the graph above.

The operational avantages

AFM® improves both the efficiency and stability of any installation in order to optimise the filtration performance of the new or old circuits in which it is installed. It also offers many operational advantages such as reduced water (backwash) and hence energy consumption (reduced heat loss), improved air quality (reduced ventilation and associated heat loss, reduced degradation of structures) or longevity (2 times greater than sand).

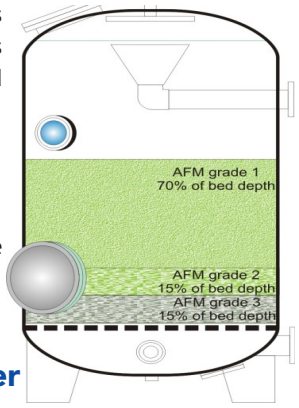
The absence of biofilm in filters also has the advantage in chlorinated circuits (swimming pools, aquatic mammals, drinking water etc.) of preventing the formation of harmful trichloramines that attack mucous membranes and the respiratory tract. Indeed, the acidic environment in the biofilm becomes the principal site for transformation of dichloramines to toxic trichloramines. Bathers and aquatic animals can swim in a healthy atmosphere thanks to AFM®.

Granulometry & répartition in the filter

AFM® is available in 3 different grades which constitute the three layers for filtration (G1), diffusion (G2) and support (G3).

- Grade 1 = 0.6 to 1.2mm - 70%
- Grade 2 = 1.2 to 2.5mm - 15%
- Grade 3 = 2,5mm to 6mm, -15%

The total recommended height of the filter bed is 1100 to1200mm.



Commissioning of the filter

After filling the filter with AFM® it is important to carry out three 10 minute backwashes in order to rinse the media and to ensure the correct repartition of the layers in the filter bed.

Key certified figures

- ✔ Ultra fine filtration < 5 microns (at 20 m/hr)
- ✔ No loss of efficiency during the filtration cycle
- ✔ Minimum certified backwash time 200 seconds (at 45 m/hr)
- ✔ Developed surface area 205 000 m^2/m^3
- ✔ PSurface zeta potential = -65mv (pH 7)

Composition

Sillice	70 %	Calcium	0.1 %
Magnesium	1 %	Lanthane	0.02 %
Sodium	8 %	Cobalt	0.00016 %
Aluminium	1.5 %	Plomb	< 0.005 %
Antimoine	< 0.001 %	Mercure	< 0.0005 %
Arsenic	< 0.0001 %	Titane	0.1 %
Barium	0.02 %	Rubidium	0.05 %
Cadmium	< 0.0001 %	Iridium	0.05 %
Chrome	0.15 %	Platine	0.0001 %

Operational criteria

Variable filtration speed according to application :

- Public pools and aquariums - 15 to 25 m/hr
  - preferably - 15 to 20m/hr
- Industrial water treatment variable according to application but :
  - normally - 10 to 15m/hr
- Drinking water treatment - 5 to 10m/hr
- Tertiary treatment of sewage - 5 to 10m/hr

- Air backwash: 50 - 100m/hr
- Backwash speed : 45 to 55m/hr for 3 to 5 minutes maximum.

Physical Specifications

GRADE 1

Granulometry G1	0.5 to 1.0 mm
Hardness	7 mohs
Sphericity	> 0.8
Roundness	> 0.7
Coefficient of uniformity	< 1.3
Aspect ratio	< 2.4
Specific density	2.5
OAD	>10
Purity	99.95 %
Energy	< 65 kw/tonne
Density G1	1.25 kg/l
Density G2	1.23 kg/l
Density G3	1.22 kg/l

These figures are derived from independent analyses by WRc-NSF.

Who is Dryden Aqua?

We are marine biologists specialising in swimming pool water treatment.
Our mission is to eliminate toxic chlorine by-products and provide the best air and water quality on the market. For over 30 years we have been working with chlorinated systems for dolphins and other aquatic mammals before successfully introducing our technology to the pool industry. Today, as a testament to the performance, safety and benefits of our integrated water treatment system, there are over 100'000 swimming pools worldwide using our products.

www.drydenaqua.com