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GUILD OF CLEANERS AND LAUNDERERS

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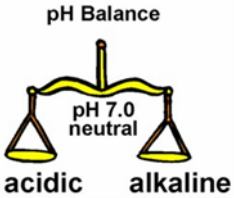
Chemistry and the Washing Process

There is now greater attention paid to product quality, hygiene, and safety, when items are being processed than perhaps even the customer appreciates but linen, especially white linen, is even better after a washing process because all of the finishes put on during the weaving process will have been removed and it could be the whiteness has also been enhanced.

Water Quality

In general the amount of water available is reducing and its price increasing and we must use our technological skill to be as economical as possible with its usage, because of an increasing awareness of environmental conservation and we have a duty to conform with legislation regarding the quality and quantity of effluent we discharge into our sewers. The quality of raw water supplied by the water authorities is considered high in terms of purity for human consumption, but there are however, few waters which can be used for washing in laundry terms without some form of additional treatment. Impurities of concern in washing, or wet cleaning, are the bicarbonates, sulphates and chlorides of calcium and magnesium, known by launderers as hardness. Removal of this hardness is achieved by the installation of a water softening unit known as a "Base Exchange" or "Zeolite Softening" of water. Washing with 'hard water' requires more detergent and can cause furring on the heat exchange surfaces of the washing machine. Iron in water has other detrimental consequences.

pH in Washing



Another factor of concern in washing is that of the pH of the water. The pH of a solution is its degree of acidity, or alkalinity, with a level of 7 being considered as neutral with those lower being acidic of increasing concentration and those higher than seven being alkaline with increases in alkalinity with the even higher numbers. The pH scale is 1 - 6 acid and 8 - 14 being alkali.

Cleansing Power

In a washing process both soap and synthetic detergents have better cleansing powers when in an alkaline solution. Soiling, especially of a fatty nature, can combine with alkali when in a hot solution and even have a cleansing power in the absence of added soap or detergent as it combines with fatty acid to form its own soap. This technology is not new as there is archaeological evidence that the Phoenicians were aware of this over 5000 years ago. When in solution soaps tend to hydrolyze (breakdown) to produce fatty acids (combination of fatty acid and soap known as 'acid soap'. Additions of an alkali to the solution maintains the stability of the soap keeping it in a form which will, wash. It is true dirt often contains some acid which destroys soap unless it is neutralized by the addition of an alkali. Alkali can have a detrimental effect on animal fibres, such as wool, and when setting up a wash programme it is important to consider what implications there is likely to be when selecting the type of detergent and wash programme to be used. One of the characteristics of acids is that they will dissolve a wide range of metal compounds and they are therefore used for the removal of metal stains of which the most common is iron mould, or rust. Textiles can vary in their susceptibility to damage by acid, and therefore vegetable fibres such as cotton and linen are more readily damaged than are animal fibres. Nylon is also susceptible to acid conditions and care should be taken. Care should also be taken if an acid is used for stain removal because if it is not removed completely before the article is dried the drying process concentrates the acid and damage to the fabric is then inevitable. If heat is applied the damage can be all the greater.

Synthetic Detergents

The synthetic detergents, in use today, are not 100% pure and compared to soaps, which have a purity of 70% to 95% that a lower purity from about 20% to 35% is normal. Soap less detergents are sub-divided into three groups; anionic, cationic and non-ionic.

Anionic Detergents-this type are almost completely biodegradable and are stable over a wide pH range. They are built with alkalis, which are used as builders and originally phosphates, (sodium tripolyphosphate (STPP), the main detergent phosphate, was something of a wonder ingredient, helping to maintain pH, remove food and grease, inhibit corrosion, and suspend insoluble dirt. For the launderer, its main visible benefit was to reduce spots of grease and filming by sequestering calcium and magnesium ions in the wash water), as well as an

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oxidizing bleach (sodium perborate) and optical brightener and also carboxy methyl cellulose (known as cmc) to prevent redeposition, blended into a powdered detergent product. Now Zeolite A - type products and sodium citrate; polyacrylates; and tetra sodium etidronate, a phosphonate, are now key elements in phosphate replacement because of being a restricted use product both in the EU and USA . Phosphate, when flushed out to waterways, will stimulate the growth of plankton and aquatic plants which provide food for fish. This process in turn causes the death of aquatic life because of the lowering of dissolved oxygen levels. Sodium Perborate is also restricted in the EU for use in cosmetics but not laundry.

Cationic Detergent - as detergents these have little value in the wash process, although they have other uses, for example, disinfection of articles, which are heat sensitive, when it is added to the final rinse. They are also useful as textile softening agents when they produce a more bulky fabric. For these reasons they have a use in dry cleaning detergents (soap).

Non-ionic Detergents - are extremely stable under any conditions likely to be encountered in a washing process, making them good wetting and emulsifying agents and also useful for stain removal processes. Unfortunately, it does not degrade easily and resist bacterial attack when in the sewage treatment works. For this reason, consistent with satisfactory soil removal, it is wise to use as little as possible of this detergent.

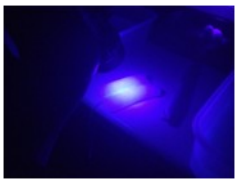
Bleaching

Of all the materials used in a washing process, bleach is the one potentially most dangerous to fabrics. It is no substitute for good washing as it will not remove the bulk of inorganic and organic soiling whereas a good wash will. The main function of bleach is the removal of stains which are not removed by ordinary wash processes but are amenable to bleaching. Common bleaches used in laundry processes are oxidizing agents and their action is due to the fact that staining becomes colourless, or soluble, in water, or both on oxidation. To rely on a bleach process for the production of a 'good colour' is a complete misuse of bleach. The effect of regular bleaching is always to cause some damage to fabrics as it exerts a simultaneous attack upon the stains and the fabrics. Control of the quantity of bleach and temperature is to minimize the damage caused. Chlorhexidene used in hospitals can result in pink to brown marks when subjected to chlorine bleach in a wash process. For more information on bleaches see next page.

Temperature and Bleach - In use chlorine bleaches should never be used at a temperature higher than 60°C, and never used on animal fibres (such as wool), whereas per bleaches (hydrogen peroxide, sodium Perborate and sodium per carbonate, which is also used in powders) do not start to work until this temperature is achieved and work best at high levels.

Peracetic acid (PAA) (is made up of approximately 31% Acetic Acid and 11% Hydrogen Peroxide)

When washing white work a laundry can achieve a significant economy in water consumption by using PAA to neutralise the wash alkalinity instead of relying on rinsing alone. This means that the rinse zone of a tunnel washer can be used to extend the wash zone. It is essential to neutralise correctly in the final compartment of the tunnel washer, but if after the wash process the work is over-neutralised there is a risk of rotting cotton, especially the belts, of the multi-roll ironer. Peracetic acid is a mild bleach (it's bleaching action for example is not as powerful as chlorine bleach). It is also a disinfectant and because of this can be used in healthcare laundering. However, it can give rise to corrosion problems with some equipment if misused. Any metal, with which the PAA liquors might come into contact, need to be a good grade of stainless-steel, and both brass and copper can be attacked. Although in tests to identify the risks of textile damage, it has been found that the risk of weakening the textile is significantly less with PAA, than with chlorine bleach-based systems, in a well-designed system. Use of PAA can leave a pungent (vinegary) smell in a commercial laundry



Optical Brighteners—Optical whiteners, or brighteners, are colourless or pale coloured substances, which give out a blue light when exposed to ultraviolet radiation. They are also dyes, in that they firmly attach themselves to textiles when applied in warm, or hot, solution. They are rarely used separately but are blended with the detergent as purchased and their use is to enhance the whiteness of a washed article. The problem with their use, if not confined to white work, is that they have a tendency to mask the brightness of colours, giving the effect of fading, although the original fabric dye may have been quite fast. This effect cannot be easily reversed as it is not possible to remove the optical white without affecting the original dye as well.

Laundry Sours— Laundry Sours are acidic substances which are used to neutralize alkaline liquors, or fabrics, and are crystalline powders. They are dissolved in the washing machine on the final rinse and are not suitable for use in a porcelain sink because they attack the glaze. Cotton and Linen items can suffer from the drying of traces of alkali from the wash liquor or even from the water supply and this leads to yellow or brownish marks called gall marks. These marks are also likely to appear during ironing especially on parts that have become partly dry, due to concentration of the trace alkali in these areas.

Waste Water, Effluent and the Mogden Formula—The Mogden formula is used by water companies in the UK to calculate charges made to collect, treat and dispose of your industrial trade effluent and takes into account the strength of the trade effluent discharge. The cost depends on the volume and strength of the discharged effluent. If industrial wastewater is sent to a foul sewer there will be a "Trade Effluent Charge". This is calculated and collected by the receiving Water Company to recover the cost of carriage to and treatment in their treatment plants (sewage works). The scale of this charge depends on set factors, coupled with the measured "strength" and quantity of the received effluent.

The Mogden Formula is Stated as: $C = R + V + Vb + B \times Ot/Os + S \times St/Ss$—Where:

C = Total charge rate for disposal (pence/cubic metre)
R = Unit cost for conveyance (pence/cubic metre)
V = Unit cost for volumetric treatment (pence/cubic metre)
Vb = Additional volume charge if there is no biological treatment
B = Unit cost for biological treatment (pence/cubic metre)
Ot = COD of trade effluent (mg/l); Os = COD settled sewage (mg/l) (COD = Chemical Oxygen Demand)
S = Unit cost for sludge disposal (pence/cubic metre)
St = Solids value trade effluent (mg/l); Ss = Solids value* settled sewage (mg/l)

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Resin Finishes on Fabrics

The special finishes applied to fabrics during manufacture, to produce crease resistant, glazed, embossed and many other effects, are mainly fast to washing, but should they be lost during the wash it is seldom possible to restore the fabric to its original condition by additional treatment in a wash sequence. There are however, a wide range of finishing agents that can be applied and give satisfactory results and the most common of these available in a laundry is starch.

Shower Proofing Agents

Shower proofing finishes can be applied, following a wash process, but it is recommended you contact a specialist supplier and follow their procedures as different emulsions give varying results.

Flame Retardant Agents

If you require a finish to provide some form of flame proofing you must remember it is not possible to proof a fabric so that it will not be destroyed by fire and the main purpose of any treatment is to prevent the material flaming readily so as not to spread the fire. Obtain your flame retardant treatment from a specialist supplier and follow their guidance because the level of retardancy can depend on the amount of product taken up by the fabric.

Classifying for good cleansing

Good cleansing and finishing starts by having the right sorting and classifying prior to loading your machine. A basic understanding of the different types of fibre, how these are made into fabric and dyed, will help to ensure launderers and dry cleaners treat the items and select the most appropriate cleansing and finishing methods. There is a reference book, obtainable from the Guild, entitled 'Textiles for Dry cleaners and Launderers', by Mike Clark FGCL, which is an excellent reference guide covering most fabrics, finishes, with help and hints.

Word of Warning

For any soil to be removed it must be soluble, either in water, detergent solution (which is alkali), an acid, or a solvent. Marks and stains become more difficult to remove each time they are processed. They will 'set' during the first wash unless they are recognised and the correct removal procedure applied, and although it may be possible to remove them at a later stage it will be by expensive special processes, or at the risk of damage to the fabric.

Cleaning Fabrics With Water

Since water is wet it is sometimes taken for granted that it will readily wet anything with which it comes in contact, but often the wetting which does occur is largely superficial. In fact, it is common experience that if ones hands are immersed in water, and then withdrawn, most of the water runs off, leaving a few droplets on the otherwise dry skin. This is due to the presence on the skin of the natural body greases with which water has no affinity. Similarly, water does not readily wet a textile fabric. In order to do so, it must come into contact with every fibre and must displace the tiny pockets of air which fill the spaces between the fibres and which hinder the penetration of the water. Water cannot do this without assistance of some sort; it is said to have poor wetting properties, or to be a poor wetting agent.

Chlorine and Peroxide Bleaches (Precautions)

Chlorine bleaches (Sodium Hypochlorite NaOCl) can destroy the flame retardancy of fabrics and storage of hydrogen peroxide with this laundry bleach should be avoided because of potential release of chlorine gas when mixed. In acidic solutions, Hydrogen Peroxide (H_2O_2) is one of the most powerful oxidisers known—stronger than chlorine, chlorine dioxide, and potassium permanganate. Peroxide bleaches should not be stored with strong acids either because accidental mixes can be exothermic. Exothermic reactions are reactions that release energy into the environment in the form of heat. Exothermic reactions feel warm or hot or may even be explosive.

MECHANICAL ACTION AND DETERGENTS

One way of assisting the water is to provide mechanical action, such as by movement of the load in a washing machine, this forces the water into the fabric and thus achieves wetting, but it is a slow process and the excessive mechanical action is harmful to the work, especially outerwear. Much more rapid wetting can be achieved, and far more gently, by dissolving soap or detergent in the water which is referred to as the wash liquor. Because detergent in solution has an affinity for both the water and the greasy soiling on the fibres it is able to act as a good wetting agent. Unless this wetting is achieved at the commencement of a washing process, the wash liquor cannot begin to remove the dirt from the fibres. Once the fabric has been wetted it remains wet for the duration of the process, but this does not mean that the detergent has served its only function. Again, due to its affinity for both grease and water, the detergent is able to carry the water along the fibres, between the fibre surface and the dirt, which is thus lifted away from the fibres.

The deposits of oily dirt roll up and form droplets containing the particles of solid soiling, and these droplets have such a small area of contact with the fibres that they are readily removed by the agitation of the wash process. Detergent is therefore a soil removing, and suspension, agent.