

# Water Filtration for the Modern Hydrometallurgical Process Plant

## Presenter

## Stewart Shipard

B.AppSc Chem, G Dip Met, C PLC Prog.

Owner Manager

SLS Technology Pty Ltd

AusIMM member +20 years

[info@slswaterfilters.com.au](mailto:info@slswaterfilters.com.au)



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## Acknowledgements

This document contains photographs created by SLS and public domain pictures of installations of SLS products and other water filters at various locations around the world. SLS Technology Pty Ltd wishes to thankfully acknowledge the use of all such material for its educational value.

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1/173 Planet St, Carlisle  
Western Australia 6101  
info@slswaterfilters.com.au



Water filters perform many different tasks at mine sites

## Today's talk is focussed on Media Bed filters.

All media bed filters perform  
water purification

### Polishing/clarifying filters

Improve the purity of a water, such as

- reduce total suspended solids
- removal of microbes

Some media bed  
filters also provide a  
chemical reaction

### Process Filters

Combine a chemical or biological assisted reaction with  
filtration to improve the chemistry of the water, for example

- A precipitation reaction, such as softening
- an oxidation reaction such as iron removal
- a reduction reaction such as Nitrate removal

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# Polishing or Process Filters

There are basically 2 types

Membrane barriers or Media bed filters

## Examples

Membrane Filters		Media Bed Filters	
Pressure	Vacuum	Down flow	Up flow
<ul style="list-style-type: none"> <li>• Plate filters</li> <li>• Disc filters</li> <li>• Drum filters</li> <li>• Cartridge filters</li> <li>• Bag or sock filters</li> <li>• Tube filters</li> <li>• Hollow fibres</li> </ul>		<ul style="list-style-type: none"> <li>• Sand filters</li> <li>• Dual media filters</li> <li>• Carbon filters</li> <li>• Textile Media filters</li> <li>• Glass bead filters</li> <li>• Synthetic media filters</li> <li>• Green sand media</li> <li>• Zeolite media</li> <li>• Husk, fibre or shell grit filters.....</li> </ul>	



# World's first ceramic membrane filter?

The ancient Inca tribes learnt how to manufacture porous ceramic membrane pot shaped filters over 2,000 years ago. So to the Egyptians!

# World's first membrane process filter?

By 500AD, Guatemalan tribes had learnt that by adding silver and copper to the ceramic filter pot they obtained a water sterilisation process filter.

We have come a long way!

NASA uses silver copper ceramic filters for water recycling on space craft.

**Did you know ?**

**The Romans and Venetians sensibly designed and used sand media bed filters 1500 years ago. --- So why are there inferior design decisions today?**

# 3 most common reasons why media bed filters get a bad wrap

1	Under sized tank	High flux = poor adsorption High TSS = insufficient media depth for the amount of fines
2	Poor operating methods	No automation or partial control, illogical pre treatment process concepts, eg Large particles in feed, stop start operations, insufficient backwash agitation or rinse volume
3	Poor choice of media	Poor adsorption, difficult to backwash, short media life

## COMMENTS

a) Design guides for sand filters are readily available ANSI/NSF, AWWA + US and Euro EPA --- so why do we see inferior design decisions today!

b) Highlights importance of knowing technology limitations and operating practise before the design selections, not after!

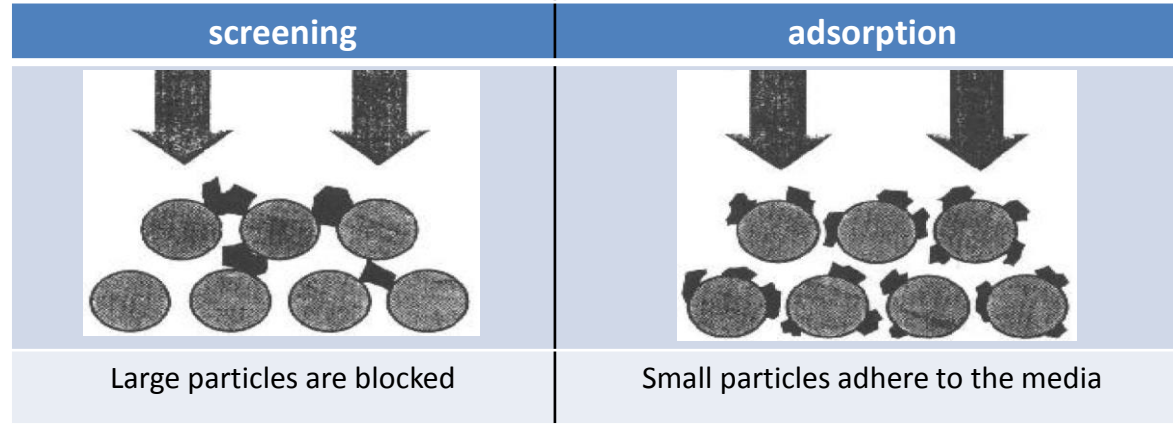
c) **Poor choice of filter media**

- **Worked at the last mine!**
- **Convenient to procure from the pool shop!**

# Sensible Media Bed Filter Design

## How do they work?

A simplified explanation with 2 mechanisms



### Comments

- A media bed filter is not a renowned screening mechanism, but for removing 50 micron contaminants an automated media bed filter is about the same Cap cost as an automated screen but the filter has Lower Operating cost.
- More than 85% of mining applications require design emphasis on the adsorption mechanism. (i.e. Contaminants are less than 20 micron)
- Well designed & operated media bed filters can and do remove sub one micron particles.



# Media Bed filters are found in both polishing and process applications

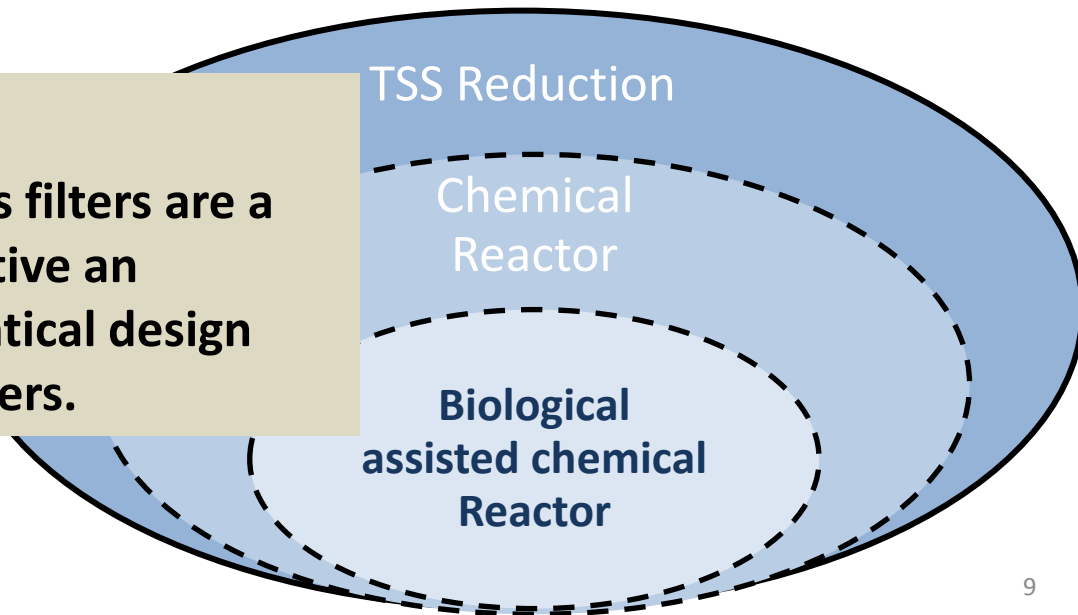


## From the designer's perspective

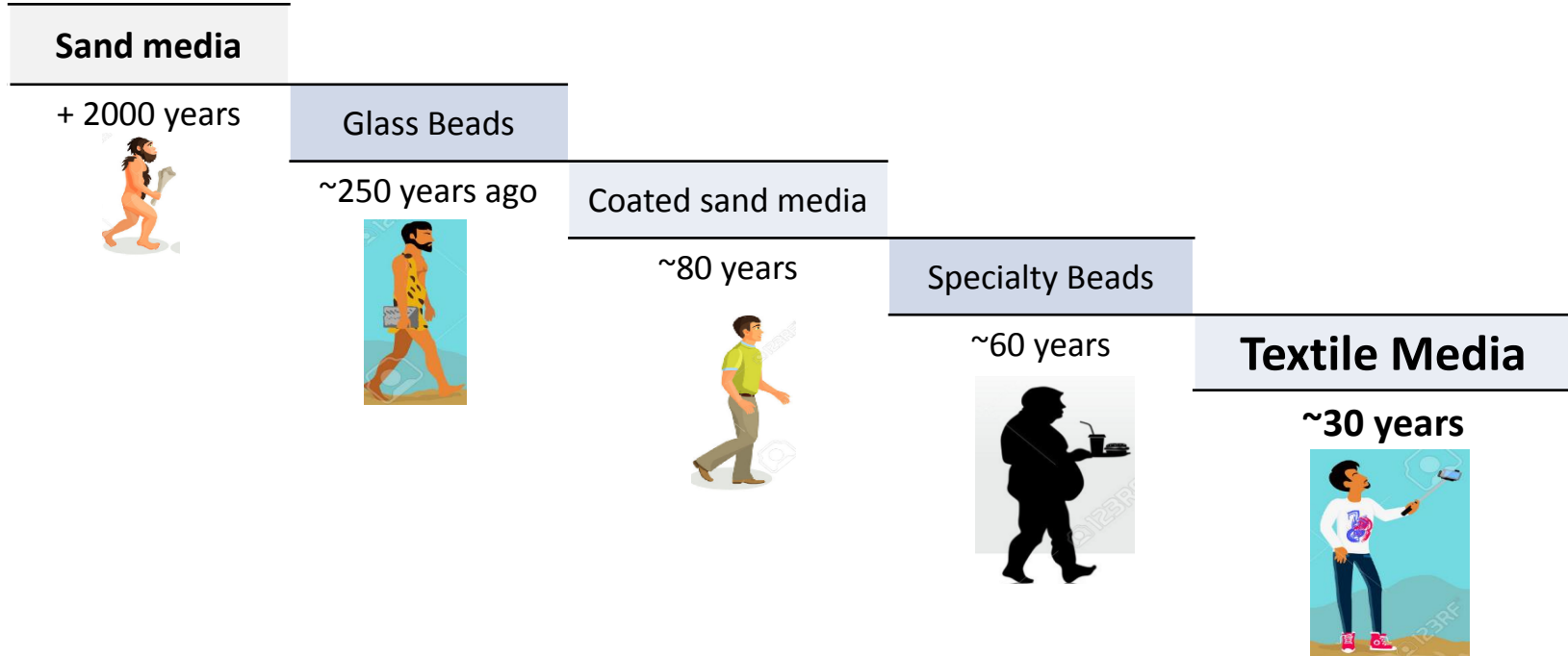
media bed filter installations can be divided into three application groups according to the primary design objective.

### Design basics

All filters reduce TSS, the process filters are a subset, from the design perspective an engineer applies essentially identical design parameters for all media bed filters.



# What are the latest improvements with regard the media for polishing filters?



# Specialist Chemical Process media bed filters

## World's first media bed process filter?

1. circa 2000BC. Ancient Hindu Sanskrit writings recommended that activated carbon be used for water process filter applications.

*--- Whilst science has progressed significantly in 4000 years we do see inferior design an operating decisions for activated carbon filters today!*

## World's first synthetic media bed process filter?

2. The US EPA has approved more than 6 specialty coated filter media as suitable for drinking water manufacture; but only under their design guide regulations.

*The EPA guide preface does state that specialty media are useless without appropriate process engineering!*

# Nowadays many different process filter media are available



Classification		Filtering media types	Application
Catalytic Media	<b>Electro-Catalytic</b>	Greensand Manganese sand Synthetic coated sands DMI 65	Iron removal Ammonia removal
	<b>Photo-catalytic</b>	Silver bead, TiO <sub>2</sub>	antimicrobial
Reactive media (Media that dissolve)		Activated Carbon organic fibres Limestone	NO <sub>3</sub> , Cl <sub>2</sub> , SO <sub>4</sub> removal Water hardening
Adsorption media	<b>Lyophilic</b>	Anthracite Activated carbon nutshell	Removal of organics, micelle droplets or organic material
	<b>Natural and synthetic minerals</b>	Granular Hematite	Arsenic, phosphate removal
		Synthetic Alumina Silicates	phosphate removal
		Zeolite	Water Softening
	<b>Specific affinity</b>	Activated alumina Silver/Copper	Fluoride removal Pathogen kill



# Textile Media Bed filtering

Lowest known CAPEX \$/Performance ratio

**Why it  
continues  
with sales  
growth**

Features	Benefits
Higher filtration flux	Lower capital costs Smaller footprint
Larger window of operation	Higher feed TSS
NO max particle size limitation	Less pre treatment concerns
Larger bed depths	Better filtrate clarity differential
Longer media life	Lowest maintenance cost
Non abrasive media	Filter tank internals don't corrode
Floccule friendly	High MW polymers can be applied to the feed
Wide pH range	0-14

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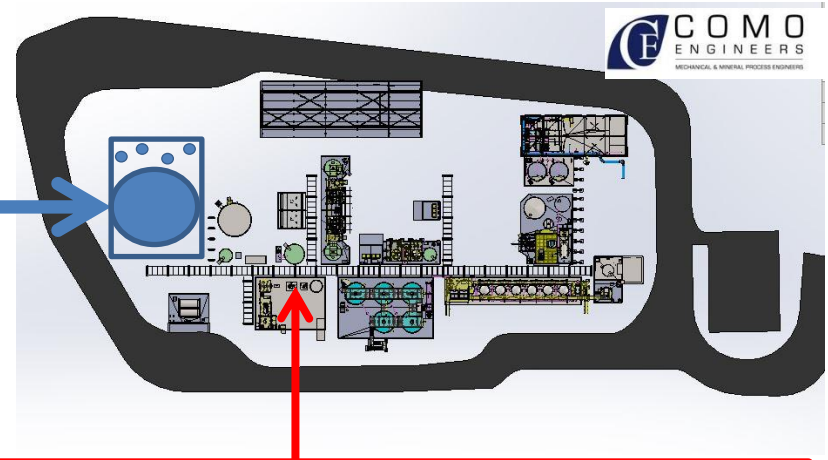
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info@slswaterfilters.com.au

# Textile media bed filters offer a significantly higher TSS operating window



This area was originally set aside for a 26m clarifier + 4 x 18m<sup>2</sup> sand filters



Process Design Engineers chose to install a **one** Textile Media Bed Filter plant

## Mongondow Gold Mine, Sulawesi

Heap Leach with IX recovery

Pregnant liquor filtration

FM-U-2625

2600mm Diameter Tank , 300mm piping and valves

**Design Feed 350m<sup>3</sup>/hr at 50mg/L**

Install Date 2005



## Twin Hills Silver Mine, Qld

Merrill Crowe Process plant

Pregnant liquor filtration

FM-U-2125

2100mm Diameter tank, 250mm piping and valves

**Design feed 200m<sup>3</sup>/hr at 300mg/L**

Install Date 2011



Up flow textile media bed filtration is recommended when for alkaline liquor filtration i.e. pH>9

Case  
Studies

Up Flow  
Filtration

SLS

Installations

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# Case Studies

An advantage of down flow textile filtration is it better handles stop start operation

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info@slswaterfilters.com.au



## Kalgoorlie Nickel Smelter

Process water return

FM-0820

800mm Diameter tank

80mm piping and valves

**Design feed 40m<sup>3</sup>/hr at 100mg/L**

Install Date 2011



## Martabe Gold Mine

Process Plant Intake Water

FM-1620

1600mm Diameter Tank

150mm piping and valves

**Design Feed**

**140m<sup>3</sup>/hr at 100mg/L 70m<sup>3</sup>/hr at 500mg/L**

Install Date 2012





# Textile media bed filters provide a Significantly Reduced Footprint

## Acknowledgments

photo - Tokyo Water  
Sand Filter – MetWater  
Textile filter - Ishigaki



	Sand filter	Textile Media Filter
Capacity	2500m <sup>3</sup> /day	2500m <sup>3</sup> /day
Tank Diameter	5.0m	1.6m
Filtration Flux	5.3m <sup>3</sup> /m <sup>2</sup> /hr	51.8m <sup>3</sup> /m <sup>2</sup> /hr

# Clever Improvement in Textile Media



## Type of Textile Media

### Felt cloth



### Life expectancy

Degradation though  
continuous fibre release

Usage Life circa

**3,000 – 4,000 wash events**

### Typical wash time

**~ 10 minutes**

### Melt rolled cloth



Does not release fibres

Predicted Usage Life

**10,000 ++ wash events**

**~ 7 minutes**

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**THANK  
YOU !**

## ***Further information***



**Please contact - Stewart Shipard**

- At the conference
- Perth office ++61 8 9361 6262

***SLS* Technology Pty Ltd**

**Water Treatment & Engineering Consultants**

1/173 Planet St, Carlisle

Western Australia 6101

[info@slswaterfilters.com.au](mailto:info@slswaterfilters.com.au)