C-MEM Pool

Ultra-filtration for Swimming Pools up to 100 m³
PRINCIPLE

Suspension
CLEANWATER

BACKWASH
Cleaning
In order to achieve a high packing density several membrane bundles are wound up a carrier cartridge.
Ultra-filtration for Swimming Pools up to 100 m³

FILTRATION

(1) C-MEM™

Water

Sleeve

Membranes
Ultra-filtration for Swimming Pools up to 100 m³

(1) C-MEM™

BACKWASHING

Water

Sleeve

Membranes

Air
C-MEM™ water treatment for roof tanks

1. GENERAL

In many countries house water supply from the municipality is only available in relatively low quality and with intermittent supply. The water shortage in between is usually balanced with roof tanks on top of the houses or multi-storey buildings which are fed only once water is available. Remaining suspended solids and bacteria lead to strong microbiological growth in pipes and tanks, which decreases the water quality even further. This water can not be safely used for drinking or showering.

2. OUR SOLUTION: C-MEM™

With C-MEM™ the incoming water will be treated by ultrafiltration membranes which will completely reject all particles and bacteria / virus > 0.2 μm.

This state of the art technology will produce high quality water, which will be far better than the water from the city line or tankers.

3. C-MEM™ PRINCIPLE

The basic principle of the filtration is that porous organic hollow fibre membranes with micropores (< 0.2 μm) are used as basic filtration media. They are spiral wound and protected by below cartridge.

This technical concept describes the process of treating the incoming water by the C-MEM™ technology to avoid re-growth in the in-house storage and pipes and to increase the water quality so that it will be safe for all household applications (cooking, drinking, cleaning, washing, showering...).
C-MEM™ water treatment for roof tanks

Hence, all suspended solids, inorganic precipitation, bacteria as well as virus will be removed safely. The mode of filtration through the hollow fibers is “outside-in” by very low pressure.

4. PROCESS DESCRIPTION

The treatment process is incorporated in one compact unit as shown in the pictures below. The overall process consists of only one step – the C-MEM™ ultrafiltration.

The C-MEM™ membrane filtration inside the filtration tank removes all precipitations as well as suspended solids and microorganisms which might be already present in the raw water source. Also Cryptosporidia and Giardia are removed practically completely – which chlorine doesn’t do!

The treated water will be clear and safe for drinking.

A periodical backwash removes the retained bacteria and solids permanently to the drain. The modular design of the system allows a wide range of applications. Daily flows in a range of 10 to 1,000 m³/day are available.

5. ADVANTAGES

The main advantages of C-MEM™ are as follows:
- robust process, no fine-mechanical parts
- solar driven possible
- no hazardous chemicals used
- modular expandable
- complete removal of suspended solids, bacteria and virus
- long lifetime of membranes
- cheap and easy replacement
- simple operation
- << 1 bar pressure loss
- safe water for the entire house

Water from the city line or tankers is filled into the underground cistern. The feed pump, which is used for water supply to the roof tank, will be connected to the C-MEM™ unit on the roof, which further supplies treated water to the roof tank.
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Introduction
A clean pool and clear water - permanently and possibly without any effort and side effects - who wouldn’t like to have that? If it only were so easy! C-MEM™ membrane filtration can really make your life much easier.

Process basics
The basic principle of keeping water clean is the removal of sudden contaminations, or germs are brought in, which even might continue growth in the water in the worst case. C-MEM™ is a membrane filtration technology successfully applied in drinking water treatment with a pore size of 0.2 μ, which completely separates all suspended matter as well as bacteria, virus and permanent forms of parasites from the water.

Growth in pond or pool
Unfortunately, non-desired growth in pond or pool does not only result in the necessity to completely exchange all water as quickly as possible, but mostly also requires extensive cleaning of the system. In case pool or pond water is used for a longer period, nutrients are brought in automatically, which are a perfect growth basis for algae, the concentration of which increases unnoticed in the beginning, but from a certain point of time on shows a distinct exponential growth curve. If e.g. the concentration of a once brought in blue alga with a division rate of 1 per day only increases by 2.7 times after 1 day, the blue alga concentration at the same division rate has already increased by 7.4 times after 2 days. An even faster growing alga, which divides e.g. three times per day, has already reached 20 times the original concentration in pond or pool after 1 day and 400 times after 2 days!!!

Figure 2 Decrease of turbidity or number of bacteria and germs according to exchange rate

Figure 3 Exponential growth of algae according to division rate

Sudden contamination
In case the pond or the pool gets suddenly contaminated, the only 100 % effective counter-measure is the immediate exchange of all water. However, mostly the contamination is not noticed (pathogens), and it is not practicable either to fully drain the pond or the pool. Even chemicals like e.g. chlorine are ineffective against contamination by pathogens that may be combined with dirt because the sand filters, which are mostly upstream the chlorine dosing stations, fail easily. With C-MEM an exchange rate of one exchange/day already reduces the contamination to a remainder of 37 %, three exchanges per day to 5 %.
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If the water of a pond or a pool is filtered by a C-MEM™ membrane filtration system and the recirculation rate is equal to the growth rate, exponential growth and algae growth respectively are completely suppressed. As division rates are mostly lower than once per day under practical conditions, the unpopular guests are completely removed from the system after a few days. The observer does not notice their existence at all – algal bloom has been prevented.

Similarly, all dreaded diarrhoea causing bacteria i.e. coli forms, which are brought in by people and which by the way do not reproduce in water outside the intestines of warm-blooded creatures at all, are also removed efficiently.

How does it work?
Membranes are like little hollow fibers, which are combined to bundles and flown through from outside to inside. Due to this all pollutants remain outside. The clear water flows through the membrane fibers, gets collected and then re-circulated into the pond / pool. For protecting the membranes these fibers are put into a cartridge, which has a central water connection on top for taking in clear water, and the cartridge remains submerged in the polluted suspension. In order to prevent the polluted suspension from getting back into the pond or pool, the cartridge is put into a filtration vessel, which is filled with pond or pool water and in which the polluted water is automatically withdrawn via suction.

Figure 4 Removal of pollutions at exchange rates “equal” and “1 x higher” than the growth rate

Figure 5 C-MEM™ cartridge
Occasionally, the membrane is backwashed by changing the rotational direction of the pump. By doing so, solids are removed from the membrane surface, and the water pumped back flows into the discharge. Flowing back into pond or pool is prevented by a check valve.
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C-MEM Pool

C-MEM™ Filtration Unit

Complete system consisting of:
- filtration tank
- filtration pump
- filtration cartridge set
- connection set filtration cartridges
- valve set for filtration tank
- control unit C-MEM™
- pressure monitor
- level monitor

Figure 6  Installation of the system at pond/pool
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Advantages
The C-MEM™ membrane filtration mainly scores with:
- small pore size of 0.2 µ
- membranes don't wear out
- lifetime of up to 5 years
- all particles are removed: bacteria, virus, oocysts, turbid matter of all kind
- seasonally operated plants have no problems when the membranes stay dry for several months
- membranes can be individually exchanged within the cartridge
- the system is as simple and maintenance friendly

Why not UV as alternative?
UV oxidizes essential parts of cells and therefore kills them extremely quickly and prevents further growth respectively. But as UV radiation has to get through to the pathogens, the coverage of pathogens by suspended solids may impair its effectiveness, and therefore the water should be very, very clear when UV is applied. Otherwise, it would be rather ineffective.
Just like chlorine UV does not remove particles, it simply kills.
Sudden contamination by turbidity and pathogens cannot be cured by UV, either.

Why not chlorine?
The application of chlorine or other chemicals in fish farming is out of the question. In public swimming pools it is a request. But we all know the disadvantages: red eyes, itching skin and no 100 % guarantee that possible infections can definitely be avoided. A private swimming pool owner can decide on his own what he would like to have. Comparable automated plants as used in public swimming pools with sand filter plus control of pH-value, chlorine and Redox-potential are expensive. Dosing chlorine simply on spec will have an impact on either safety or convenience.

Several highly contagious pathogens are not killed by chlorine at all (giardia and cryptosporidia)!!!

Also, pathogens are mostly not alone in the pool, but are frequently protected by other particles, which prevent chlorine from entering the cell nucleus and thus oxidation.

Consequently, chlorine disinfection is totally ineffective at high turbidity values, and upstream sand filters are no permanent solution for separating the small particles that protect the unpopular guests.

So, what is the advantage of ultra-filtration?
Ultra-filtration separates particles and does not kill them. It separates everything: bacteria, virus, harmless turbidity, algae or other solid matter. Everything is removed from the system and does not get back again.

Isn't something like that already available anyway?
Due to the very compact and extremely robust cartridge form of the C-MEM™ cartridge it has been possible for the first time to offer compact and small units in simple design at a consumer friendly price.

Do I need a sand filter for this?
Sand filters are not required. C-MEM™ replaces the sand filter plant and the chlorine dosing station.

Scope of performance
The smallest unit can filter about 25 m³ per day and would be ideal for single family house pools and Koi ponds, bigger units that filter up to several 1,000 m³ per day fit perfectly for big pools or big fish farms.
FAQs

What about dissolved degradable contaminations in my fish pond?

Experts frequently define this as dissolved organic matter, the micro-biological degradation of which leads to growth of micro-organisms on the one hand and on the other hand to oxygen consumption. This material, measured as BOD (bio-chemical oxygen demand) is mostly dissolved and in fish farms frequently degraded via fixed bio-film beds or other matter, whereby biomass is produced. This biomass is mostly separated by appropriate filtration systems (drum filters) and the filtered water is conducted back into the pond. The C-MEM™ plant combines these 2 systems. An additional upstream biological line is not necessary.

Can ammonium (NH4) and nitrite (NO2) also be removed?

These dissolved substances are also oxidizes biologically in the bioreactor and converted into non-harmful nitrate. Depending on the concentration of this contamination, oxygen is consumed for this process and if required, it is simply supplied by a blower.

Doesn’t the system remove things from my pond, which I would actually like to keep?

Components of the C-MEM™ Filtration Unit

Installation Kit

The C-MEM™ Pool System is a modular kit that can be assembled according to requirement.

Filtration tank

Contains the membrane cartridges. Feed water from the pool / pond will enter the tank by gravity or slight vacuum. The filtered suspended solids will be collected there. It has connections for clear water abstraction, drain and feed from the swimming pool.

From time to time the backwash will remove the suspended solids automatically to the sewer system.

Filtration pump

Permeate pump for clear water abstraction and backwash, long lifetime, corrosion resistant. Flow direction can be reversed for backwash.

Membrane cartridge
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Naturally, there are very well pond dwellers, which one would not like to remove because they are of great benefit to the pond like e.g. fly larvae or water fleas. However, in order to keep them it suffices to put a primary filter upstream the suction part of the membrane filtration plant, which should be accessible and which can be cleaned occasionally.

Membrane filtration with nominal pore size of 0.2 μm removes all suspended solids and microorganisms. The membrane modules will be installed with a suitable connection assembly into the filtration tank.

Control unit

The complete unit works PLC controlled. The PLC controls the filtration system (permeate and backwash) and has further connections for optional pressure control of the membranes and level indication of the filtration tank.
(3) APPLICATIONS

POND FILTRATION