

Perlite Filter Aid for Recreational Water Filtration



Filtration is one of the most widely applied techniques for the removal of insoluble contaminants from recreational pool water. Fully natural, lightweight and chemically inert, perlite filter aid offers a high performance, yet cost effective, method for the removal of microbes, bacteria, and suspended solids.

Effective Filtration with Perlite

According to a 2012 study published in the *Journal of Water and Health*, traditional sand filters and cartridge filters have limited effectiveness when it comes to pathogen removal.^[2] Microbes and bacteria active in recreational pools and spas pose a potential health risk to humans when their numbers grow too large. Due to their tiny size, pathogens such as these, require very fine filtration removal methods. This can only be achieved through the use of fine-grained filter media, such as perlite filter aid.

Filter aids used in recreational water filtration

Fully natural and chemically inert, perlite is affordable and highly effective for removing contaminants from pool water.

WHY PERLITE FILTER AID?

- Excellent filtration performance
- Superior precoating ability
- Significant loading capacity
- Easy, quick and complete cake release/removal
- Lightweight spent filter-cake
- Chemically inert, non-toxic, odorless, and environmentally safe
- Inherently resistant to chemical attack by chlorine or its compounds

can drastically improve the cleaning and disinfection of swimming pools, spas, and splash pads.

The World Health Organization (WHO) publishes a comparison of common filtration methods in terms of the performance, filtration efficiency and maintenance cost (Table 1).^[1]

Of particular interest are *Cryptosporidium* oocysts and *Giardia duodenalis*. According to the WHO, *Cryptosporidium* oocysts are best removed by filtration media with pore spaces smaller than 4 μm (4/1,000s of a millimeter), while *Giardia* cysts may be removed by filters with slightly larger pore size of 7 μm or less. Filtration offers a critical step in the removal of these pathogens from pools and spas. In fact, the use of fine expanded perlite resulted in the removal of more than 99.9% of *Cryptosporidium* oocysts. Perlite filter aid has also been found to be effective against microbes, notably, free-living amoebae that harbor opportunistic bacteria such as *Legionella* and *Mycobacterium* species.

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COMPARISON OF FILTER TYPES FOR RECREATIONAL WATER ENVIRONMENTS			
CRITERIA	FILTER TYPE		
	ULTRA-FINE FILTER	MEDIUM-RATE SAND	CARTRIDGE
Common filter sized	Up to 46 m ²	Up to 10 m ²	Up to 20 m ²
Design filter flow rate	3-5 m ³ /m ² /h	25-30 m ³ /m ² /h	1.5 m ³ /m ² /h
Cleaning flow rate	5 m ³ /m ² /h	37-42 m ³ /m ² /h	Not applicable
Cleaning	Backwash and media replacement	Backwash	Manual, hose down
Average wash water	0.25 m ³ /m ² pool water	2.5 m ³ /m ² pool water	0.02 m ³ /m ² mains water
Cleaning implication	A backwash tank may be required. Separation tank required to collect used filter media with periodic sludge removal.	A backwash tank may be required.	Hose-down and waste drain facility.
Particulate collection	Surface	Depth	Degree of depth
Nominal particle removal	1-2 µm	10 µm, 7 µm with coagulant	7 µm
Pressure rise for backwash	70 kPa	40 kPa	40 kPa
Comparative running costs	High	Low	Medium
Comparative installation costs	High	High	Low

Table 1 • Comparison of filter types used for recreational water environments from WHO Guidelines^[1]

Perlite Filter Aid

Perlite is derived from an amorphous volcanic rock (aluminosilicate) which in crude form contains 2-5% moisture by weight that is chemically bound in its structure. When perlite is rapidly heated to temperatures over 850 °C (1,600 °F), the combined moisture vaporizes and turns to steam, causing the creation of tiny glass bubbles 20 times the volume of the original starting particle size. The lightweight grains are then milled to produce tiny flattened particles that are classified into various filter aid grades according to size.

In addition to filtration for swimming pools and spas, perlite filter aid is widely used in purifying beverages, edible oils, and pharmaceuticals. The filter aid forms a porous layer on the septum that traps solids and prevents it from becoming clogged or

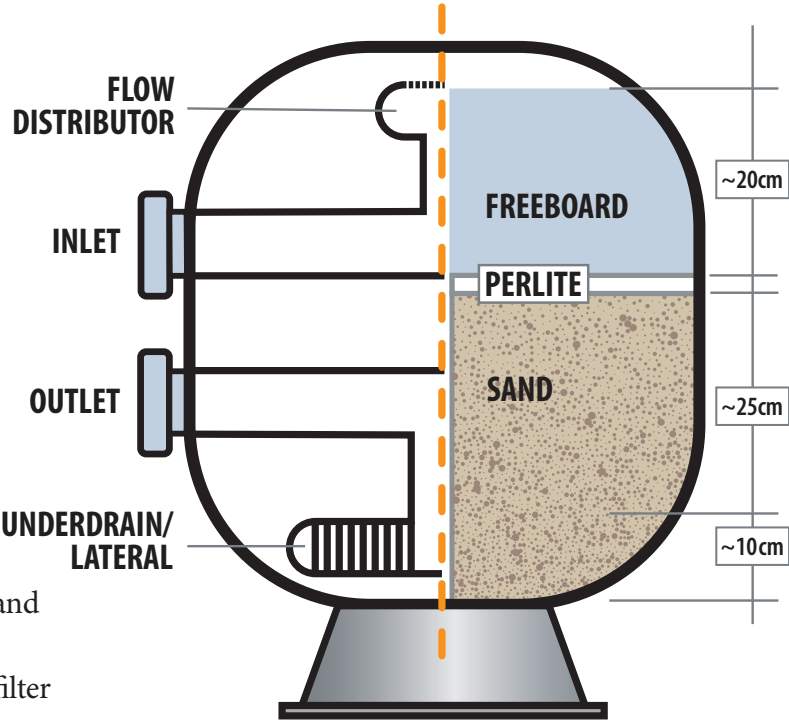


Figure 2 • Cross-sectional drawing of a typical sand filter^[3]

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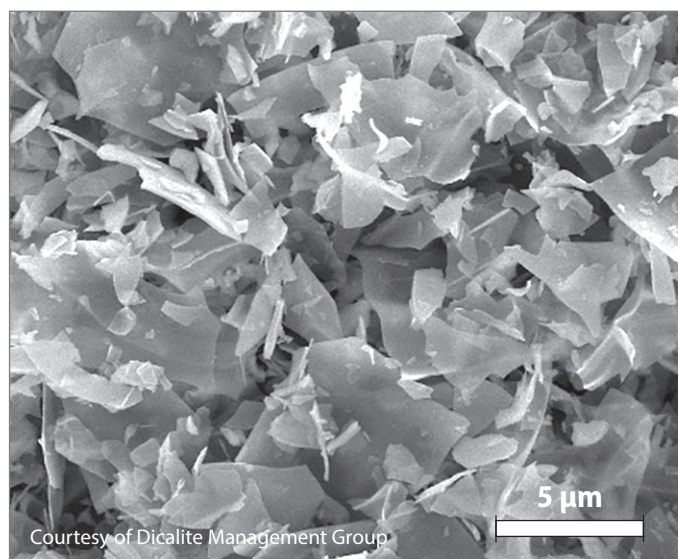
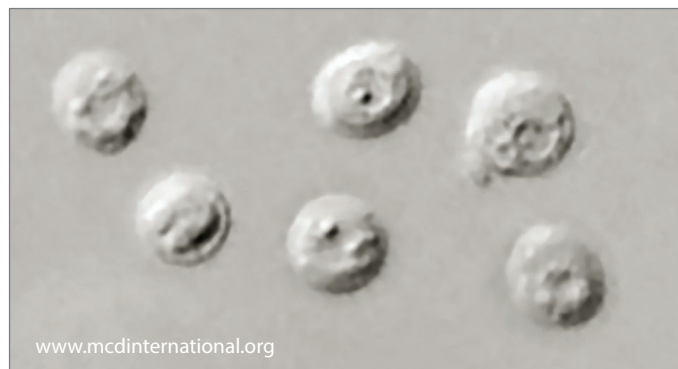


Figure 1 • TOP: Oocysts of Cryptosporidium parvum, in wet mount, seen with differential interference contrast (DIC) microscopy. The oocysts are rounded, 4.2 to 5.4 μm in diameter. ABOVE: Scanning Electron microscopy image of milled and classified perlite filter aid.

blinded. Filter aid particles exhibit a jagged interlocking structure that present numerous microscopic channels when applied in a layer on the septum. Various perlite filter aid grades are available for a wide range of applications, or to achieve optimum flow rate and clarity.

A Case Study: Removal of Cryptosporidium

In a recent study, perlite filter aid was used in combination with a sand filter to remove *Cryptosporidium*-sized polystyrene microspheres from swimming pool water^[3]. The use of a sand filter alone removed only 19% of the microspheres, while adding a thin layer of perlite (1.2 kg·m⁻²) resulted in a nearly 98% removal.

DE Replacement

Diatomaceous Earth (DE) is a another mineral commonly used for liquid filtration. It is made from the fossilized remains of tiny, aquatic organisms called diatoms. Their skeletons are made up of a natural substance called silica. Over a long period of time, diatoms accumulate in the sediment of rivers, streams, lakes, and oceans. This material is mined and calcined (heated at high temperature) to destroy any organic matter. After the separate diatoms are agglomerated, the material is widely used as filter media. The level of agglomeration is controlled to achieve different flow rates. The diatomaceous earth is then milled and separated into various filter aid grades through the use of air classification. Due to the crystalline silica contained in calcined DE, the material has been classified as a Group 1 carcinogen by the U.S. Occupational Safety & Health Association (OSHA). Perlite filter aids are functionally like DE, however the different origin and physicochemical properties render perlite advantageous in the following ways:

DO MORE WITH LESS

Perlite has 30-50% less bulk density, thus comparable filter applications typically require 30%-50% less additive.

EASIER BACKWASHING

DE can build up where it is deposited and be difficult to remove. As a lighter product, perlite does not stick to the filter grids and bind them as easily, which makes the filter backwash easier.

FEW HEALTH CONCERNS

Contrary to DE, perlite filter aids generally contain no, or very little crystalline silica, thus only creates nuisance dust. Appropriate PPE is recommended.

NO DISPOSAL LIMITS

Due to its inert nature, perlite filter cake is not subject to the strict regulations governing its disposal.

EASY SUPPLY

Contrary to DE, a wide network of perlite suppliers is established assuring quick and uninterrupted local supply.

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A Case Study: Use of Volcanic Glass in Filtration

Volcanic glass of rhyolitic composition has been used in gravity fed rapid filters for water treatment and its performance as filter media has been evaluated and compared to sand which is commonly used for such applications.^{[4];[5]} Some interesting findings have arisen:

- The rate and the amount of wash water needed on the cleaning of the filter unit composed of sand is greater than for the bed composed of crushed volcanic material, because of the difference in densities involved.
- Durability tests show that similar to sand, natural glass is resistant to abrasion and/or attrition.
- Volcanic glass is suitable for the treatment of water containing high carbon dioxide content or high acidity, since it possesses lower solubility in acidic environments.
- In swimming pool environments, researchers noted as much as an 88% reduction in the

amount of cleaning water needing to be replaced compared to traditional sand filtration, and that the replacement period could be extended to as much as twice the length of time as with sand filtration.

For more information on perlite filter aid and its application, see the Perlite Institute publications: *Perlite Filter Aids Explained* and *Perlite for Filtration*.

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