COUGAR COATINGS Estd. 1988
WASTEWATER DIVISION
Supplying unique solutions for the water and waste water industry

BIO-BLOK® INTELLIGENT FIXED FILM BIOLOGICAL FILTER MEDIA

1.1.4. Biofilm

1. On BIO-BLOK® 100

A BIO-BLOK® 100 is a block welded together of net tubes with an outer diameter of approx. 70mm. Each cubic metre BIO-BLOK® 100 filter medium consists of 204 net tubes with a 70mm diameter in a length of 1m.

Each net tube is "put together" of 32 polyethylene strings with a theoretic diameter of approx. 2-3mm. The net strings are welded together so that they form square holes in the tube wall. The size of the holes is approx. 8mm x 8mm.

These strings give a total area of approx. 100 m^2/m^3 in dry condition. For competing products only the active area is given based on a biofilm thickness from 0.8mm to 3mm.

The question is then: *What happens when the biofilm grows on the BIO-BLOK® filter medium?*

* BIO-BLOK® 100 Dry condition 100 m^2/m^3
* BIO-BLOK® 100 1mm biofilm 165 m^2/m^3
* BIO-BLOK® 100 2mm biofilm 233 m^2/m^3
* BIO-BLOK® 100 3mm biofilm 299 m^2/m^3
* BIO-BLOK® 100 4mm biofilm 366 m^2/m^3

By approx. 4-5mm biofilm, the biofilm will start closing the holes in the net tubes.

If you imagine that the biofilm is completely smooth on the inner and the outer sides, the minimum surface of the filter medium will be approx. 90 m^2/m^3.

However, this situation is rather theoretic because the two strings that together form the tube wall are approx. 5mm thick. Therefore, as the wall consists of strings with a diameter of approx. 2.5mm, the inner and the outer tube walls will not be smooth; on the contrary, they will be extremely varied in thickness. This is also confirmed by practical tests (picture material can be required).

The conclusion is that if the filter medium is heavily loaded in a period so that very thick layers of biofilm come into existence on the filter medium resulting in "closing" of the holes in the net tubes, then the real accessible biological surface area will be between 90 m^2/m^3 and 130 m^2/m^3.

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On the other hand, in such a situation the filter medium will never clog and the counterpressure will constantly be low.

When the filter medium is normally loaded again, the old biofilm will fall off and new biofilm comes into existence so that the accessible biological surface areas increase as described above.

If it is a matter of trickling filters, the thickness of the biofilm is regulated by increasing the hydraulic surface load on the filter.

If it is a matter of submerged, aerated filters, the thickness of the biofilm is regulated by increasing the distribution of air in the filter medium.

Based on above observations it is obvious that it is important to keep an eye on the development of biofilm and to work-in routines with this with regard to operation of wastewater treatment plants. This means that the operation of a filter medium always will be optimal.

By doing so, the biological wastewater treatment plant can decompose the overloads that always occur in a wastewater treatment plant because the capacity of the biological filter, in periods, is able to decompose 2-300% more than assumed.

This is among other things the reason why wastewater treatment plants constructed with BIO-BLOK® filter medium always have a good and stable operational process.

2. On BIO-BLOK® 150

A BIO-BLOK® 150 is a block welded together of net tubes with an outer diameter of approx. 55mm. Each cubic metre BIO-BLOK® 150 filter medium consists of 330 net tubes with a 55mm diameter in a length of 1m.

Each net tube is "put together" of 32 polyethylene strings with a theoretic diameter of approx. 2-3mm. The net strings are welded together so that they form square holes in the tube wall. The size of the holes is approx. 4mm x 4mm.

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These strings give a total area of approx. 150 m^2/m^3 in dry condition. For competing products only the active area is given based on a biofilm thickness from 0.8mm to 3mm.

The question is then: *What happens when the biofilm grows on the BIO-BLOK® filter medium?*

* BIO-BLOK® 150 Dry condition 150 m^2/m^3
* BIO-BLOK® 150 1mm biofilm 268 m^2/m^3
* BIO-BLOK® 150 2mm biofilm 387 m^2/m^3
* BIO-BLOK® 150 3mm biofilm 507 m^2/m^3

By approx. 2-3mm biofilm, the biofilm will start closing the holes in the net tubes.

If you imagine that the biofilm is completely smooth on the inner and the outer sides, the minimum surface of the filter medium will be approx. 114 m^2/m^3.

However, this situation is rather theoretic because the two strings that together form the tube wall are approx. 5mm thick. Therefore, as the wall consists of strings with a diameter of approx. 2.5mm, the inner and the outer tube walls will not be smooth; on the contrary, they will be extremely varied in thickness.

The conclusion is that if the filter medium is heavily loaded in a period so that very thick layers of biofilm come into existence on the filter medium resulting in "closing" of the holes in the net tubes, then the real accessible biological surface area will be between 114 m^2/m^3 and 200 m^2/m^3.

On the other hand, in such a situation the filter medium will never clog and the counterpressure will constantly be low.

When the filter medium is normally loaded again, the biofilm will partly fall off and new biofilm comes into existence on the net tubes so that the accessible biological surface areas increase as described above.

If it is a matter of trickling filters, the thickness of the biofilm is regulated by increasing the hydraulic surface load on the filter.

If it is a matter of submerged, aerated filters, the thickness of the biofilm is regulated by increasing the distribution of air in the filter medium.

Based on above observations it is obvious that it is important to keep an eye on the development of biofilm and to work-in routines with this with regard to operation of wastewater treatment plants. This means that the operation of a filter medium always will be optimal.

By doing so, the biological wastewater treatment plant can decompose the overloads that always occur in a wastewater treatment plant because the capacity of the biological filter, in periods, is able to decompose 2-300% more than assumed.

This is among other things the reason why wastewater treatment plants constructed with BIO-BLOK® filter medium always have a good and stable operational process.

3. On BIO-BLOK® 200

A BIO-BLOK® 200 is a block welded together of net tubes with an outer diameter of approx. 55mm. Each cubic metre BIO-BLOK® 200 filter medium consists of 330 net tubes with a 55mm diameter in a length of 1m.

Each net tube is "put together" of 32 polyethylene strings with a theoretic diameter of approx. 3-4mm. The net strings are welded together so that they form square holes in the tube wall. The size of the holes is approx. 3mm x 3mm.

These strings give a total area of approx. 200 m^2/m^3 in dry condition. For competing products only the active area is given based on a biofilm thickness from 0.8mm to 3mm.

The question is then: *What happens when the biofilm grows on the BIO-BLOK® filter medium?*

* BIO-BLOK® 200 Dry condition 200 m^2/m^3
* BIO-BLOK® 200 1mm biofilm 312 m^2/m^3
* BIO-BLOK® 200 2mm biofilm 426 m^2/m^3

By approx. 1-2mm biofilm, the biofilm will start closing the holes in the net tubes.

If you imagine that the biofilm is completely smooth on the inner and the outer sides, the minimum surface of the filter medium will be approx. 114 m^2/m^3.

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However, this situation is rather theoretic because the two strings that together form the tube wall are approx. 7mm thick. Therefore, as the wall consists of strings with a diameter of approx. 3.5mm, the inner and the outer tube walls will not be smooth; on the contrary, they will be extremely varied in thickness.

The conclusion is that if the filter medium is heavily loaded in a period so that very thick layers of biofilm come into existence on the filter medium resulting in "closing" of the holes in the net tubes, then the real accessible biological surface area will be between 114 m^2/m^3 and 200 m^2/m^3.

On the other hand, in such a situation the filter medium will never clog and the counterpressure will constantly be low.

When the filter medium is normally loaded again, the biofilm will partly fall off and new biofilm comes into existence on the net tubes so that the accessible biological surface areas increase as described above.

If it is a matter of trickling filters, the thickness of the biofilm is regulated by increasing the hydraulic surface load on the filter.

If it is a matter of submerged, aerated filters, the thickness of the biofilm is regulated by increasing the distribution of air in the filter medium.

Based on above observations it is obvious that it is important to keep an eye on the development of biofilm and to work-in routines with this with regard to operation of wastewater treatment plants. This means that the operation of a filter medium always will be optimal.

By doing so, the biological wastewater treatment plant can decompose the overloads that always occur in a wastewater treatment plant because the capacity of the biological filter, in periods, is able to decompose 2-300% more than assumed.

This is among other things the reason why wastewater treatment plants constructed with BIO-BLOK® filter medium always have a good and stable operational process.

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