

Comparative table between sand and GARO®filtre for irrigation purposes

	Sand	GARO®filtre	comment
Filter Media characteristics			
Material surface	Porous	Smooth, non-porous	Excavated from natural resources, sand offers the benefits of a low price, but it is a porous material with an irregular surface, which encourages bacterial growth within filters. This bacterial development also named biofilm clogs up the filter media and contributes to the creation of preferential paths, to pressure increase and in the end filter clogging. Conversely, biological activity is inhibited in a GARO®filtre bed due to the totally smooth surface of the material. This way GARO®filtre has shown its ability to resist to clogging, especially to algae in filter systems running with sea of surface water. Thus, filter efficiency remains constant during cycles, and backwashes are optimized in comparison with sand.
Grain shape	Rolled or crushed (not so angular)	Angular	The very angular shape of GARO®filtre enhances particle trapping, with an increase of tortuosity of capillaries going through the filtering pack.
Composition	80% Silica minimum, no lime	72% silica, and metallic hydroxides	GARO®filtre predominantly consists of green or brown glass granules. Colorants used to taint wine, champagne or beer bottles are the source of the media catalytic properties which enhances the filtration.
Uniformity coefficient	1,5 à 1.6	1,4 ¹	The uniformity coefficient is related to features read on the particle size distribution curve (CU = d60 / d10). Filtration sand uniformity coefficient is given between 1.5 and 1.6 whereas GARO®filtre is more qualitative with a uniformity coefficient less than 1.4. Indeed, filtration is enhanced when the media has the lowest uniformity coefficient (ideally the media uniformity coefficient would be equal to 1). Otherwise a granular grading takes place during filter backwashes, the smaller particles being led to the surface so that the depth filtration is reduced to surface filtration.
Bulk specific gravity, loose	1.5 – 1.6	1.4	100 litres of media in a filter means 150-160 kg of sand and only 140 kg of GARO®filtre.
Bed porosity (<i>void percentage in the filter media</i>)	~ 40 %	44 %	Sand porosity is about 40%, GARO®filtre offers a greater void coefficient, with the corollary being a greater permeability through the filter media, and a higher storage capacity for retained particles.
Hardness	7 mohs	7 mohs	GARO®filtre hardness is the same as sand's one, and thus higher than most of other filter media. Attrition during backwash is then similar using sand or GARO®filtre. In contrast, backwashes using GARO®filtre are reduced, as a result GARO®filtre lifetime is increased in comparison with sand.

¹ Measured according to NF X 45-401 for GARO®filtre with an Effective size of 1.3

Operation			
Filter rating With an effective grain size of 1.3	100-120 µm	80-100 µm	Under the same conditions of specific speed (flowrate divided by the filtering surface) and raw water quality, the filter rating using GAROfiltre will be lower. Filtration fineness is enhanced substituting the sand with GAROfiltre.
Pressure loss	Reduction up to 50 % replacing the sand with GAROfiltre		The permeability through a GAROfiltre filtering pack is higher than with a sand filtering pack, thanks to a greater porosity. Therefore the initial pressure loss induced by a GAROfiltre filtering pack is 40 % lower compared to the initial pressure using sand with the same effective grain size. The pressure loss during operation is also reduced since depth filtration occurs more than surface filtration, the corollary of this drop of pressure loss being less electric consumption for the pumping system and/or a more reliable pressure on irrigation networks (the electric consumption being more optimized if the pumping system is equipped with frequency converter).
Clogging	very high caking of sand with limestone grip in case of highly mineralized water	Limestone grip delayed	GAROfiltre has a smooth, non-porous surface and without biofilm ⇒ glass granules delay grip phenomenon and thus clogging
	very high caking of sand with algae grip	Algae grip drastically reduced	
Backwash water consumption	Reduction up to 50 % replacing the sand with GAROfiltre		Resistance to biological fouling leads to decreased clogging and thus less frequent backwashes which also means a reduction of backwash water consumption

Advantages are then :

- Increased filtration efficiency,
- Drop in water consumption with more rapid backwash thanks to the smooth and non-porous surface,
- Resistance to biological or lime fouling which leads to decreased clogging and thus less frequent backwashes,
- Drop of pressure loss which means less electric consumption for the pumping system and/or a more reliable pressure on irrigation networks
- Greater lifetime delaying the filter replacement operations,
- Environmentally friendly: more sustainable material than sand.