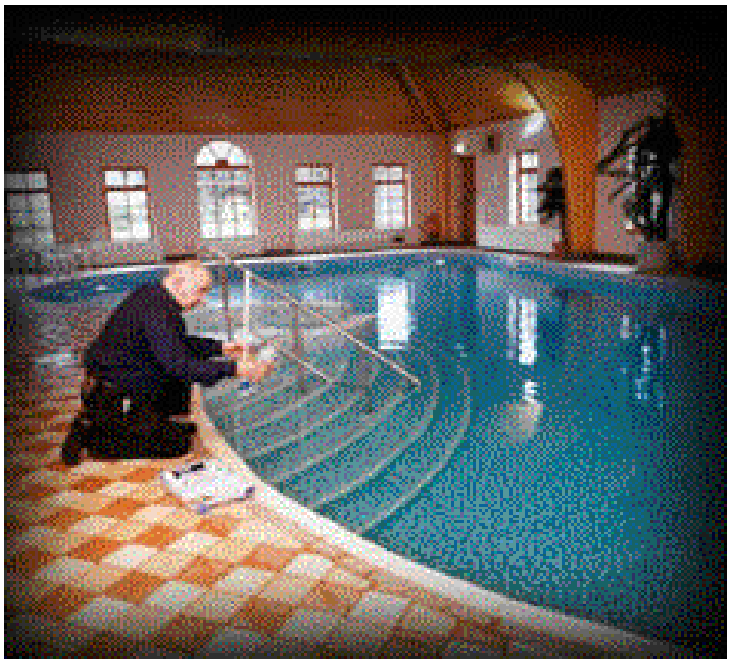
AFM verses Sand filter media in the Swimming Pool industry

The operating costs of media filters can be hidden in the process, it is therefore important to fully quantify the performance requirements of a system and how this relates to operational costs for the entire process. The figures can be quite remarkable and make a strong case to use AFM with a pay back well under 1 year.

In media filtration systems, the actual cost of the filtration media (even AFM) is usually a small percentage of the total cost of the water treatment system, however the long term performance and running costs of the entire system are directly related to the quality of the filter media. Quality is often sacrificed on a cost basis because sand is a disposable product. However AFM should last the life of the filtration system, and as such it is not a consumable or disposable product, but an integral part of the treatment system with major performance and economic advantages over sand.



Filter Performance Issues

Sand filter performance will be equivalent to AFM, during the first few weeks of a new system. However, it does not take long for the surface of the sand to become contaminated, and colonised by bacteria. Once the bacteria have established they will slowly develop through the sand filter bed. Under these conditions there is a gradual deterioration of filter performance and increasing consumption of chemicals.

Sand filters can achieve a semi steady-state situation in which parts of the bed are by-passed due to bed channelling, or there are pea sized balls of sand glued together by bacteria through-out the bed. The bacteria colonies are robust and are not broken down by back-flushing or air scouring. The system operator may not notice the very gradual decline in performance, certainly the filter will seem to be behaving properly, but the performance will be deteriorating. The filter is now seeded with bacterial and ready to move into the next phase.

If the seeded sand filter is turned off for a few hours, or if the operator misses one or more back-flushes, or if the system is hit with a high load of organics (food for the bacteria) then the sand filter may crash. The heterotrophic bacteria in the filter can double their population density every 30 minutes, it then only takes a few hours for the bacterial population density to reach critical proportions and for the sand to fail. Bacteria will be dumped into the water, the water will suddenly become cloudy, combined chlorine levels jump and free chlorine levels can go to zero.

Running Cost

The cost of AFM is considerably more than the cost of sand, however once you take into account the running cost and life cycle costings, then the pay back period can be as short as a few months. Huge cost savings and water quality benefits can be gained by switching to AFM.

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Key points

1. *Pressure drop through the filter bed*
2. *Frequency of back-flushing*
3. *Quantity of back-flush water*
4. *Chemical consumption*
5. *Replacement of filtration media, maintenance and disposal costs.*
6. *Damage to filter, caused by blockage of sand*
7. *Public health implications and pool closure*

Example. **Running costs of sand and AFM based on 1 cubic metre filter media**

The figures have been calculated on the basis of 1 cubic metre of filter media. To calculate the total costs for a pool using 30 tonnes of filter media, multiply the figure by 30.

	Sand	AFM	Mean cost difference £/annum	
			costs	savings
Filter media cost, AFM 15% lower density	150	500	350	**
Water used for back-flushing @ £0.50/cubm	400 cubm	200 cubm		100 (a)
Processing wastewater @ £0.50 /cubm	£140	£70		100 (b)
Running cost energy requirements	£350.40	£273.75		76.65 (c)
Filter media replacement costs	£70	£0		70 (d)
Chemical costs	£1000	£500		500 (e)
Total			350	846.65
Pay back period (350/846.65) x 12 = 5 months				

a. The cost of water will be £0.50 if public water supplies are used, back-flush rate is 30 cubm/hr per square meter of filter bed surface area. Sand back-flushed for 8 minutes, AFM for 4 minutes twice each week. 8 cubic metres of water are used for the sand and 4 cubic metres for the AFM, at £0.50 per cubic, cost saving is £2.00 per week, or £100 per year with AFM
b. There is a cost for the clean water usage, but there is also a cost for the discharge of the back-flush water. This cost is a variable, however it is increasing year on year, a cost of £0.50 per cubm is used in the above table, but it could be several pounds.
c. Water flowrate is 15 cubm/hr at approx. 0.5bar delta P, pumping energy requirement approx. 0.8kw @ £0.05/kw/hr, energy saving approx. 20% with AFM due to lower pressure drop.
d. Replacement cost for sand, normal life before filter failure is approximately 5 years. Cost of sand is approx. £150, labour costs for replacing sand £50, disposal and transport costs £150. Total cost of sand over a period of 5 years is £350; taken over 5 years this is approx. £70/year. The filter media disposal costs may be much higher if the sand is classified as industrial waste under the new landfill directive, costs up to £700 per tonne have been quoted for waste sand.
e. Chemical costs equate with approximately £1000 per year, per tonne of filtration media. This is a rough approximation, but is around +/- 20% of the actual figure. AFM will make around 50% chemical savings per annum because of the lower organic and bacterial levels in the filters.

AFM benefits

- *Better water quality*
- *Better water clarity*
- *Pay back under 1 year*
- *100% sustainable product*
- *protect public health*

AFM is being reviewed for BAT (Best Available Technology) for water filtration and treatment. AFM is also in compliance with local authority sustainable procurement policies.