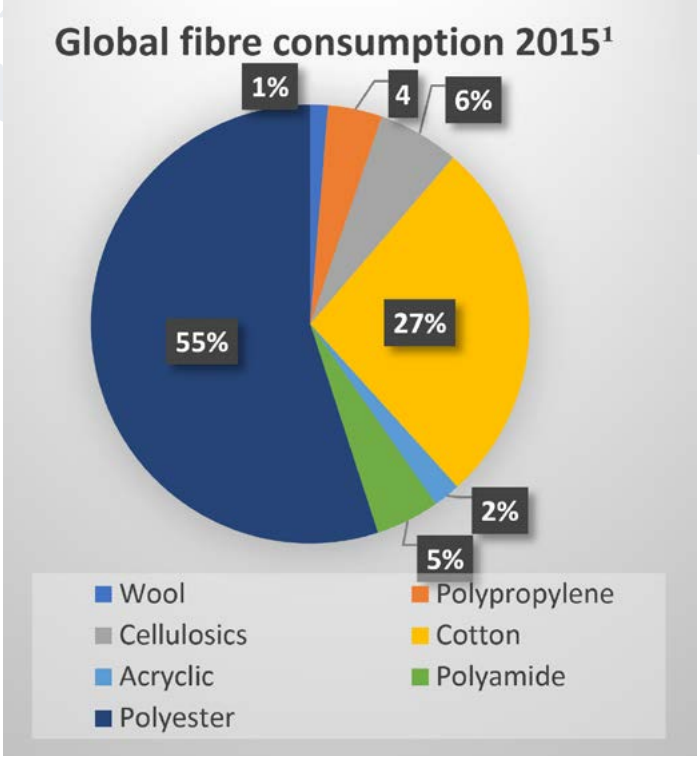
CINET
Professional Textile Care

BUILDING A GLOBAL NETWORK

Solvent of your choice;

Independent review of various available cleaning solvents

Over the last years, many new cleaning technologies and solvents have been introduced to the textile cleaning market. Due to changing dressing habits, new textile materials, sustainability profiles and legislation, developments and innovations are important to enable new business cases. Because of all these new solvents and technologies it becomes often unclear to the professional textile cleaner which solvent or cleaning technology is the most suitable for him. In this brochure the most common solvents will be discussed from different perspectives to provide a clear view of the available options.
The different cleaning methods and solvents will be evaluated based on market developments, technological innovation, market segments, essential differences in solvent properties, costs and cleaning performance.



Market developments

- There is a global trend in changing dressing habits, however in different dimensions. Overall, people shift from elegance (luxury) to comfort (convenience) and more casual garments. This means that the use of luxury textile fibres like wool and silk, is decreasing and fibres like polyester are more and more used.
- The use of functionalized synthetic materials is becoming more popular and also biomaterials and recycled materials like Lyocell will be used more often. The new fibres can often resist a water based cleaning process, in contrast to the traditional textile fibres.
- The third development is an increasing awareness of sustainability. Not only consumers are more concerned about their influence on carbon footprint, also governments are steering towards a more sustainable environment. This results in more use of biomaterial fibres and recycled textile fibres but also stricter regulations on the use of cleaning solvents.

Technological developments

Over the last two decades, there have been many technological developments in the field of alternative cleaning technologies. These developments may be in the field of new solvents, new or improved machine technology or new or improved detergents. This is mainly a result of the pressure worldwide on the use of perchloroethylene. The recently introduced alternative solvents are Ktex, Arcaclean, HiGlo, Intense and SENSENE. These solvents are available besides the more or less established solvents like hydrocarbon solvent, Solvon K4 and GreenEarth.

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At the same time developments of proper alternatives cleaning methods have taken place. Over the last years advanced wet cleaning systems have been introduced and recently new dry-to-dry wet cleaning systems were presented. Currently many different wet cleaning systems are on the market, each with their own combination of equipment, chemicals and cleaning programs. One of the most discussed items is the ability of a wet cleaning system to replace the dry cleaning process. This question is difficult to answer due the differences in dry cleaning operations. Nevertheless wet cleaning is a good way to provide a mild professional water based cleaning process for delicate and non-washable textiles.

Market segments

Depending on the type of consumers, specific conditions can be requested from the cleaning solvent. Individual consumers tend to have their own special needs and preferences. They usually only take special garments and articles such as suits and curtains to the professional cleaner. Moreover, they bring small quantities of items and do not bring their textile items often to a professional textile cleaner. Textiles of individual customers can be cleaned with a wet cleaning system. Because most of the stains of consumer garments are water-soluble, they can be easily removed in a water based mild process like wet cleaning.

Additionally, consumers do wear more synthetic textiles which are resistant to a water based cleaning process like the wet cleaning process.

Individual consumer goods can also be dry cleaned. It is advisable to have different solvents because different solvents have different cleaning properties. PERC and SENSENE are known because of their strong cleaning performance. GreenEarth and hydrocarbon solvent are gentle dry-cleaning solvent for all kinds of textiles and leather articles.

Professional textile cleaners with corporate clients receive often higher quantities of goods. Goods of corporate clients are often only lightly soiled and can therefore be cleaned with mild cleaning solvents or wet cleaning, depending on the type of textile and soil.

If the textiles are heavily soiled with non-water soluble stains, solvents like PERC and SENSENE can be used. These solvents can also dissolve effectively greases and oils. Solvents like hydrocarbons and GreenEarth tend to dissolve greases somewhat less easily. This is due the high Kauri–Butanol value of the solvent[2].

Essential solvent properties

The cleaning properties of a cleaning solvent are determined by the viscosity, density, surface tension , chemical composition of the solvent but also by the right process conditions and a proper choice of detergents. While making this not to complicated some essential differences are explained in order to choose the optimum cleaning method.

Solvents with a high Kauri–Butanol value are able to dissolve lacquer and varnish stains from the garments more easily. But the total composition of the solvents, including detergents, determine the cleaning performance of stains like greases, oils, particle soil, protein and tannin stains. To remove water soluble soils like salts, sugars, sweat and urine a certain amount of water is required, which is often part of the detergents.

Modified alcohol or glycol ethers are somewhat polar, as is water, which means that these substances show some interaction with water. Examples of glycol ether based solvents are Ktex, HiGlo, Intense, SENSENE and Arcaclean. Hydrocarbons are apolar , having a good interaction with greases and oils.

One of the major differences between PERC and the alternative solvents is the flammability. PERC is a non-flammable solvent while the other solvents are flammable, requiring a multisolvent dry cleaning machine Class IIIA with safety precautions. Another difference is that alternative solvents need more time to evaporate. This often results in a higher drying temperature and/or longer cycle times.

Modified alcohols or glycol ethers have an interaction with water, so attention is required to keep the moisture content well controlled and avoid textile damage. This requires a high level of water separation in the dry cleaning machine.

Costs

To determine the operating costs, the labour costs are the most important followed by consumption of water and energy. Labour costs are mostly based on the required level of spotting and finishing. The required level of spotting is depending on the type of soil, the level of soiling, the chosen solvent or wet cleaning system and the added detergent. The required finishing time for wet cleaning is often higher than for dry cleaning. In a CINET wet cleaning benchmark study it was concluded that wet cleaned items need 20-30% extra finishing time compared to dry cleaned items[3].

In general, the energy consumption of one cleaning cycle with hydrocarbon or other alternative solvents are higher than those for PERC. This is mainly due a higher energy consumption in the drying and distillation (if available) processes. The same applies for the water consumption.

The use of cooling water for the alternative solvents and hydrocarbons is higher than the cooling water consumption for PERC. Additionally the purchasing costs of a multisolvent machine suitable for class IIIA solvents is higher than the cost of a PERC machine.

There are additional costs for dry cleaning related to environmental legislation and safety, which are most strict for PERC. A spill containment or impermeable floor is required for the area where the machine is located and where solvent and waste are stored. The spill containment enables safe storage, transport and handling of solvent and helps to prevent soil and groundwater contamination. Solvent emission to the atmosphere and especially neighbouring premises should be prevented, e.g. by creating gastight walls.

Finally, solvent usage needs to be recorded in a solvent management system. The aim of the solvent management system is e.g. to show the authorities that the company has met with the emission limit. For example the emission limit in Europe of 20 gram per kilogram of cleaned textiles as demanded in the European solvent Directive.

When wet cleaning is used these costs related to environmental legislation and safety are not applicable. The legislation related to wet cleaning is not as strict as for dry cleaning. Wet cleaning detergents products are designed to be biodegradable and only standard waste water demands have to be met.

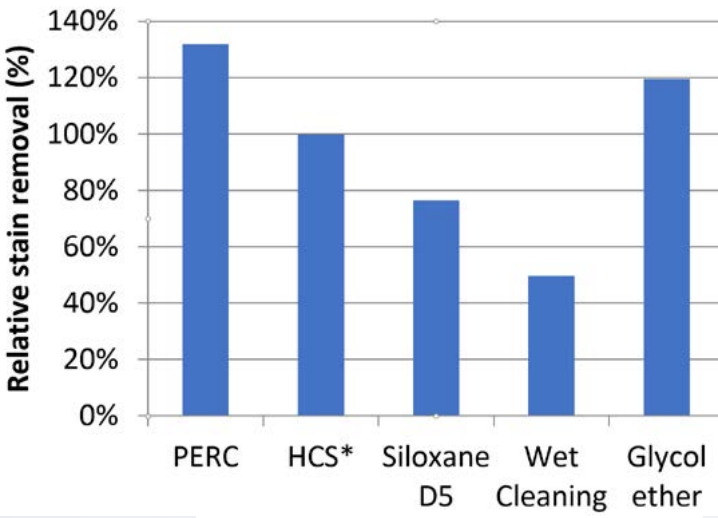
Cleaning performance

In CINET benchmark studies called 'Solvetex', the cleaning performance of different solvents are evaluated together with wet cleaning systems. In order to measure the cleaning performances, the complete cleaning systems have been tested, including the equipment, the detergents, solvents, conditioners and the settings or programs as used in practice. What was excluded from the test are the pre and post spotting or any other special treatments.

The overall conclusion of the cleaning performance with regard to the non-water soluble soil is that PERC provides the best cleaning results, followed directly by the glycol ethers. Hydrocarbons and Dibutoxymethane (Solvon K4) also showed good results on removal of non-water soluble stains. Siloxane D5 (GreenEarth) showed an average result. HiGlo showed cleaning results which were equivalent compared to those of PERC and hydrocarbons, especially a good removal of fatty stains and particles (carbon black) was reported.

The overall cleaning performance of SENSENE is better compared than that of PERC and HCS. Especially on polyester, SENSENE has a very good cleaning performance. The solvent Intense is a boosted hydrocarbon solvent formulated with glycol ethers. Due to the glycol ethers the solvent has the ability to take up some moisture. This makes it easier to remove water soluble soil and stains from the fabric.

Solvent	Commercial name	Kind of textiles	Specialty	Care label
Perchloroethylene	PERC	Heavily soiled textile	Good removal of lacquer and varnish stains	Care label 'P'
Hydrocarbons	HCS	Little soiled textile	Good removal of greases.	Care label 'F' & 'P'
Siloxane D5	GreenEarth	Little soiled textile	Good removal of greases.	No
Dibutoxymethane	Solvon K4	Heavily soiled textile	-	No
Glycol ethers	Arcaclean	Little soiled textile	Good interaction with water-based stains	No
Glycol ethers with hydrocarbons	Ktex, HiGlo, Intense	Little soiled textile	Good interaction with water-based stains	No
Modified alcohol with glycol ethers	Sensene	Heavily soiled textile	Good interaction with water-based stains	No
Wet cleaning process	Various suppliers	Little soiled textile	Good removal of water based-stains	Care label 'W'



Relative stain removal compared to HCS for non-water solulbe stains

Wet cleaning is a water based cleaning method. Previous studies of CINET have shown that, as expected, wet cleaning systems have a lower cleaning performance on fat, grease and oil based stains than the solvents due to the limited interaction between water and this type of stains.

The use of detergent enhances the removal of non-water soluble stains. The removal of water soluble stains in a wet cleaning process is however significantly higher than the stain removal in solvents, which is as expected due to the good interaction of the soil with water. This can be beneficial for the removal of stains like odour or sweat.

The current spectrum of cleaning techniques offers sufficient possibilities for cleaning textiles at a high quality level. Especially taking in consideration that the dressing habits, textile materials and type of stains are changing for the textile cleaning industry. More information on cleaning performance can be found in the Solvetex benchmark studies.

References

1. Textile Exchange, 2016
2. Kleinberg, 2012
3. CINET, 2014

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