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1. INTRODUCTION

The buzz words of recent times have been “sustainability and footprint”, put simply they refer to the awareness of consumption and measurement of impact by individuals or companies making environmental choices to ensure that they don’t overdraw resources from nature.

Two institutions that can assist you with calculating your ecological footprint are:

1. The Victorian EPA, www.epa.vic.gov.au (and follow the various prompts).
2. Dr Mathis Wackernagel sites,
www.rprogress.org
www.ecofoot.net
www.redefiningprogress.org/footprint
www.footprintnetwork.org
 (follow the prompts to participate in your own footprint).

In Australia it is recommended that you contact the EPA for an accurate footprint of your business and they may refer your details to one of the universities for the calculations.

Sandmar’s pursuit of reducing its ecological footprint has seen the development of “Coloured Formula Optimisation” as a manufacturing tool used in production scheduling, hence resulting in various savings from water reduction, reduced labour, minimising overheads and increasing our respect for the environment whilst maintaining a healthy bottom line.

Sandmar has implemented various business strategies to maintain competitiveness in the market place resulting in quality products, streamlined manufacturing, automated filling lines and a cheerful work crew who aim at prospering the business through caring for the environment.

2. COMPANY HISTORY

Sandmar Products Australia Pty Ltd is a wholly owned Australian company, located in the eastern suburbs of Melbourne and servicing the construction industry since the early 1990’s with an enviable reputation for quality and service.

The company name “Sandmar” originated from combining the first two names of the owners Sandy and Martin Thomas who humbly look back on the early days of product development in a small factory in Scoresby as compared to our current factory complex, housing all manufacturing, product research and development, quality control, filling lines, warehousing and direct sales to public from reception.

In keeping with modern trends, our product range is exclusively water based technology.

Our product range comprises of the following:

- Aquepoxy® Sealers & Floorcare products
- Acoustic & Fire rated construction sealants
- Acrylic Joint Sealants for tilt up construction
- Coloured Caulks
- Coloured Gap Fillers
- Construction Adhesives

Aquepoxy® is a registered Trade Mark of Sandmar Products Australia Pty Ltd.

Sandmar's focus on product development has successfully released a broad range of products from construction adhesives to floor sealers and we are always interested to discuss with prospective clients further developments to cater for their needs.

Sandmar also participates in "retain reclamation", this means conducting stability testing on all retain samples for two years and then reconstituting the small quantity of 500 grams back into new product. This plays an important part of the recycling system that results in no disposal of product into landfill.

We also provide complimentary samples of sealant and fillers including our Aquepoxy range of two part water borne epoxy coatings for concrete floor finish which allows customers to evaluate prior to purchasing and this reflects a marketing strategy through quality product promotion.

As a two part water borne epoxy coating system, the Aquepoxy range of products are supplied as the Part A (coloured component) in a 15 litre pail, and the Part B (latex component) in a 10 litre pail, as shown in the photograph below. Applicators mix these on site and apply the coating system onto concrete floors by spray, brush or roller.



Fig 1 – Aquepoxy Two Part Kit And Application Equipment.

The Aquepoxy range of products come in twelve colours, which are shown below, and each colour is made in its own vat, therefore any residue left in the vat after filling is washed down with clean tap water and this water becomes the initial stage of a new batch, no waste just a continuous cycle.



Fig 2 – Aquepoxy Colour Range.

All the other products are made in the Stainless Steel Ribbon Blender.

Graffiti 2000, a solventborne Anti-Graffiti treatment developed by Sandmar was successful for many years and was made under the Onslow High Speed Stirrer. This product line of the business was recently sold to a company in England.

3. COLOURED FORMULA OPTIMISATION

Sandmar's strong commitment into research and development had the technical team working on methods of manufacturing waterborne sealants in a range of multiple colours in the Ribbon Blender (elevated horizontal mixing machine) without adverse effects on colour reproducibility and remaining conscious of the water consumption required for the washing in between batches.

The technical team set about their tasks by selecting to make all twelve coloured sealants on a small high speed stirrer in a one kilo quantity in the laboratory. The idea of starting with the lightest colour and progressing to the darkest was not so straight forward, especially when you have colours ranging from off-white, vanilla, cedar, light grey, black and brown.

Many of the lab batch trials were not matching the "colour standards" so it was time to tackle the formulation by modifying the levels of iron oxides, introducing surfactants for colour development and the addition of titanium dioxide to whiten and return to a neutral base.

It's the very core of persistence that was required to develop reproducible colours in a set sequence that has given Sandmar the ability to save a minimum of 400 lt of water per production batch and four hours worth of labour. Success was finally at hand when certain colours were reproduced out of sequence with the smallest amount of formula tweaking to achieve a 100 % match. A further benefit was noted by way of zero yield loss when a wash up was not required and the outcome was considered a win-win situation.

The following flow chart shows various sequences to allow the manufacture of any sealants requested by our clients ordering schedule.

Sandmar's Coloured Sealant Flow Chart Sequence.

All the following colours can be made over Neutral Base 351 (a waterborne sealant).

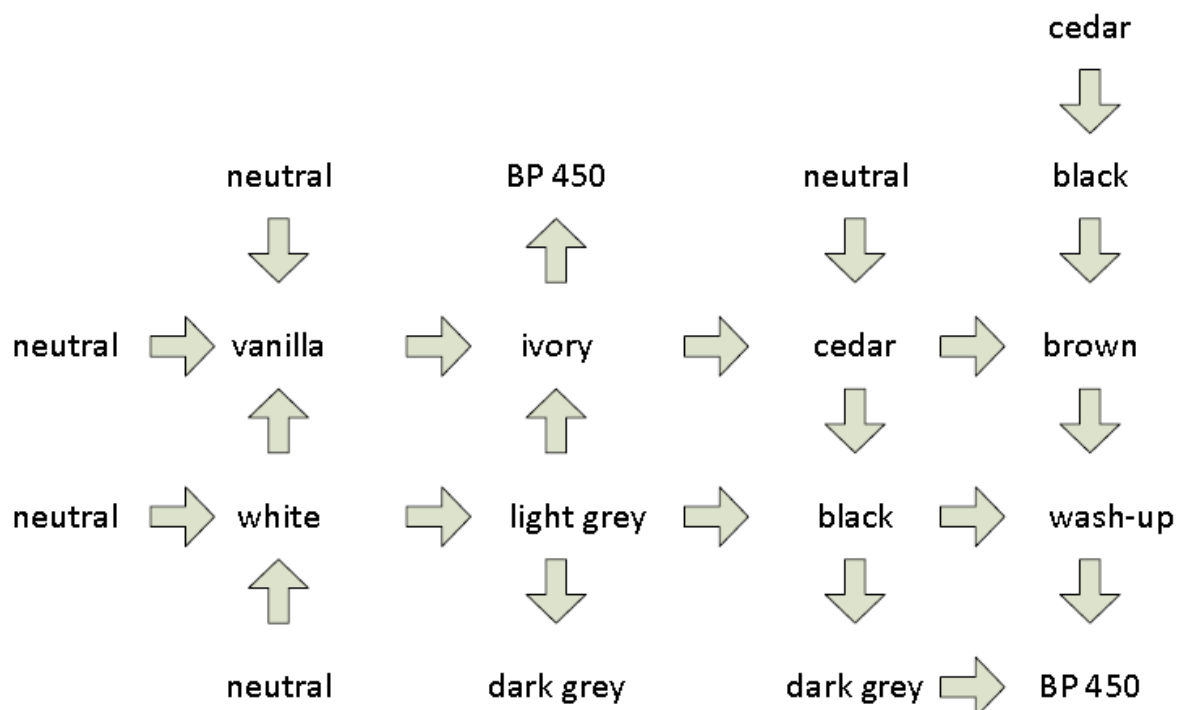


Fig 3 – Sandmar's Coloured Sealant Flow Chart Sequence.

We should point out that BP 450 is a grey sealant.

The above colour combinations allow Sandmar to carefully plan their production schedule and cater to the ordering requirements of our clients and a typical three colour order is fulfilled within a week.

4. THE ECO FOOTPRINT

The Ecological Footprint was a collaborative idea between Professor William Rees and Dr Mathis Wackernagel who went on to pioneer the measurement of consumption by humans on earth and how our decisions impact on nature.

As the Founder and Executive Director of the Ecological Footprint Network, Dr Mathis Wackernagel has authored or contributed to various books on sustainability that focus on the questions of embracing limits and developing metrics for sustainability that include:

1. Our Ecological Footprint
2. Reducing Human Impact On Earth
3. Sharing Nature's Interest
4. World Wildlife Fund (WWF) International Living Planet Report

This is an example of how Dr Mathis Wackernagel calculated the American Ecological Footprint,

If we divide the planet's ecological capacity by the world's population, we get around two hectares per person, we can then compare that surface area with the area necessary for us to produce food, fibres, to absorb CO₂ and to host our infrastructure. When we add it up for the United States, it roughly works out to 9 – 10 hectares of ecological capacity to provide for the average American. That means if everyone lived like an American, it would take six planets to sustain such a lifestyle, yet we only have one Earth.

Based on this philosophy, I undertook the first case study with the Victorian EPA in 2001 and applied it to the coatings industry to further understand how small to medium sized business could benefit from these calculations and implement strategies to improve their bottom line.

Calculations were made by Melbourne University based on information provided by Sandmar on Aquepoxy two years ago; this takes into account all the requirements to produce the product:

- a. all the raw materials used
- b. all the deliveries required to acquire the raw materials
- c. all the labour and overheads
- d. all the filling and packaging
- e. all the storage for completed goods
- f. time to manufacture a batch
- g. destination of sale of goods

Our Aquepoxy Concrete Coating 25 Lt pack returned with an Ecological Footprint of 24 Global Hectares, this figure is not so high as compared with the average 4 Lt can of paint sitting at 30 gha.

The main reasons for achieving a lower footprint as compared with a 4 Lt can of paint are:

1. lower number of raw materials per batch
2. less time to manufacture
3. less labour and reduced overheads
4. cost effective packaging in 25 Lt as compared to 4 Lt
5. less raw materials means less ordering and deliveries, this also reduces the amount of labour required to organise all the supplier raw materials therefore reducing the total impact on the demand of goods and services.

Over the following two years, a conscious effort was made to try and reduce our footprint of 24 gha by implementing the following,

1. ordering raw materials on a monthly basis
2. purchasing and sourcing locally produced raw materials
3. minimising overheads, for example, turning off lights and equipment not in use
4. recycling damaged goods, (accidents or in transit).

These new figures were submitted and the calculations returned with a surprising figure of 17 gha, this shows us that every little effort made towards helping the business and the environment can prove mutually beneficial.

5. WATER TREATMENTS

Over the past twenty five years there have been various ways to conduct water treatments with a variety of chemicals depending on the actual outcome desired. In my experience with water treatments, there are three main outcomes:

1. A full water treatment where the sludge and liquid are removed off site by an Authorised Liquid Waste Remover at a cost of “approx” \$5 per kg
2. A full water treatment where the liquid portion is collected for reuse with a high pressure cleaner or reworked into products such as fence paints
3. The remaining sludge from (Point 2) can either be taken away by an Authorised Remover or further treated and solidified in house using Sandmar’s method

Here are some methods I have tried and tested with proven results.

Treating 10,000 to 15,000 litres of wash water,

- a. This method requires three additives, its very labour intensive and extreme care is required when handling the following, add Hydrochloric Acid to reduce pH and control stability, add Limil (Calcium Oxide) to begin the phasing stage and neutralise odour, then Aluminium Sulphate for flocculation and settling process.
- b. This method requires one additive if the pH is between 7 – 9, just add 200 kg of Poly Aluminium Chloride and this will maintain a neutral pH while phasing and settling the pigment component. This method is very efficient but expensive.
- c. The most economical method is to use Aluminium Sulphate to treat water especially if your intention is only to reuse the treated water after the settling has occurred

Here is the method that Sandmar has adopted for best results under 1000lt treatments.

Sandmar has maintained a strict policy on all “wash water” generated from various departments within the factory. Each workstation has a designated wash vat containing approximately 30 lt of “reclaimed wash water” (treated water from the Holding Tank) for the purpose of washing equipment, tools and soaking. Once these vats contain excess sediment and the water content is unable to wash equipment, generally after one week, these contents are discarded from the vats and poured into Wash Tank 1 (allocated IBC) for future treatment. The capacity of the Wash Tank is 1000 lt, its design at the top has been modified by 75 % removal of the lid to allow easy pouring from the workstation vats, however we only fill the Wash Tanks to a level of 600 – 700 lt to avoid splashing being caused in transit by the forklift. Sandmar has utilised four IBCs for the various stages of the treatment cycle, they are labelled as:

- (a) Wash Tank
- (b) Holding Tank
- (c) Sieve Tank
- (d) Final Drain Tank

Once we have reached the level of 700 lt in the Wash Tank, it’s ready to be treated.

Wash Water Treatment Procedure:

- 1) Wash Tank contains 700 lt of wash water.
- 2) Dissolve 500 g Aluminium Sulphate into 5 lt hot water @ 1100 rpm small mixer.
- 3) Scrape base of Wash Tank to loosen sludge and sediment layer for 3 minutes with a long handled spade or place the Wash Tank under high speed stir @ 1200 rpm for 2 minutes.
- 4) Add Aluminium Sulphate solution to Wash Tank and stir for 1 minute.

- 5) Observe the visual effects of the treatment for 2 minutes.
- 6) If the treatment has started the flocculation process, all is well and the Wash Tank can be put aside for one week for the full phasing to occur between the solid and liquid components.
- 7) If the flocculation process has not occurred, points 2) to 6) need to be repeated.
- 8) Test for water clarity, after one week of phasing/settling compare one cup of water from the tap against one cup of treated water from the Wash Tank, ensuring no turbidity or strong colour tones are evident, upon approval for clarity we move onto the Siphon Process.
- 9) Raise the Wash Tank onto five pallets for assistance in siphoning.
- 10) The Siphon Process is the old but trusted method for drawing liquids.
- 11) A 3 m hose is required with a metal rod taped at each end.
- 12) Fill the 3 m hose very slowly with tap water and sealing each end with your thumbs.
- 13) Using a step ladder, climb up to the Wash Tank and submerge one end of the hose 60 cm into the top of the Wash Tank while simultaneously releasing your thumb.
- 14) Place the other end of the hose into the Holding Tank and by releasing your thumb it will immediately commence the siphoning of the treated water.
- 15) This method should only drain 80% of the treated water, the remaining 20% is a mixture of treated water, sludge and sediment that must be drained from the bottom of the Wash Tank.
- 16) Attach a 30 cm nozzle to the base of the Wash Tank and commence the slow process of draining the sediment into a Small Sieving Tank containing crushed rock for the purpose of further draining, drying and solidifying the solid component.
- 17) The fourth IBC comes into use, its cut down to half size and catches the dripping water from the Small Sieving Tank containing the sediment undergoing the process of drying and forming a crust. This treated water is quite clear due to most of the impurities being caught by the crushed rock from the Small Sieving Tank.
- 18) Three to four days later the solid component in the Sieving Tank can be cut with a spatula into squares of approx 15cm x 15cm and let dry for another week, then removal of the solid pieces becomes easy to lift and disposed of in normal fashion as prescribed solid waste.
- 19) The total cost for raw material used in the process of a water treatment (worse case):
 - a) Aluminium Sulfate 1 kg @ \$15 (two treatments).
 - b) Pool Chlorine 500 gm @ \$10 (to mask possible odour in Holding Tank).
 - c) In-can Biocide 1 kg @ \$10 (kills fungi and algae and maintains stability over two months).
 - d) Hose and metal rods @ \$10 (once off cost).
 - e) Labour 4 hours @ \$100 (total process from set up to disposal).

Total cost over three months is \$145, and over 12 months is \$580.

Total wash water reclaimed over three months is 500 lt.

From this reclaimed wash water we are able to replenish the washing vats at the various workstations, furthermore we can attach the High Pressure Washer (Karcher) to the Holding Tank to facilitate the full wash and clean of the Ribbon Blender after the darkest colour in the run of the construction sealant has been made.

Below in the photograph, we can see the complete wash water system.

Note the process:

- 1) Siphoned water from the wash tank.
- 2) Work tank
- 3) Sieve tank holding sludge.
- 4) Water collected from sludge.
- 5) There is a High Pressure Washer (Karcher) on the left hand side attached to siphon water to wash the blender after production of the darkest colour.



Fig 4 – Wash Water System.

Below is a different view, note the High Pressure Washer (Karcher) attached to the second water tank.



Fig 5 – Water Filtering From Sludge Through The Crushed Rock.

Below in the photograph can be seen the drop in sludge level in the sludge tank due to water filtering through the crushed rock.



Fig 6 – Drop In Sludge Level Due To Water Filtering Through The Crushed Rock.

Below in the photograph we can see the clarity of the water collected from the sludge after passage through the crushed rock.



Fig 7 – Clarity Of Water Collected From Sludge After Passage Through Crushed Rock.

In the photograph below, this demonstrates the clarity of the water obtained from the sludge.



Fig 8 – Water Collected from Sludge through Crushed Rock.

As can be seen in the photograph below, this shows the wash tank after water has been siphoned, sludge removed, ready for the next wash water collection.



Fig 9 – Wash Tank With Water From Sludge, Ready For Next Wash Water Collection.

6. COST EFFECTIVENESS AND THE BOTTOM LINE

Following the principles of Coloured Formula Optimisation saves between 400 – 500 lt of water per batch by eliminating the need to wash the Ribbon Blender after every batch.

Other benefits include:

- Eliminates labour by a minimum of 4 hours
- Increases productivity by 4 hours
- Reduces consumption of forklift and gas (\$10)
- Eliminates requirement for extra electricity (\$15)
- Water savings by not drawing on this resource (\$75)
- Labour savings by not washing up or going into overtime (\$200)

Annual savings based on an average of 15 batches per month x 12 x \$300 = \$54,000 saved against the expenditure of \$580 pa for chemicals and labour. Quite a handsome return!

Annual water saved on an average of 15 batches per month x 12 x 450 lt = 81,000 lt saved.

The bottom line is a healthy balance sheet for the business and knowing that we have saved 81,000 lt of precious resource called “water”, the production schedule continues to run smoothly and efficiently whilst saving over \$50,000 per annum by following the Coloured Formula Optimisation procedure.

7. THE EPA's MOTTO

From my past experiences and associations with the EPA, I can confirm they are steadfast in upholding their motto on the Three R's.

1. REDUCE
2. REUSE
3. RECYCLE

The EPA has printed many booklets for business and industry to follow the guidelines for using the Three R's and the way it can assist your business and improve your bottom line.

Now on the other hand, we at Sandmar have gone one better and introduced the Fourth 'R' and it was only befitting that it fell into place and made everyone very happy.

We call it the “REWARD” for a team effort that is conscious of the environment, maintains a healthy bottom line and keeps MANUFACTURING in a CLEAN and GREEN BUSINESS SENSE.

This reward is generously given to us in the form of a BBQ at the end of every month which extends well beyond the normal lunchtime.

Sandmar is proud of and dedicated to the business initiatives it has in place and it will continue to minimise its ecological footprint by finding new ways to lessen its demand on nature by using the EPA's Three R's and consistently reducing costs in an ecologically sound way.

We all know that the EPA does not need an invitation to conduct a “surprise audit” at your business, therefore don't become a victim, why not implement some form of water saving initiative and begin to improve water consumption and ultimately the bottom line.

In these straitened times, we should all try to rethink about how we can improve our business and reduce its impact on the environment.

8. SUMMARY

In this paper we have endeavoured to provide information regarding the company Sandmar, a manufacturer of coatings and sealants who has implemented ecological initiatives to assist its bottom line and save water.

I would like to quote Dr Mathis Wackernagel, "That Humanity's ecological footprint is currently 20% greater than the carrying capacity of the Earth, this represents far more than that which can be regenerated by nature. In short, we are running an ecological deficit; we must learn to balance our books".

From a professional point of view I would add that we must all be proactive and vigilant at work and home regarding the consumption of goods and services because "we are all custodians of the environment" and resources must be plentiful for the next generation and beyond.

It's this school of thought that Sandmar has adapted for its creative approach to business and its ability to pioneer innovative products and services.

In conclusion, Sandmar has many ongoing initiatives with proven success in manufacturing and sales of coatings and has actually thrived during this difficult period of economic downturn where general manufacturing actually has declined.

Sandmar is proud to boast the following business initiatives:

- Saving water
- Water reclamation
- Retain reclamation
- Coloured Formula Optimisation
- Product promotion via free samples
- Eco Footprint of 17 gha and decreasing

Thank you for sharing our Clean and Green Manufacturing theme at Sandmar.

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