

QuickTime™ and a  
decompressor  
are needed to see this picture.

## **Understanding The Baleen Filter (Self Cleaning Micro Screen) With Reference To The Recovery And Upgrade Of Fine Coal From The Feed To Thickeners.**

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### **Abstract**

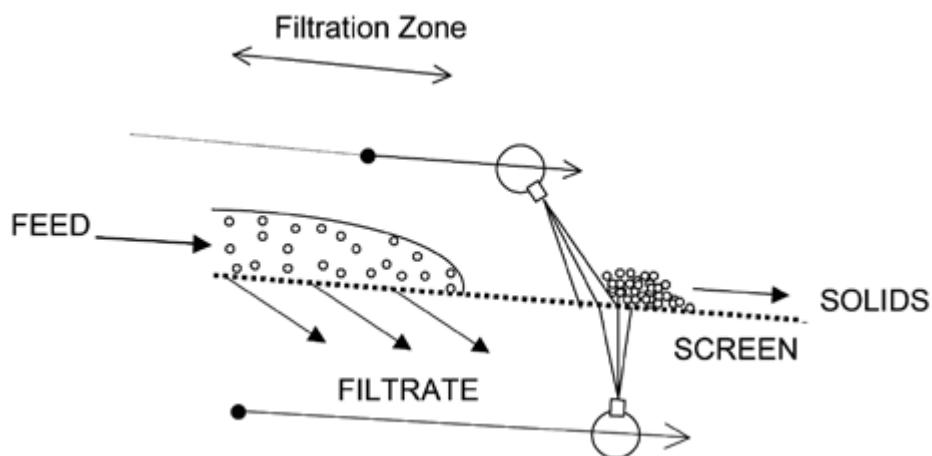
The coal industry's focus upon filtration and separation technologies has been steadily growing in recent times, and with the uptake of innovative advances in micro-separation techniques the need for improved economic fine coal recovery is becoming more important, particularly as technologies such as the Baleen Filter now make this possible. The micro screen is a high flow, small foot print, low utility and maintenance self cleaning micro screen with an absolute aperture that can maximize the upgrade and recovery of fine coal from the feed to a coal thickener.

### **Research And Development**

The Baleen technology evolved as the result of a five-year Research & Development program conducted at the University of South Australia in collaboration with industry partners from the food, beverage and manufacturing industries. It was conceived by a general need for cost-effective means for wastewater handling and treatment, stimulated by an ever-growing demand for simplified methods for wastewater reuse and recycling. The solution brought to market is a continuously self-cleaning filter and separation technology capable of removing traditionally 'nonfilterable' contaminants from all types of process streams. The market opportunity seems endless with proven applications across the: meat and by-product (abattoir, tannery and rendering operations); wood, pulp and paper; wine and beverage; food and dairy; aquaculture; manufacturing; vehicle and plant washing; mining; and municipal (both in water supply and sewerage) industries. It has the potential to vastly improve, if not re-engineer traditional process practices across industry, according to reports from its developers.

## Unique Micro Screen Self Cleaning Process

The Baleen technology, protected by international patents, is based on a simple, yet ingenious 'double act' of high pressure, low volume sprays, one of which dislodges material caught by the micro screen, while the other sweeps it away for collection. As water flows through the micro screen, substances initially suspended in the water are left behind by the filtrate, but before they are allowed to substantially accumulate and adversely blind the micro screen the 'double-act' effects their removal from the filtration zone to thereby sustain the separation process (see Figure 2). The principles of operation rely upon the response of particle (and droplet) dynamics to laminar flow under ambient condition. Reliability of the Baleen separation process is achieved by 'state-of-the-art' process control to ensure trouble-free 'absolute' screening from between 1,0 mm<sup>2</sup> (1 000-microns) to less than 250-microns or micro-screening to less than 25-microns, and nominally to 5-microns when using chemical assistance. The Baleen technology separates both solid and sticky matter to a specific micron rating for collection as a 'natural' mass, typically of spade-like consistency with minimal 'free' water retention.



## Technical Performance

The Baleen technology is able to effectively separate both organic and inorganic matter from water to less than 25-microns (1/16th of human visibility). In addition, when coupled with secondary treatments involving chemically assisted techniques (egg, precipitation, coagulation, absorption, etc), filter efficiency increases to also capture suspended matter to less than 5-microns (1/400th of human visibility). Success of industry trials demonstrates the technology's ability to separate a wide range of matter (solid, semi-aqueous or immiscible), including those constituent in highly potent process streams in which combined suspended solids or fat concentrations exceed 5 000 mg/L.

Continuing research is assisting new and extended market opportunities for the technology. Successful application has been based upon gaining an intrinsic understanding of stream constituents in terms of physico-chemical properties, in lieu of biodegradability attributes. Such properties include volume loading variances, particle size populations, settle-ability, constituent-water interaction and their flow-dynamics at differing filter ratings to determine separation limitations.

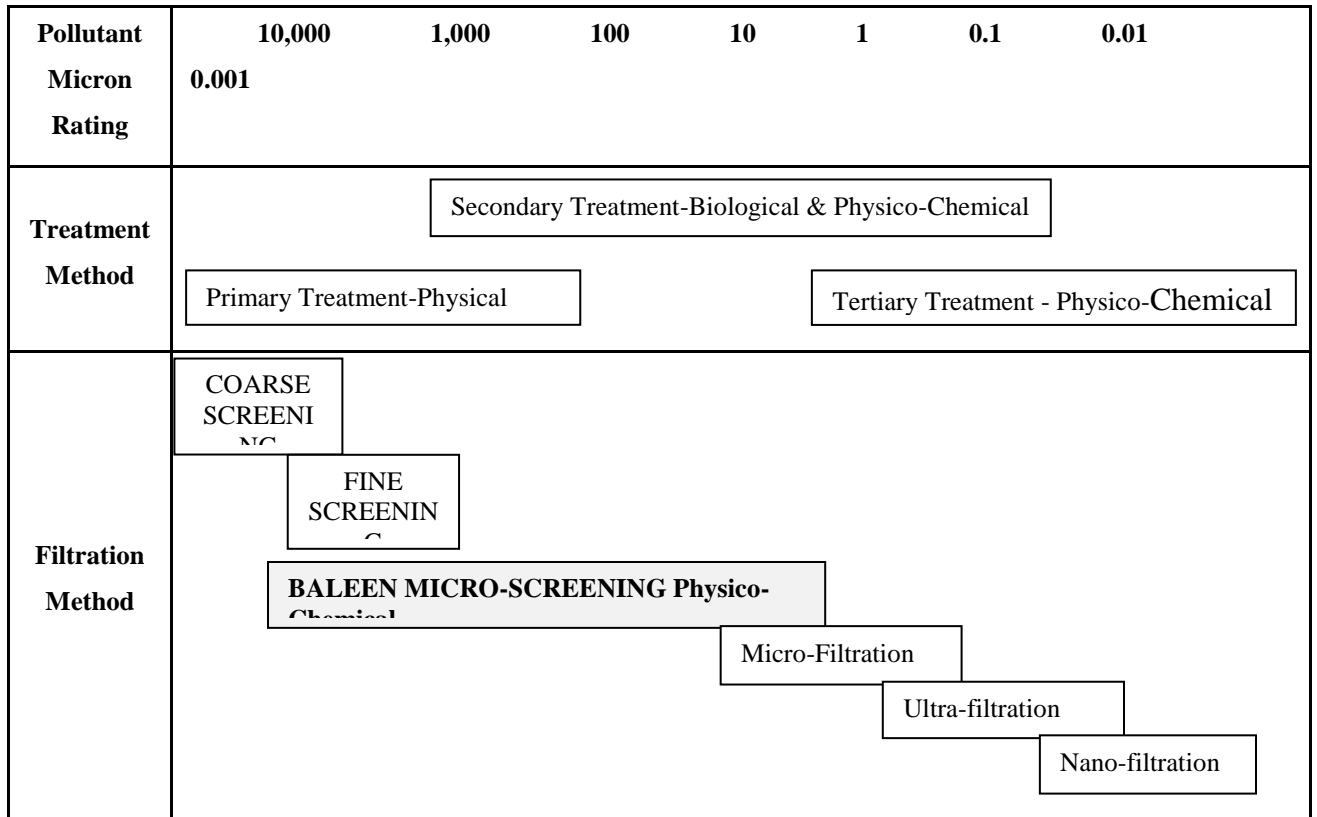
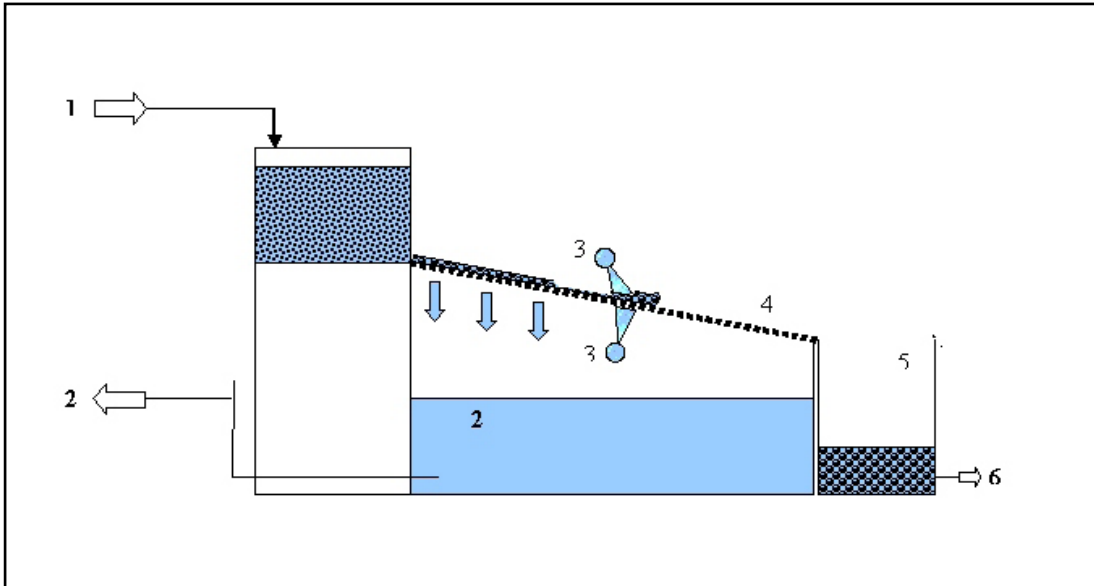


Figure 1: Filtration Spectrum

## The Baleen Filter – Self Cleaning Micro Screen.



1. Feed to header tank
2. Filtrate/undersize
3. 'Double act' of high pressure, low volume spray bar
4. Screen discharge/dewatering of oversize solids
5. Dewatering bin (for batch operations)

The trial Baleen Filter mounted on a trailer.



The Baleen Filter consists of-

The pump control unit, where all the utilities are fed through to the screen i.e.

Compressed air – 6cfm @ 6 bar

Power – 220 volt at 10 Amps

Spray Water – particulate free @ 4 bar

The above utilities are specifically for the trial unit as seen in the photo above.

The micron screen is static, with a pneumatically driven spray bar carriage for cleaning the micron screen.

The fine coal is fed through the distribution header over the screen with the oversize reporting to the solids bin. The undersize out the bottom of the built in sump.

## The Use Of The Baleen Filter – Self Cleaning Micro Screen For Fine Coal Separation.

Trials have been run on the feed to the thickener on a number of South African coal processing plants with good results. The objective during the trials was to upgrade the fine coal and maximize the mass recovery of the coal so that it would be economically viable to sell the coal that is generally been discarded.

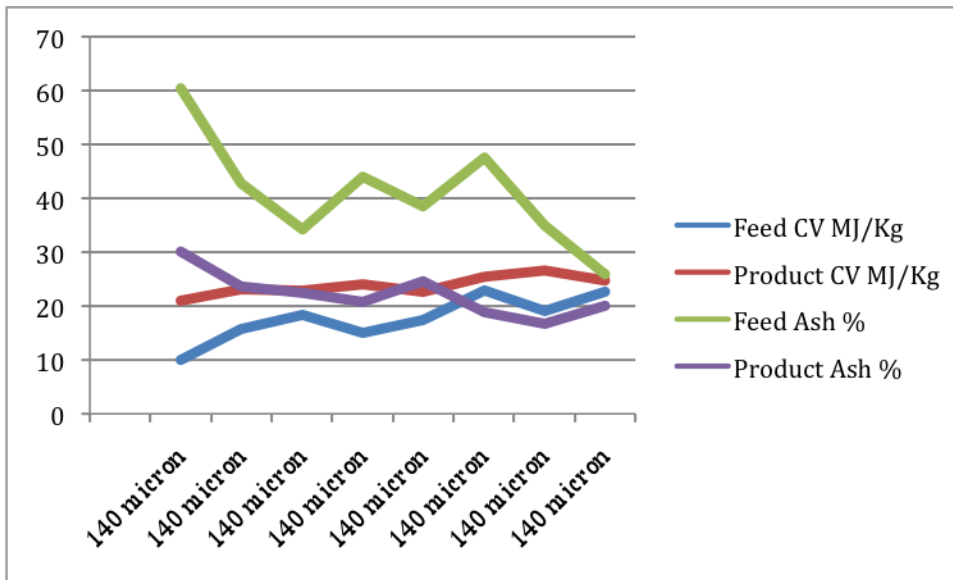
### Trial 1

Thickener Feed

Screen Aperture 140 micron

Average Results

Feed CV MJ/Kg	Product CV Mj/Kg	Feed Ash %	Product Ash %	Mass Recovery %
17.66	23.75	41.00	22,16	80.03

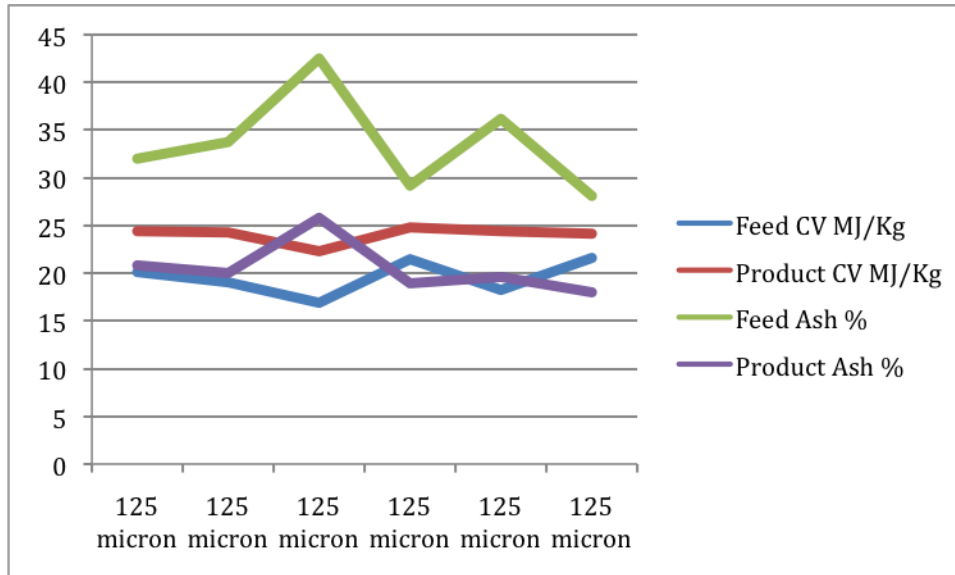


Graph Shows individual sample results on the 140 micron screen.

It is clear from the results that there has on average been a 34.48% increase in CV and a 45% upgrade in the ash with a good mass recovery of 80.03%.

Screen Aperture 125 micron

Feed CV MJ/Kg	Product CV Mj/Kg	Feed Ash %	Product Ash %	Mass Recovery %
19.55	24.05	33.63	20.52	86.90



Graph Shows individual sample results on the 125 micron screen.

It is clear from the results that there has on average been a 23.02% increase in CV and a 38.98% upgrade in the ash with a good mass recovery of 86.90%.

### Baleen Filter Installation

Screen Aperture            125 micron  
 Flow Rate                    580 m3ph  
 Feed to plant                35 tph  
 Mass Recovery               86.9 %

Product Recovered        30.41 tph  
 Saleable coal recovered   21 500 tons per month

Baleen Filter                60W15 – 304SS – T1  
 Cost Estimate               R3 000 000.00 ex vat

Coal Price                    US\$45 per ton (Export) or R70 per ton (Local/ power station)  
 Additional Income        R7 546 500 or R1 505 000 per month

Payback                      2 weeks or 2 months (Depending on where the coal is sold)

In addition to recovering saleable coal, there is reduced load to the thickener and also extended life to the discard slimes dam.

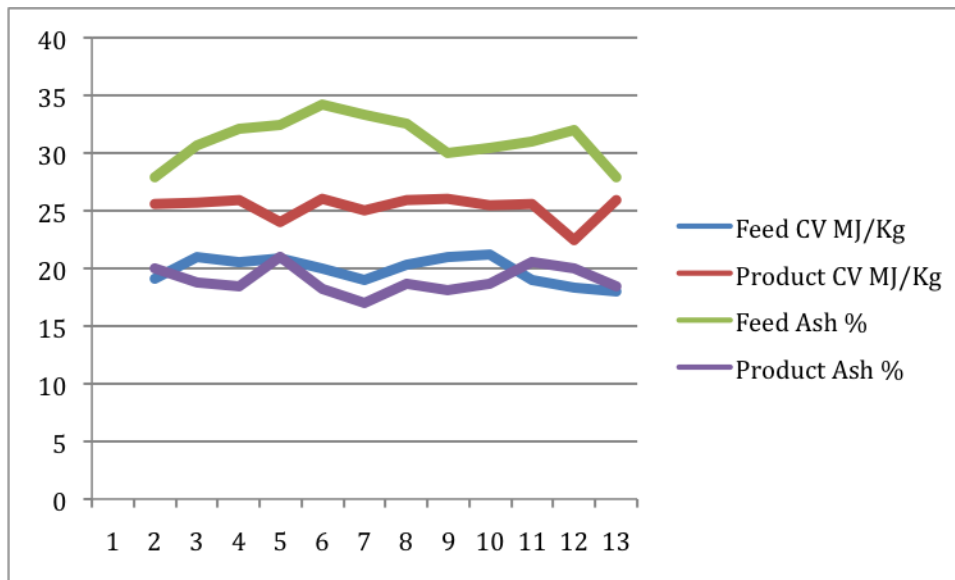
### Trial 2

Thickener Feed

Screen Aperture 140 micron

Average Results

Feed CV MJ/Kg	Product CV Mj/Kg	Feed Ash %	Product Ash %	Mass Recovery %
19.96	25.35	31.44	19.15	53.55



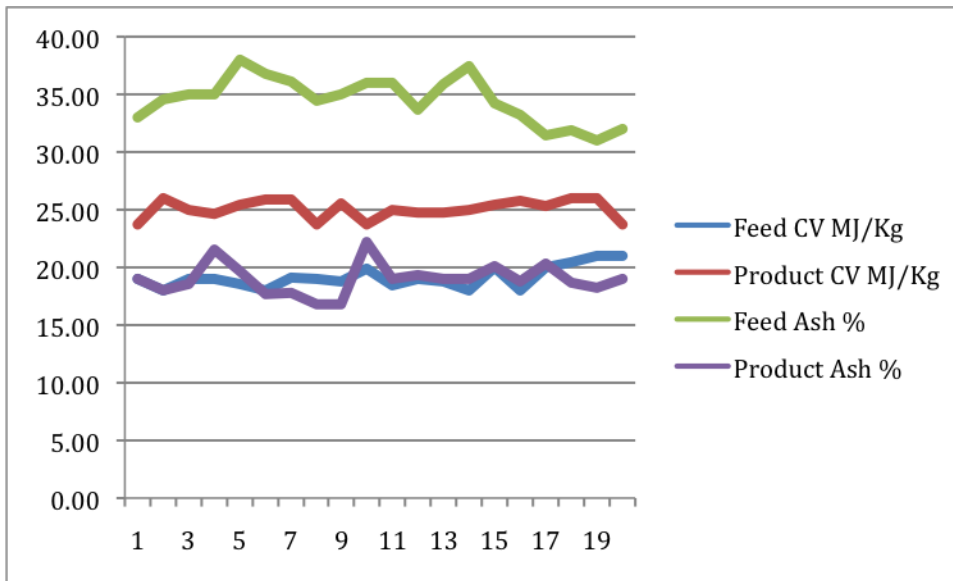
Graph Shows individual sample results on the 140 micron screen.

It is clear from the results that there has on average been a 27.00% increase in CV and a 39.09% upgrade in the ash with a good mass recovery of 53.55%

Screen Aperture 90 micron

Average results

Feed CV MJ/Kg	Product CV Mj/Kg	Feed Ash %	Product Ash %	Mass Recovery %
18.93	24.84	35.54	19.79	62.80



Graph Shows individual sample results on the 90 micron screen.

It is clear from the results that there has on average been a 31.22% increase in CV and a 44.31% upgrade in the ash with a good mass recovery of 62.80%.

#### Baleen Filter Installation

Screen Aperture	90 micron
Flow Rate	826 m3ph
Feed to plant	40 tph
Mass Recovery	62.80 %

Product Recovered	25.12 tph
Saleable coal recovered	18 000 tons per month

Baleen Filter	80W15 – 304SS – T1
Cost Estimate	R4 000 000.00 ex vat

Coal Price	US\$45 per ton (Export) or R70 per ton (Local/ power station)
Additional Income	R6 318 000 or R1 260 000 per month

Payback	3 weeks or 3 months (Depending on where the coal is sold)
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In addition to recovering saleable coal, there is reduced load to the thickener and also extended life to the discard slimes dam.

In order to understand the full extent of both equipment scale up and economics it is advisable to run a trial on site and quantify all the necessary benefits.

### **The Future Of Micro-Screening**

The use of the Baleen Filter in the coal industry will certainly grow in time as more and more applications are explored, particularly with the ability to go down to low micron levels to de-slime, upgrade and recover fine coal.

The ever-emerging demand of environmental authorities at all levels, and pressures from society to reduce pollutants in all forms, are placing ever-increasing costs on water users. The Baleen technology provides an affordable, simple means for practitioners to enhance environmental compliance, and in many cases return immediate cost-savings (based on load reduction) to provide a ready solution to costly disposal. From a practical perspective, Baleen can be employed in any fine mineral, water or waste water application and can be readily integrated into existing processing plants regardless of treatment-method.

Tangible benefits include: displacement of land-area occupied by settling volumes; enhanced water recycle and re-use; byproduct recovery; improved plant performance and reliability; reduced plant maintenance; environmental compliance, including ease of mobility for tactical clean-up or emergency pollution response.