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GUILD OF CLEANERS AND LAUNDERERS

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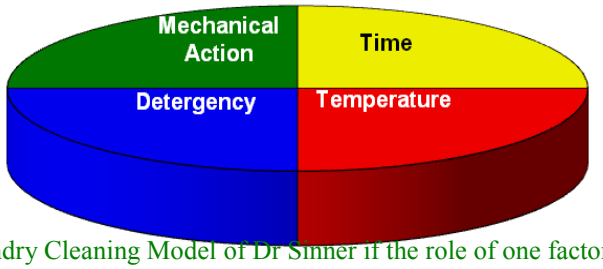
INTRODUCTION TO DETERGENCY

Detergency is the name given to processes which remove soiling from an object or surface. Washing is a form of detergency as is dry-cleaning. Substances that assist in the process of cleaning, or removing soil, are called detergents.

Detergency is essentially a physical process, that is a process which depends upon physical (external) properties; chemical reactions are not primarily involved. There are 4 principle elements – or Mechanisms – that take place in any cleaning process:



The Laundry Cleaning Model of Dr Sinner if the role of one factor is reduced it must be compensated by an increase in one or more of the others.

Cleaning processes are generally carried out in a liquid medium as this aids the detachment and dispersal of the soiling; in washing, the liquid is water, in dry-cleaning, it is an organic solvent. The surface to be cleaned, albeit a 'hard surface', e.g. Floors, walls, etc., or textiles, e.g. Clothing, carpets, upholstery, etc., are collectively called the 'substrate'. In any successful cleaning process, the following must take place :

a) The soil is detached from the surface of the substrate being cleaned;

b) The loosened soil is removed from the vicinity of the substrate and dispersed into the liquid;

c) The soil that has been transferred to the liquid is prevented from returning to the substrate.

Amplification of these points

a) Detaching the Soil from the surface of the Article

How easily the soil is removed in a cleaning process depends upon :

i) the nature of the surface to be cleaned

ii) the nature of the soiling to be removed

iii) the attachment between the soiling and the surface of the article.

It is much easier to clean a very smooth surface than a rough one. For instance, an object with a very smooth surface such as a vitreous enamel oven door, or a sheet of glass, can often be cleaned satisfactorily by wiping with a damp cloth, but one could not expect to clean clothes in this way. Soiling is unable to attach itself firmly to a very smooth surface and so it can be removed easily. In the example given, the soiling transfers to the cloth, where it is held more firmly. It is more difficult to get the cloth clean again!

All textile fabrics have a rough surface even though some may appear, at first sight, to be quite smooth. Mostly, they are made from numerous individual fibres which are twisted together to form yarns, which are then interlaced so that the final surface is far from smooth and even. The individual fibres themselves may also have a rough surface.

Most of the soiling present on our clothes consists of very small dark coloured particles and grease. Many, but not all of the solid particles, are attached to the textile by a thin film of grease. Some water-soluble substances may also be present. Some of this soiling is removed simply by being dissolved in the cleaning liquid, (i.e. the grease in dry-cleaning solvent, or water-soluble substances in water). Thus solubility plays some part in detergency. Most of the dirty appearance is, however, due to the presence of the solid particles that are insoluble in either organic solvents or water.

When the film of grease is removed (by solubility in dry-cleaning solvent, or by the emulsifying/saponification action of soap and water in washing), the particle is released from the surface of the textile. The use of detergents in the cleaning process also assists in releasing the soiling particles from their attachment to the non-soluble surface of the textile.

b) Moving the soil from the vicinity of the article into the liquid

Having freed the soiling particles, they must be removed from the surface of the textile and dispersed throughout the cleaning liquid. This is achieved by detergent action and also by mechanical action, usually some form of agitation. For this reason, mechanical action is necessary in all cleaning processes. If a soiled fabric is simply placed in an organic solvent, or soap/water, and allowed to remain quite still, not much soiling would be removed, although its attachment to the fabric may be broken down.

c) Prevention of re-deposition of the soil particles on to the textile

The soiling particles transferred from the textile to the cleaning liquid are dispersed throughout it by mechanical action. These particles must be prevented from finding their way back to the textile. The re-deposition of soiling in this way, during a cleaning process, is known as 'Greying' because it gives the materials a dingy or grey appearance. In these circumstances, the soiling is, to some extent, being spread out instead of being removed completely. Detergents help to prevent the soil being re-deposited, particularly in water-washing processes, by aiding its suspension throughout the liquid.

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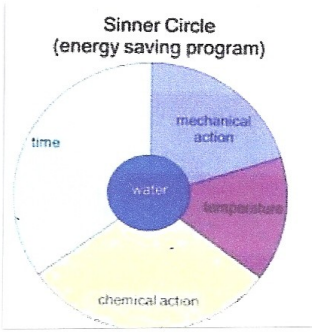
Greying can also be minimised by removing the dirty cleaning liquid as quickly as possible and replacing it continuously with clean liquid. Care must also be taken to remove, from the textile, the soiling that has dissolved in the cleaning liquid, as well as any detergent used and any insoluble soil which may have remained suspended in the liquid at the end of the process. This applies to both washing and dry-cleaning processes.

Re-deposition of soiling can be prevented, primarily by using sufficient water to dilute the soiling to a level that allows detergents and alkalis to work effectively. This process is controlled, by having correct dip levels and the correct number of stages, within the wash process. Afterwards as much wash liquid as possible must be removed (for example by hydro-extraction), to remove the small amount of dirty liquid which remains within the textile. This rinsing must be carried out efficiently. Any substances left behind on the garments will cause discoloration and may give rise to objectionable odours. *All cleaning processes should be ended with thorough rinsing.*

Dr Herbert Sinner of Henkel in 1959 came up with his ideas on washing performance . According to Dr Sinner, there are four main factors in the cleaning process: chemical action, mechanical action, temperature and (reaction) time. These factors are represented in a circle which illustrates how the individual factors compensate for each other. In 2010 water was introduced as a fifth factor, shown as an inner circle, by Stamminger to show the importance of water as an essential element in wet cleaning. Water acts as an agent for dissolving the detergent, for transportation of the detergent ingredients, as well as heat to the laundry items, and for providing the mechanical force on the soil, also for transporting the released soils away from the fibres and for diluting the detergent solution during the rinse process.



The sinner circle, as an illustration, may have its shortcomings (for example it will not show the interaction with the individual detergent ingredients) but it can communicate the interdependence of the various factors influencing the washing process. The picture left shows a visual energy saving cycle formed by reducing the temperature portion of the pie (i.e. Heating is responsible for the energy consumption) and by simultaneously enlarging the contribution (size of pie) coming from the time factor.

A COMBINATION OF FIVE FACTORS: WATER, TIME, DETERGENT, TEMPERATURE, MECHANICAL ACTION (THE SINNER CIRCLE)

Chemical action (chemical energy): This represents the action of the dissolved detergent. The action is increased or decreased by the concentration of the detergent ingredients in the solution (water + product).

Mechanical action (mechanical energy): This is the mechanical action of the washing machine, which generates friction and pressure. For manual washing, when no equipment or devices are used, the person doing the cleaning is considered to provide mechanical action by rubbing, sometimes with the help of auxiliary devices (e.g. scrubbing board).

Temperature effect (thermal energy): Heat is often used in cleaning activities. The elevated temperature enhances the chemical reactions, solubilises greasy soils and weakens the binding forces of the soil on the fabric.

Time: The duration of the cleaning operations determines how long the product is allowed to act. Combined with the mechanical, thermal and chemical action, the duration affects the cleaning power. Longer cleaning times will typically improve the cleaning performance.

Water has been introduced as a fifth factor to show the importance of water as essential element in wet cleaning.

The Sinner model can help to understand how energy saving cycles (washes at lower temperatures) can be operated without compromising the washing performance. The reduced thermal energy (from lower washing temperatures) can be compensated by a longer wash duration and/or by the use of detergents that have been designed to be highly efficient in the lower temperature range.

Most modern detergents have intentionally been designed to wash efficiently across the entire range of temperatures, and specifically to wash well at low temperatures without compromising cleaning performance. With the objective to make low temperature washing more efficient, significant R&D efforts have been invested in the recent decade to better understand which ingredients and formulations work best at lower wash temperatures with real soils/stains and under relevant laundry conditions. Special ingredients, such as enzymes and other catalytic and activator ingredients, have been developed to be active at 30°C and lower temperatures. These have been assessed to be safe for the environment. In addition, the purchaser has a broad choice of product forms to determine which one best fits their washing needs, loads and habits In general, it is recommended to avoid short cycles when a performance cycle is needed or desired. If those performing the washing use a short cycle at low temperature (e.g. quick & cold), the Sinner model shows that both time and thermal energy will be reduced. As a consequence, this would thus mainly be considered as a refreshment cycle with a relatively low cleaning performance. Cold cycles can offer the sometimes other desired user benefit of convenience, combined with improved fabric care properties (e.g. longevity of clothes, reduced colour fading). Short cycles should be avoided if a performance cycle is desired, especially at lower washing temperatures.

The question also arises of bacteria and low temperature wet cleaning because low temperature does not kill bacteria, just spreads it around the load, although some detergent suppliers have started to add bactericides to low temperature detergents to compensate for this. Without these additives low temperature washing will only dilute the level of bacteria, not remove it, and in a time of infection this could lead to other problems.