

# Cleaning manufacturing equipment ecologically

In the past year there have been plenty of articles on technical innovations and new or renewed methods for cleaning quicker, more efficiently and, mainly, cleaning more cheaply. However, there were hardly any on cleaning in an ecological way.

The main themes which are actually worrying the European cosmetic producers are (in no particular order): REACH, animal testing, parabens, GMOs and the ubiquitous question, 'is it compliant with Ecocert?' It looks like a random collection of unrelated elements, but ultimately these themes are related to ecological cleaning, even if this is not immediately apparent.

First of all, we have to understand what the term 'ecological' stands for; what exactly is ecological cleaning? There are countless meanings and even more opinions to be found on that. The Free Online Dictionary describes the term as: *'tending to benefit or cause minimal damage to the environment'*, as do most of the dictionaries around. Most probably this is also the most common definition of the term, even though it remains rather vague and people will struggle to explain it. I am quite sure that if one asked Ecocert, even they would have to scratch their heads.

I developed my own characterisation in the course of my career as a product developer and concept manager, which started in 1972. Not that I explicitly wanted my own definition, but I was dissatisfied with the ones I found; they did not touch the essence of the subject and at the same time they were not sufficiently objective. 'The environment' as a single entity does not exist; what is beneficial to a desert is not necessarily so for the pampas, and vice versa. And 'cause minimal damage' can be interpreted in many kinds of ways, depending on whether you speak to the manager of



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*Traditional industrial cleaners promote aquatic toxicity.*

a nuclear power plant or to a gardener.

What I eventually came up with is: 'A substance or a process which fits into the logic of the ecosystems, can be called ecological'.

## The ecosystems

Central to this characterisation are the ecosystems. There are many different ones on our planet - water, air, land, plants, animals - all of them have their own logic and the interaction between them follows its own logic as well. Think about how the Gulf Stream moves between warm and cold zones on the planet.

When we learn to slip into these logics even before we start developing anything, we have a powerful guide at our disposal to make choices on raw materials, ingredients and processes and to build a product or service that is itself in the full sense,

'ecological': it fits into the logic of the ecosystems from cradle to grave, or even from cradle to cradle. I take it for granted that professionals know that the largest part of actual, carbon-based ingredients for industrial cleaners come from fossil sources (mainly mineral oil and derivatives). That goes as well for the cleaners used to clean equipment in the cosmetics industry.

The problems with those sources are multiple: they are running out of stock and cannot be replenished, and many of these compounds cause a lot of trouble down the line, as well as at use as in the waste phase. More often than not they feature an unacceptable aquatic toxicity and very bad biodegradation behaviour, with lots of stable leftovers afterwards. The situation is far worse than with household cleaners, as the detergent legislation that has been implemented throughout the EU (and to some extent on a global scale) is not yet compulsory for industrial cleaners.

Cradle to grave (C2G) and cradle to cradle (C2C) are principles which have been extensively developed by the German chemist, Michael Braungart, and the American architect, Bill McDonough. Cradle to grave means that you look on a voluntary basis at and take responsibility for the whole life cycle of a product or service, from the sourcing of raw materials down to the ultimate degradation and everything in between. This is more than just your strict legal responsibility, which always lags behind reality.

Cradle to cradle means that you go even further. When designing your product or service you ensure that the ingredients and materials can be reused for a second (third, fourth, ...) time at their life's end, or become part of a different product or service.

It is obvious that when this is done on a

large scale – especially with C2C – the material flows on the planet, including the generation of virgin material, could be dramatically slowed down. There would be more material available to fulfil the needs of an ever-growing world population. It is equally obvious that C2C is not possible with cosmetics, cleaners or similar applications. These are products (or services) which are destroyed when applied, just as food is. However, when such products are designed along C2G principles, they disappear without a trace left in the material flow from which they were extracted.

These few examples can give a taste of what is meant by ‘working with the ecosystems’ instead of working against them, as we do currently.

### Just cleaning

Now, that is just the one part of ecological cleaning. The other aspect to consider is that even ecological cleaning is still just cleaning. An ecological cleaner which does not clean properly may be ecological, but it is surely not a cleaner.

Of course, there is a huge difference between real effectiveness and perceived effectiveness. Many people expect harsh chemicals that smell terrible when they speak of industrial cleaners. Even more than this, people’s level of care is reduced when they work with such products.

In 1997, I audited some 11 renowned food factories in France on their cleaning efficiency. Among them were two slaughterhouses and a baby food factory and all of them were producing conventional as well as organic goods. All of them, except one, returned very poor results, despite the harsh chemicals they used. The only one that gave good results – a dairy plant – was the one not using harsh chemicals; in fact they were hardly using any detergent. What they had instead were strict protocols and a huge attention to detail and commitment. It was nearly a sport for the staff to keep the production going with a high level of hygiene. It is too small a sample to make global conclusions, but since then I came time and again to similar findings; it is not the harshness of the chemicals which guarantees a good cleaning result. On the contrary, those chemicals more often than not reduce people’s level of attention.

We should indeed not forget some essential basics of cleaning. In a textile washing process which is running with water only, with no laundry product added, the stain removal is over 40%. With detergent added it goes up to 75%-85%, depending on the type of stains, the type of fibres, the temperature and the mechanical movement. We should



Michael Braungart.

remember the late Dr Sinner, in his days as a chemical engineer with Henkel, who gave us good old Sinner’s Cycle: Time (T), Temperature (T°), Mechanics (M) and Chemistry (C) as segments of a pie. Increasing one of them may decrease one or more of the others. In this perspective it is not just the chemicals that do the job, it is a sensitive balance between several elements. That is one of the misconceptions that turns non-ecological cleaning into such a burden for the environment.

### Reconsider the process

With these still valid principles in mind we might reconsider our cleaning processes together with the products we use to assist that cleaning. In my experience it is often a weak, incoherent cleaning protocol that triggers insufficient hygiene results, even in the presence of harsh chemicals. Let me



William McDonough.

describe one situation I found myself in with the 1997 audit.

A big slaughterhouse facility dealing with cattle and pigs had towards the end of the processing line a stainless steel tank with a 2000 L capacity, to collect the blood of slaughtered pigs, which was later used for black pudding.

From a distance I observed the cleaning staff on top of a tower wagon attacking the empty, but soiled tank with a spray gun and a mixture of water at 80°C and a chlorinated, petrol-based surfactant. After the clouds had settled, the tank had been rinsed with water at 80°C and had cooled down to ambient temperature, I sampled its surface in several places with ATP swabs. I read them out on site and the results were staggering. According to the ranking proposed by the measuring device (which had been calibrated and had shown its reliability in many occasions) I should have found below 200 relative light units (RLU) as a result of a sufficiently cleaned surface. In reality I detected on all swabs a value of around 40,000 RLU. As a comparison, averagely clean hands read at 6000-8000 RLU. What went wrong, after all, they used 80°C and a petrol-based chlorinated surfactant?

Blood is a protein complex and when you attack it with 80°C, the protein simply coagulates, creating something like an ultrathin skin on the stainless steel surface. In the absence of mechanical effort (the surfaces were not touched) this skin could not be completely removed by the alkaline surfactant solution. The chlorine made no sense at all, as it is completely neutralised by protein – that is even an essential part of the European efficiency test protocol for disinfectants. Besides, chlorine is not a cleaner, it is an oxidiser and only makes sense as an agent to kill isolated colonies of microorganisms on a clean surface. It cannot penetrate soil.

A far more efficient protocol would be to do a first rinse of the leftovers and blood with the spray gun, with water at a maximum of 40°C (to prohibit coagulation) and an average concentration of an alkaline, plant based surfactant (such as lauryl sulfate or alkyl polyglucoside, among others). That could be followed by a rinse with water at 40°C (once more to avoid coagulation), increasing towards the end to 80°C, featuring a pasteurisation effect on the surfaces. Should one want to use a biocide at the end, there are several ecological possibilities for application on a clean surface: hydrogen peroxide, percarbonate, lactic or citric acid or combinations of these, chemical characteristics permitting. The only limiting factor will be the legislation. In many countries, the use of poisonous

compounds for disinfection purposes is compulsory and cannot be avoided.

This is only one example, but it could easily be adapted to quite different circumstances. The efficiency would be measurably higher and the impact on health and the environment in the second protocol would only be a small fraction of the one in the first protocol. Chlorine in an aerosol form (which was generated through the use of a spray gun) has its already unhealthy impact on the respiration tract boosted many times.

Plant-based surfactants degrade quickly and completely, without stable leftovers. Except for a possible, non-avoidable disinfection, there are no questionable chemicals used, which adds to the relatively neutral effect on health and the environment.

## Cinderella

There is another issue linked to ecological cleaning. Cleaning is still seen as the Cinderella of all trades, and that is a strong limiting factor as well. It is seen as a boring, unrewarding job, mostly done by people who do not have a choice to say 'no'. Often, they are not well trained either – or not trained at all; in the end, you do not need much training to clean, do you?

The providers of professional cleaning on their part are squeezed like a lemon by their customers to offer prices for cleaning work which are unrealistically low. So low, that the leading Dutch publication *Clean Totaal* wrote an article about the issue, addressing those customers directly, warning them that they would cause a catastrophe to the sector if they continued down that track.

One of the main issues with cleaning is that, in spite of many modern developments, it still is the kind of work that requires human attention and commitment and has therefore a high labour cost and a low product cost. Trying to lower the labour cost by strongly reducing human commitment and attention has only been successful in some specific segments, for example the cleaning of large floor surfaces. Even in those cases the use of chemicals which are questionable in terms of ecology and health is more often than not the standard and a relatively poor cleaning result in measured hygiene the average outcome. It should be clear that this type of approach cannot be continued into the future. If the trade is not innovating itself in adopting methods based on future developments, legislation will be at their backs forever. And this time, there



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*Ecological cleaning of cosmetic production equipment is not far removed from a household situation.*

will be no possibility to keep the thing low profile by heavy lobbying in the political parlours and by thinly veiled threats about job losses. The customers who need cleaning want to be seen in a clean context: ecologically, economically and socially. Using the wrong products, asking unfair prices or exploiting people is harming their own reputation with their customers. And that awareness is growing at a high pace. In business, you may lose one or two customers – that is unfortunate, but losing your reputation is deadly.

Therefore, not only has the global approach of hygiene and cleaning to be developed into a future proof context, but also the common understanding between providers, cleaning staff and customers on the matter should be upgraded.

Everybody knows that when you pay peanuts, you get monkeys. In this context 'monkeys' means 'poor results'. A job well done asks for a fair price yet that will not be an easy task, for many things have been neglected for many years. But it is a bare necessity for the sector to grow into a hygiene for the future, a futuro-logical hygiene. The only other way is to continue the total overkill with biocides – but that is not a solution. The consequence will be an ever-increasing resistance of microorganisms and an increasingly unmanageable situation.

Inspiration for innovation should this time not come from the past, but from the future. Where do we have to arrive within five to ten years? How should we endeavour to get there? Something we know already today is that ecological cleaning in the cosmetic sector is not necessarily imposing special, costly cleaners, unusual technologies or impossible, time consuming protocols. What will mainly be needed is creative thinking, cooperation, compromises and a step-by-step development. We are entering a new era, after all.

## Clean smarter, not harder

The ecological cleaning of cosmetic production is all in all not that much different from an average household kitchen situation, albeit that the size of the equipment is bigger, the soiling heavier and the cleaning frequency much higher.

There are a few essential differences left. The first one is that some substances used nowadays in cosmetic production are hardly used in the household, i.e. petroleum jelly, paraffin oil and silicones. A second difference is that technologies such as Cleaning In Place (CIP) are unknown in the average kitchen.

Inevitably, these substances and these production circumstances will ask, as long as they stay in place, for specific ingredients or cleaners and specific protocols, which will be difficult (but not impossible) to replace with more ecological ones in the first instance.

The essence of ecological cleaning is therefore not to clean harder, or harsher, but smarter. The requirements for ecological cleaning, also in the cosmetic industry, are essentially similar to conventional approaches:

- An adequate, reproducible, measurable cleaning result.
- Workable, efficient methods.
- Affordable costs.

To get there we may not expect all-round products, one-size-fits-all protocols and off-the-shelf solutions. Much will have to be found by common sense, trial and error and reactive approaches. My experience is that after a cleaning innovation has been tested and put into practice, many people involved react with "why didn't we do this before?".

## Conclusion

Ecological cleaning is far too often seen as a dark and mysterious art, only known to expert insiders and covered by certifying bodies with an almost mythical halo. In reality it is cleaning as usual, but in the perspective of Cradle to Grave and/or Cradle to Cradle. That implies a tight cooperation between all the parties involved. Equipment owners, cleaning providers, cleaner suppliers and certification bodies have to put together their skills to generate optimal solutions for ecological industrial cleaning. We live in a transition time and we have to sit and talk to each other to grow into a far better situation for everybody, including the environment.