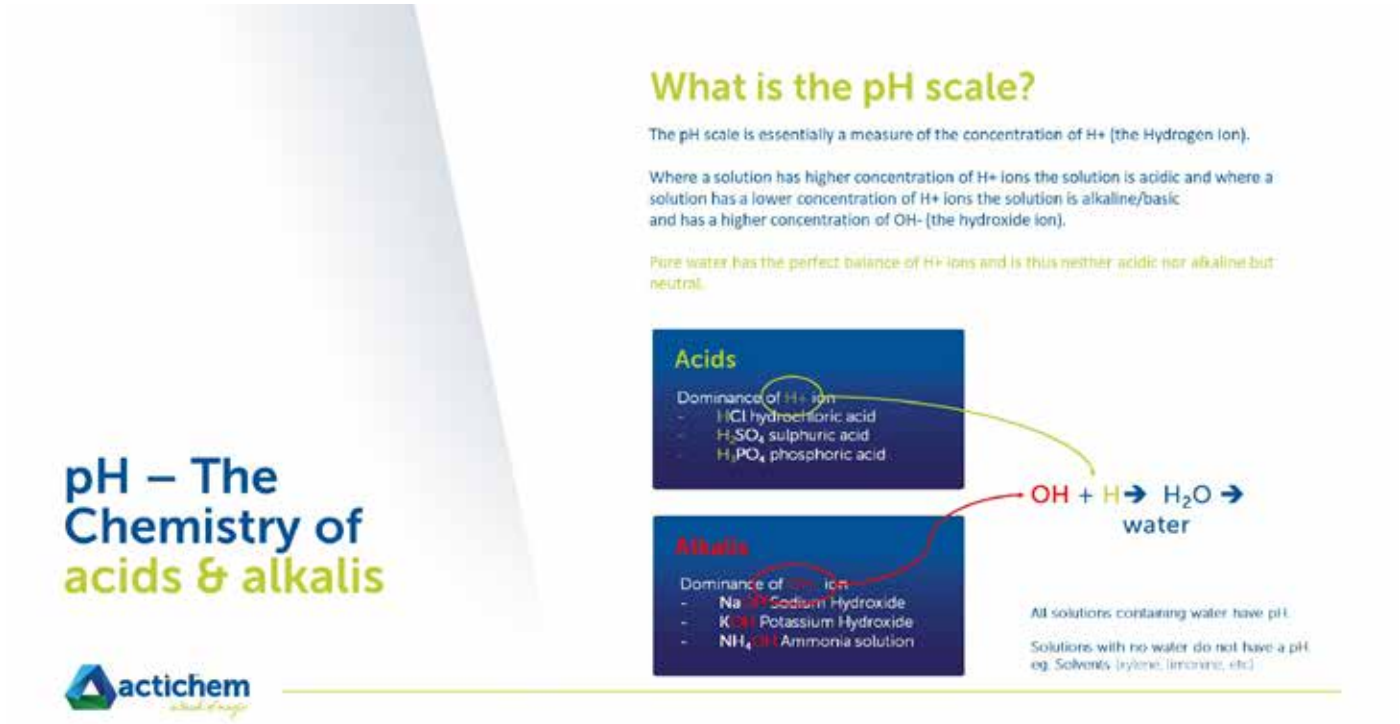
From Acids to Alkalis

Webinar Notes

actichem
a touch of magic®

Hello, and thank you for joining us today. The discussion around acids and alkalis is a key knowledge for any cleaning operation. Without it, you'll be limited. You'll struggle in your career as a professional cleaner. Somewhat like a taxi driver who does not know how to change a punctured wheel. He'll make progress due to his knowledge of the road network, of how to take credit card, payments, to be polite to customers. However, at the time that he has his first puncture, it all stops.

We're looking forward to showing you just how easy and how simple pH, acids and alkalis can be, and how effective and efficient this knowledge can make your cleaning operation. Saving you time, saving you money, saving you problems. And all with better outcomes for both you and your clients.



What is the pH scale?
The pH scale is essentially a measure of the concentration of the hydrogen ion.

When a solution has got a concentration of hydrogen ions, the pH is acidic. When a solution has a lack of hydrogen ions, but a concentration of hydroxide ions, the pH is alkaline or a basic.

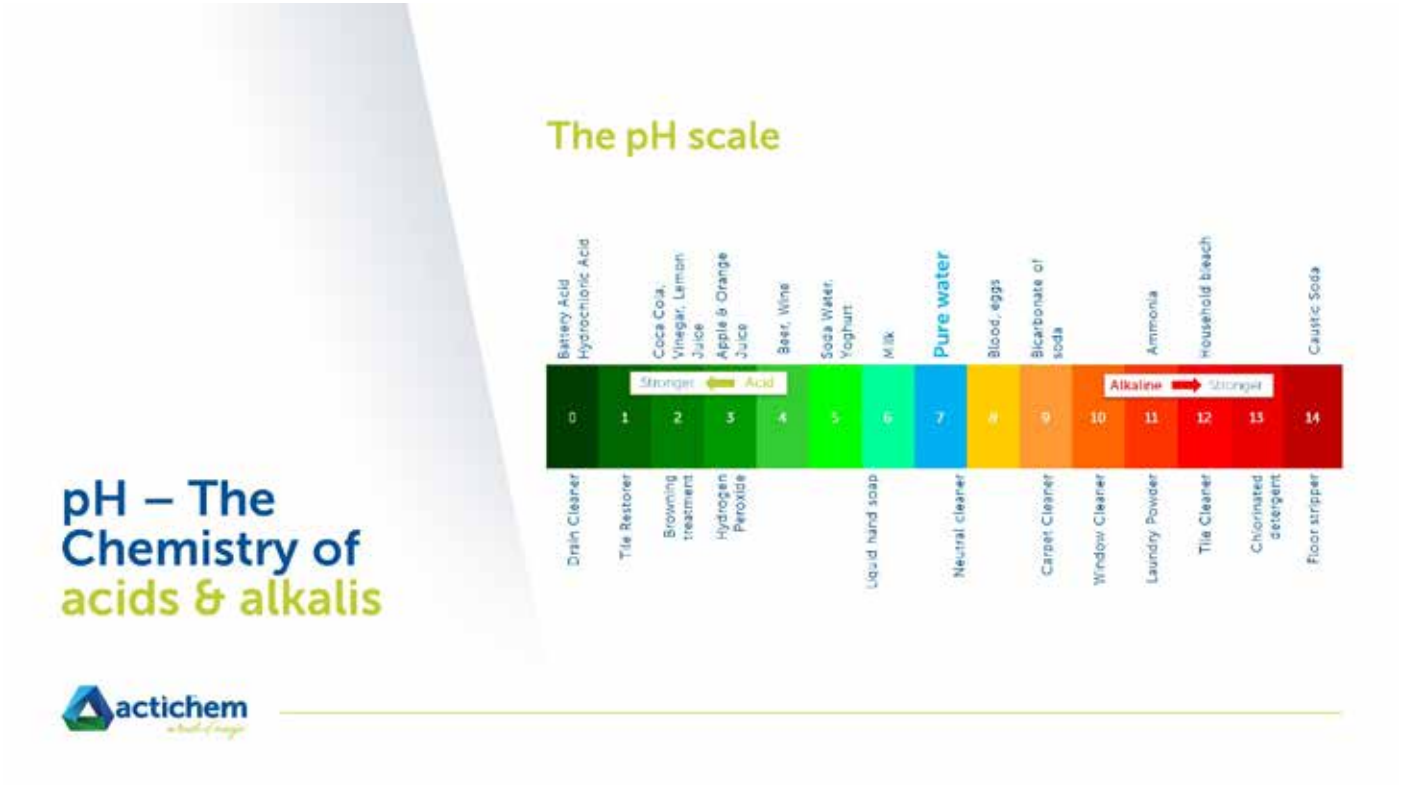
If we look at the acid solutions listed, namely hydrochloric acid, sulfuric acid and phosphoric acid solution you'll notice the dominance of the hydrogen ion, in the nomenclatures of each one.

If we then look at the alkali solutions listed, namely sodium hydroxide, potassium hydroxide and ammonium solution we can see the dominance of the hydroxide ion.

Now, we can see that water, H2O is when we have a solution which has a perfect balance of hydrogen ions (H) and hydroxide ion (OH). Water being a neutral solution.

Now all solutions having a pH contain water, or the other way we can say it is everything that contains water has a pH. This leads us to the next point, and that is where water is absent, such as with oils and solvents, there is no reference to pH. It's not that they're neutral. It's just that pH does not apply. These solutions include things like motor oil, petrol, paraffins, eucalyptus and DiLimonine.

[In the interest of scientific correctness, it should be mentioned that some polar solvent groups do have a theoretical pH due to the presence of a hydrogen ion, however this does not have any impact on the science of cleaning involving acids and alkalis]



The pH Scale

The pH scale starts in the middle at pH 7, neutral and is represented by pure water on our scale. The scale then runs to the left-hand side, getting increasingly stronger on the acid scale and then running to the right-hand side, which is increasingly stronger on the alkaline scale. It doesn't run from 0 to 14.

The pH strength increases the further you move away from pH 7. From the strong acids on the extreme left, which is solutions such as drain cleaners, battery acids. And then caustic cleaners on the extreme right hand alkaline side. Several notable points are; you'll note that most foods and beverages are on the acid side. Most of the cleaners are on the alkaline side. Interestingly liquid hand soap has a slightly acidic pH. This is a reason why the drips from a liquid hand soap lotion spout will leave an etch mark on natural stone benchtops such as travertine and marble benchtop. This is caused by the mildly acidic liquid hand soap reacting with the alkaline, acid-sensitive calcite substance. What typically happens, and we've seen this numerous times, is that the building owner or manager will insist on the cleaning contractor removing that stain. Whilst in fact, you can't remove that stain. It is an etch mark and needs to be honed back a marble polish similar. However, how many times have you tried to remove that stain, given the building manager the assurance that you can do it and have to go back and admit that you can't do it, simply because you did not know what was actually happening there because you didn't have a handle on what pH and alkaline and acids were all about.

Perfect Outcomes
Whenever faced with a cleaning challenge, we need to ask ourselves three things. And we need to have a grip and a handle on three things.

This is the secret to perfect outcomes.

The first is the **substrate**. What characterizes the substrate? Is it sensitive to acids? Is it sensitive to alkalis? Is it not sensitive to either. For example, wool carpets, and marble benchtops, etc are damaged by certain pH dominated solutions. What is this detrimental effect? We need to know a lot more about our substrates and how pH affects them.

Then we need to know about the **soiling** we encounter. What characterizes the soiling? How does the pH scale of acids and alkalis effect the soiling that we encounter on those substrates.

And then thirdly, is **chemicals.** Do I know what chemicals I have in my van, have in my store. Can I go to every single bottle or can your manager, can your supervisor, can your cleaners go to every single bottle in their cleaning van, in the store, and be able to name where it fits on the pH scale. Is the chemical product an acid, or perhaps a light acid, or an alkali, or is it neutral? If you can't do this, I'd honestly make sure that you can by the end of today. It is really important if you're going to be effective and if you're going to be able to overcome cleaning challenges and avoid making costly mistakes.

Organic Soils

A broad understanding of the pH of soiling will significantly assist with choosing the correct chemical solution to remove it. To make this really simple, categorize the soiling, into three categories. These three categories are; organic soils and inorganic soils and soils that have are characterized by oil. So, it's only three easy to remember types. Organic soils, inorganic or those characterized by oil.

So, let's have a look at **organic soils** first. Organic soils include proteins, carbohydrates, body oils and fats, food oils, animal waste, moulds and vegetation. These are all matter that once lived. That's an easy way to remember what an organic soil is. It's matter that once lived. You can also think of it as food going into the body and excrements coming out of the body. This is both humans and animals.

Where are they found? Sports facilities, eateries, pubs, clubs, kitchens, food prep area and general are all areas where organic soils are found. Another easy way of remembering it, is that organic soils occur wherever there is human activity, or animal activity. We could have included kennels and catteries and even farm animals. That is wherever there is living beings, there will be organic soils, and they are characterized by being acidic.

Now to remove organic soils, the opposite chemistry used, namely alkali detergents. Remember that an alkali detergent doesn't have to be a caustic hydroxide, pH 14 to work. There is many others for various applications. Examples include alkaline salts, builders, ammonia, ethanolamine and chlorine, bleach. These can normally be found on the SDS or the product label. We simply refer to chlorine bleach to make sure that you understand that chlorine bleach is an alkali. We typically don't use it on its own as a cleaner.

Inorganic soils

Inorganic soils are matter that never lived and are typically alkaline in nature. These include limescale, efflorescence, rust, oxidation, minerals, etc. These inorganic soils are all found where there is a presence of water. Water is needed to dissolve and transport inorganic soils, these minerals. They are either mineral salts within the substrate that are dissolved by water and transported to the surface where the moisture evaporates leaving the minerals behind on the surface. Alternately water evaporates off a surface leaving behind the hard water ions in the form of limescale.

So, wherever there is moisture or water there is a likelihood of finding inorganic soiling. Typically, this includes areas such as washrooms, bathrooms and showers, external surfaces that is subjected to rainfall or irrigation sprinklers. Cement and grout smear is included and is somewhat of a man made, inorganic soil, but is also strongly alkaline in nature. To remove these alkaline, inorganic soils the opposite chemistry is used which is acidic cleaners. Once again, not every inorganic soil needs to be removed using the strongest acid on the shelf. There are several categories of acidic cleaners or acidic raw materials. Firstly, the mineral acids are the strongest and include hydrochloric, phosphoric and sulfuric acids. Then organic acids which are typically weaker, less aggressive acids, such as acetic, citric, oxalic and glycolic acid. Organic acids are typically used in maintenance cleaning products for showers and bathrooms and also in carpet cleaning. Lastly, we have listed the acid replacement technology.

Oils

The third soil type is where pH is not relevant. And this is oils and greases. These contain no water. And we remember from the earlier slide, if it contains no water, it's got no pH. This category includes motor oils, waxes and resins, gum, bitumen, tar, inks, oil-based paints.

These soils do not have a pH and are removed with solvents, which also themselves do not have a pH value. There are many different solvent types and we have included the three most relevant categories to cleaning. Polar solvents such as glycol ethers and alcohols are solvents which will dissolve in both water and oils. These are very useful for inclusion in water-based degreasers.

What's the difference between a polar solvent and a non-polar solvent? Easy way to remember it. Polar solvents are solvents which will dissolve in both water and oil. So, think of it this way. Polar bears live where there's a lot of water. So polar areas = water, so polar solvents can dissolve in water.

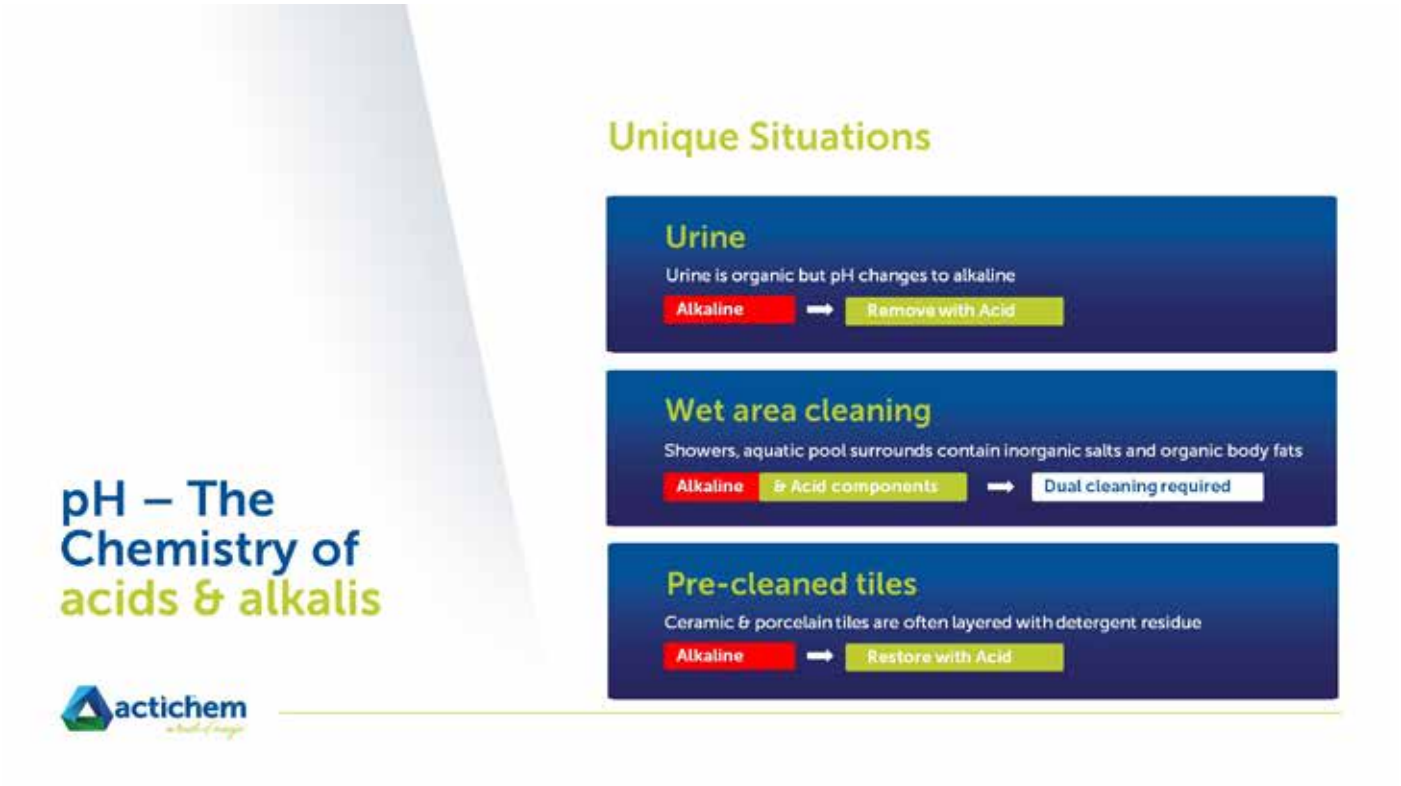
Non-polar solvents do not dissolve in water and will only dissolve in oils. These include solvents like xylene, toluene and paraffins. These solvents are typically stronger at dissolving tars, heavy greases, and oil-based paint in this soiling category.

The natural solvents such as eucalyptus and diLimonine are also non-polar and make very effective and powerful solvent cleaners.

Matching the pH of soiling to cleaning solutions and substrates
This slide provides us an excellent summary and overview of the soil types and their acidic/alkaline profile, matching this to the best chemical solution to remove it and giving consideration to the substrate.

This handy table also provides several Actichem products, in their pH category. The substrate warnings are very, very important. And this is probably a subject for another webinar. How various substrates are affected by acids and alkalis. But here's a short overview just to keep you on track.

This slide is available as a separate PDF so that you can print it out, copy it, have it on hand for yourself and your staff.



Unique Situations
There are several unique situations which I'd like to discuss with you. They are very good illustrations of how the consideration of pH, acids and alkalis work in real life.

Urine - The first situation is in relation to urine. Urine is a very unique soiling type in the fact that whilst it is an organic soiling, it's final pH is alkaline. We know that organic soiling is acidic and when urine is passed from the body it is indeed acidic. This phenomenon can be seen where there is a marble floor around men's urinals and the urine splashes create pitting. These marks can't be cleaned out, they can only be honed or polished out because the acidic urine has eaten away at the alkaline calcite (limestone, marble) stone. However, the remarkable thing is that as urine dries and ages, it turns to an alkaline crystal. This alkaline crystal is very robust. It encapsulates bacteria, which is typically E. coli. It also, emits ammonia whenever it gets wet or moist. If the alkaline crystal dries completely, it actually doesn't smell. The bacteria don't emit any smell and neither is any ammonia smell emitted. We can be tricked into thinking that it's gone away. The pH of the alkaline urine crystal is around 11, which is very similar to ammonia. This is why when you go into some animal areas such as catteries, kennels, et cetera, or even into a room which is very severely contaminated with urine, say in an aged care facility, you get that distinct smell of ammonia.
To overcome this the uric crystal must be broken down. This will release the E. coli bacteria to be flushed away or/and killed and also it will neutralize its ability to emit ammonia. There's only two ways of doing it. Firstly, enzymes are very effective, however they do take time and are seldom effective for the quick, go in, fix a problem, and walk out job type associated with carpet cleaning or restoration. They're normally used by in-house cleaning staff in aged care facilities, homeowners, animal shelters etc where they can manage the extended dwell time. However, the other way of achieving urine decontamination, is to use an acid/alkaline reaction.

The alkaline uric crystal can be effectively dissolved by an acid detergent, and we can have a result within a few minutes. This neutralizes its ability to release ammonia, It also releases the E. coli bacteria to be simply flushed away. This step can be followed up with a disinfectant to kill any remaining bacteria that may still be existent and then treated with an odour neutralizer solution to neutralise any trapped mal-odour molecules. A very effective product is the Actichem Pet and Flood which is an organic acid solution teamed up with a bactericide and odour neutralizing technology for a complete solution.
Now I'll give you one more tip in relation to urine, is that you must provide a replacement scent. If a person has always walked into a room that has smelt of urine, that person will still smell urine as he walks across the threshold of the door, even if it has been completely decontaminated. The brain tells you that there is still urine in this room because that's what it has always smelled when it's walked through that door. A replacement scent, ie a smell completely different to urine resets the brain. It reboots those olfactory sensors. Just a little tip to help you along your way when it comes to urine decontamination.

Wet Area Cleaning – Wet area cleaning is another very, very interesting. This is where there is both human activity and water. We know with human activity causes organic soils and we know that where we have water, we have inorganic soils. Take for instance changeroom showers, aquatic pool surrounds, etc. They will contain soiling from both water and human activity. So, should we clean with an acid detergent, or should we clean with an alkaline? This is where we need to do a little bit of forensics. We may have to do a dual clean. Clean with an alkaline first, followed by an acid. Rinse well in between and always do it in that order. Always an alkaline, then an acid. That dual cleaning required will normally solve most of these situations. However, if we do a little bit of analysis and identify the predominant soiling we will likely get good results with only one solution. Let's take for instance showers in a sports change room. We have a bunch of teenagers running around for two hours playing basketball. They jump into the showers for two minutes, and off they go. What is the dominant soiling in that shower? The sweaty humans going through the shower, will leave a lot of organic soils, perspiration, body fats, body oils. The likelihood therefore is that an alkaline detergent will effectively remove the acidic organic soils and clean the showers well. Whilst an acid may not work well because of the dominance of the alkaline organic soiling.
We've had situations in sports change room shower blocks where the acid cleaner wasn't working. So, the cleaning staff have then tried the "stronger" toilet bowl cleaner and then down to the store to get a hydrochloric acid product. All this time they were only using acidic solutions. If they had of switch pH chemistry and used an alkaline solution it would have likely come clean. If a surface is not coming clean, try swapping the chemistry across from an alkaline to an acid or an acid to an alkaline and typically speaking, 99 percent of the time you will achieve a result.

Pre-Cleaned Tiles - Now the last one is pre-cleaned tiles or detergent residue build-up. This occurs where tiles are cleaned regularly. Right from Mrs. Housewife, who's using a neutral detergent, which all contain a certain percentage of alkaline builders, even though the product pH is only 7,5 or 8. And of course situations like busy shopping centres, busy commercial buildings, etc where they are using an auto scrubber with an alkaline detergent. These practices leave a small amount of alkaline detergent residue on the floor with every clean. The tiles start becoming dull and slowly get more and more dirty. The use of bleach and floor stripper is often used to remove this residue, which is unsuccessful because these solutions are of the same pH type (alkaline) as the residue they are attempting to remove. The answer is to switch across to an acid cleaner and the alkaline residues are successfully dissolved and the tiled floor is effectively restored. You can reverse years and years of alkaline residue in one or two cleans when using a correct acidic cleaner.

Q&A

Would you be able to comment on the pH of tap water?
Whilst we talk about the pH of water being neutral, the pH of town tap water has normally got a slightly alkaline pH. This is largely due to the addition of chlorine, and the presence of hard water salts. Typically, pH water is somewhere around the 7.6 – 7.8 mark, It can even go into the early 8's. You can log on to your local water corporation and find out what the pH of your tap water is. Typically, it's very, very weakly buffered and wouldn't really have any influence on your cleaning operation as such.

When is a neutral rinse necessary?
Well, largely speaking, a neutral rinse is necessary due to two things. One is the type of substrate that you're cleaning. When we're cleaning a wool carpet, or a natural carpet, it is important to return the fibre to the acidic state because this is where the dyes and the fibres are in their most stable state.

Another situation is when you are using a strongly caustic cleaner in a hard surface clean, they can be difficult to rinse. Especially if the cleaning is being conducted using an autoscrubber as opposed to being spray rinsed with a hose of high-pressure washer. It is always advisable in these cases to use a light acid rinse to ensure that all alkaline residues are removed.

What's the best use of a dairy acid?
Dairy acid, which is known as lactic acid, and is an organic acid. It has inherent sanitising capabilities and is quite effective in descaling applications. It is looked on very positively due to it's quick biodegradability and favourable safety profile.

Will vinegar work to clean tiled areas soiled with alkali cleaner build ups?
Yes, vinegar will work simply from the point of view that it is an acid. I never advocate the use of vinegar as there are so many better professional acidic solutions available. The smell of vinegar can also leave your house or the facility smelling somewhat like a fish and chip shop. But in theory, yes, vinegar can be used to remove an alkaline cleaner buildup, but I would only use that as a last resort.

Can you elaborate on acid replacement?
The acid replacement technology is something that we've explored quite extensively at Actichem. The Tile and Grout Restore and the Crete Clean products are both acid replacement technology. The acid replacement technology provides the strength of a mineral acid such as hydrochloric or phosphoric acid but gives the hazard rating of an organic acid. In fact, the corrosion profile and the safety profile are more along the lines of an organic acid such as glycolic or citric acid. Including the absence of acid fuming. These therefore become very, very useful for the for the professional cleaner. Certainly, look up the T&G Restore and the Crete Clean for further information on that.

Can you explain how an alkaline rinse in the context of carpet cleaning works? Does it leave the fibres in a neutral state?
Alkaline emulsifiers are used at very weak dilutions, which means they are very, very weakly buffered and leave the carpet in pretty much a neutral state. Carpet fibre testing following alkaline emulsifier use typically return a pH of below 8. It achieves it's cleaning power, by reducing surface tension and locking up hard water ions, which are the two biggest enemies of an effective rinsing agent. We've got a couple of really good articles on the use of an emulsifier, on the Actichem website as one of the blogs, so jump on there and download them.

What is the solution for tiles that are dirty with grease like chips and drinks, or a tiled floor near a commercial kitchen.
Well, where there is a commercial kitchen, there is a lot of food activity and a lot of human activity. This tells us that we have a dominance of organic soiling on those tiles. To remove these acidic organic soils, we need to explore the alkaline cleaners. Typically, a fully built, professional alkaline detergent will work better than using straight hydroxide. Alkaline detergents are the workhorse in commercial kitchen and dining areas.

What is the best chemical to remove scaling and limescale?
As discussed earlier, scaling and lime scale is an alkaline, inorganic soil and will require an acid for removal. However, this is an area where we absolutely need to know our substrates. If the limescale is on a synthetic man-made tile, such as porcelain or ceramic, an acidic detergent will be the correct solution. For instance, a shower cleaner based on an organic acid such as RG Shower Cleaner. Or deep clean products such as Tile and Grout Restore or Crete Clean.

However, when limescale or efflorescence is on a natural stone such as marble, an acid will etch the stone and mustn't be used. This is where costly mistakes are made. The correct solution is the Actichem Stone Gel Pro, which combines specialty chelating agents with micro abrasives in a mildly alkaline cream to remove efflorescence and limescale off these delicate surfaces. Agitation becomes more important however, this is the safest, effective option.

Don't cooking oils come from living things. So, do they have a pH?
Cooking oils are fats or derived from fats from plant or animal sources. Whilst they are oils, these fall into the acidic organic (only very slightly acidic) and most successfully removed with an alkaline detergent. By comparison motor oils are hydrocarbons and pH is not relevant and are best removed with a solvent.

How do I clean high gloss tiles in an office environment?
The best option for shiny tiles in an office environment is a low residue, low foam alkaline cleaner such as Actichem Tile & Grout Cleaner LF. For deep cleans use the product at a strong dilution such as 1:10 and rinse with clean water. In maintenance cleaning applications use it at a dilution of 1:150 with no separate water rinse. Shiny tiles also respond well to a "buff" at the end of the job with a rotary polisher/scrubber with a white pad and a spray-on/spray-off window cleaner such as Actichem Windogleam. This overcomes any tendency for water spotting.

What process is required prior to sealing after a major clean for stone, tiles?
The key factors is to ensure that the stone and tiles are clean, completely dry and chemical free. After cleaning, ensure that a thorough rinse is performed. Acid cleaners are relatively easy to rinse when using a tile spinner or high-pressure system. If an autoscrubber is used, pay extra attention to the rinse especially where a strong acid solution is used. Alkaline detergents, especially high caustic detergents require special care. A tile spinner or high-pressure system is normally sufficient but extra care will be required compared to an acid detergent clean. If an autoscrubber is used, do an initial rinse using a light acid solution. A low caustic or alkaline salts solution which will rinse significantly easier than a high caustic solution.

actichem™

Actichem Pty Ltd
11 Gamma Close Beresfield NSW 2322
+612 4966 5516 | www.actichem.com.au
info@actichem.com.au