



DYEING

TANEDE[®] LR
Liquid reducing agent

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Introduction

In textile wet processing there are a lot of procedures, which require the use of a reducing agent. Typical examples are the reduction of vat dyes, the reduction clearing of disperse dyes, stripping of dyes etc. Well-known reducing agents like sodium dithionite (hydrosulphite) are commonly used. The good properties of this type of product are not in question. In modern wet processing the demands go further and additional properties are required. This includes the need for products to be liquid, for use in automated color kitchens, and also ecology is becoming increasingly important.



To meet these new demands, TANATEX Chemicals developed TANEDE® LR. This is an up-to-date liquid reducing agent, which can be applied, in a large number of applications, to replace current powder products.

Before continuing to describe the possible processes in which TANEDE® LR can be used, a brief explanation will be given about what reducing agents are, points of attention and advantages/disadvantages of certain products.

'TANEDE® LR is a state-of-the-art product'

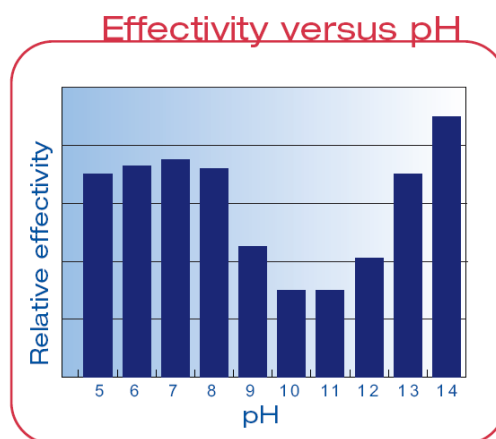
Important properties of reducing agents to be mentioned are:

- * effectivity of the product in relation to pH;
- * effectivity of the product in relation to temperature;
- * reduction potential;
- * stability of the product in application, in relation to time;
- * quantities to be used.

Effectivity in relation to pH

For most reducing agent there is a strong dependency towards the pH. This also gives an indication of where the product can be applied. Hydrosulphite is known to have a flat pH-dependency curve. This is an advantage, since the results remain the same over a broad pH range, for instance vat dyeing.

However, a product based on thioureadioxide, is giving better results at higher pH's, which makes it more suitable for stripping and reduction clearing, but not applicable for processes at neutral and acid pH, e.g. for bleaching of wool and polyamide. The new TANEDE® LR does not have a flat pH-curve, but peaks strongly in two pH areas at which it can best be used. These are the pH-range from slightly acid to slightly alkaline (pH 5-8) and at high pH ranges (pH ≥13). In both ranges there are numerous applications, which are outlined below.



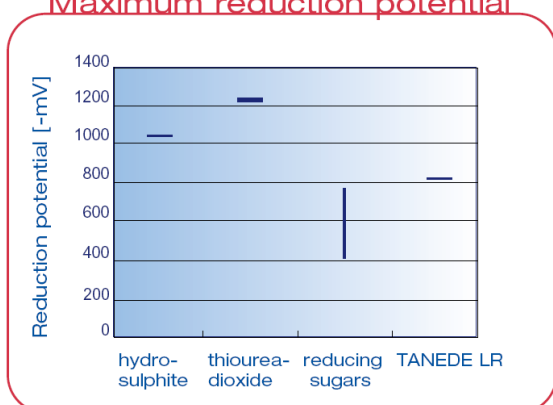
Effectivity of the product in relation to temperature

Most reducing agents perform better at higher temperatures. At 70°C TANEDE® LR is giving good results, but higher temperatures up to 90°C are generally preferred. TANEDE® LR can also be used in continuous washing and pad-steam applications for even better results.

Reduction potential

This is a very important item. It is often misunderstood or misinterpreted. Every chemical product, which has to be reduced, whether it is a dye or something else, needs a very specific minimum reduction potential. Every reducing agent yields a certain reduction potential, of course depending on pH, temperature, time etc. This means that some products can be reduced by certain reducing agents, but other products can't !!! This means that there is a strong selectivity. Increasing the amount of reducing agent will not help in this case, because the reduction potential is only to a certain extent depending on amount. Liquid reducing agents, in general, have lower reduction potentials than the well known powders. This also counts for the TANEDE® LR. However, the TANEDE® LR is again stronger than reducing sugars.

Maximum reduction potential



Stability of the product in application, in relation to time

To give good, and reproducible results, the bath stability of a product needs to be good. For most discontinuous processes this is not so critical, but for continuous processes this is very important.

This stability is strongly related to sensitivity to air-oxidation, and is product related.

TANEDE® LR performs much better than for instance hydrosulphite. This makes it an excellent product for continuous processes, also because of its liquid form (advantage in dosing in color kitchens).

Quantities to use

Of course no one can expect that a formulated liquid reducing agent can be applied in the same quantities as a 100% powder product. This means that a product like TANEDE® LR will be applied in somewhat higher quantities than normal.

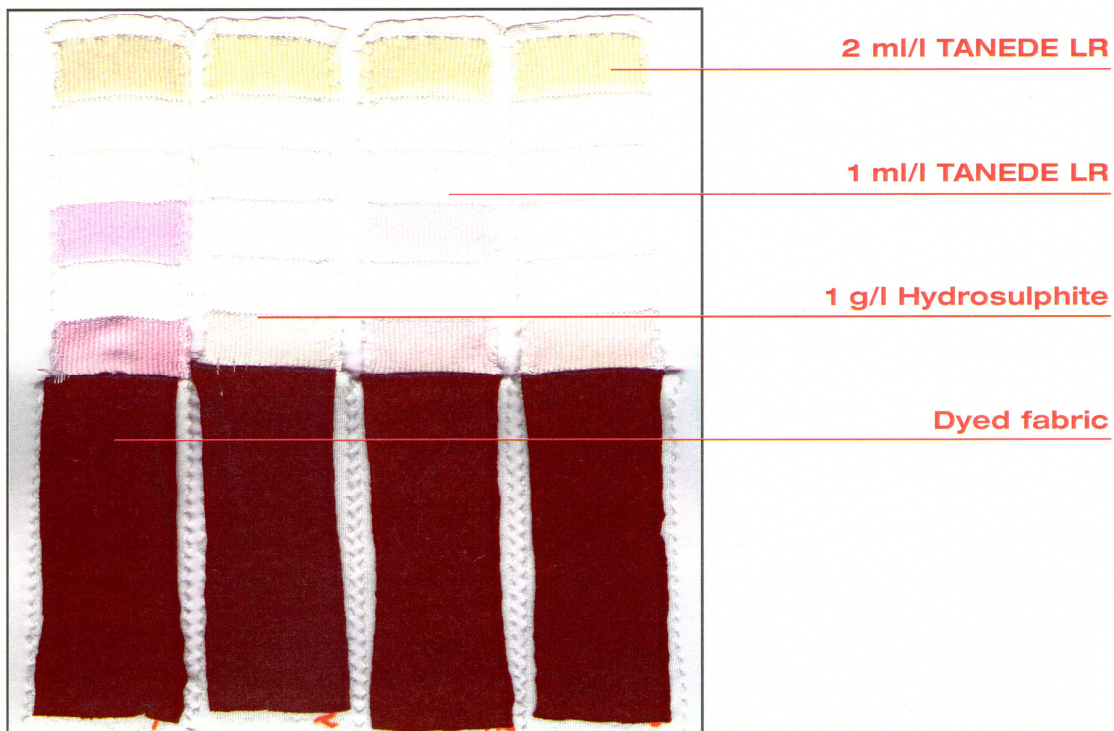
Strong points of TANEDE® LR, in comparison to standard reducing agents

- * liquid, so applicable in automatic dosing systems;
- * easily miscible in water, so no solubility problems;
- * virtually odor free, when used under controlled conditions;
- * highly stable in alkaline media;
- * no oxidative decomposition during storage;
- * environmentally friendly;
- * low COD;
- * low tendency to oxidize with atmospheric oxygen, so stable during processing and storage;
- * fully active in neutral pH range;
- * no negative effect of NaOH on the polyester;
- * no neutralizing required.

Fastnesses

A picture is shown below with the fastnesses of several polyester fabrics, dyed with Disperse Red and reduction cleared with either hydrosulphite or TANEDE® LR. It is clearly visible that TANEDE® LR will give good results at relatively low amounts.

When using TANEDE® LR, it must be remarked that most dyes are perfectly reduced in slightly acid medium, but that others are better reduced in alkaline medium. The effect is dyestuff related.



Processes

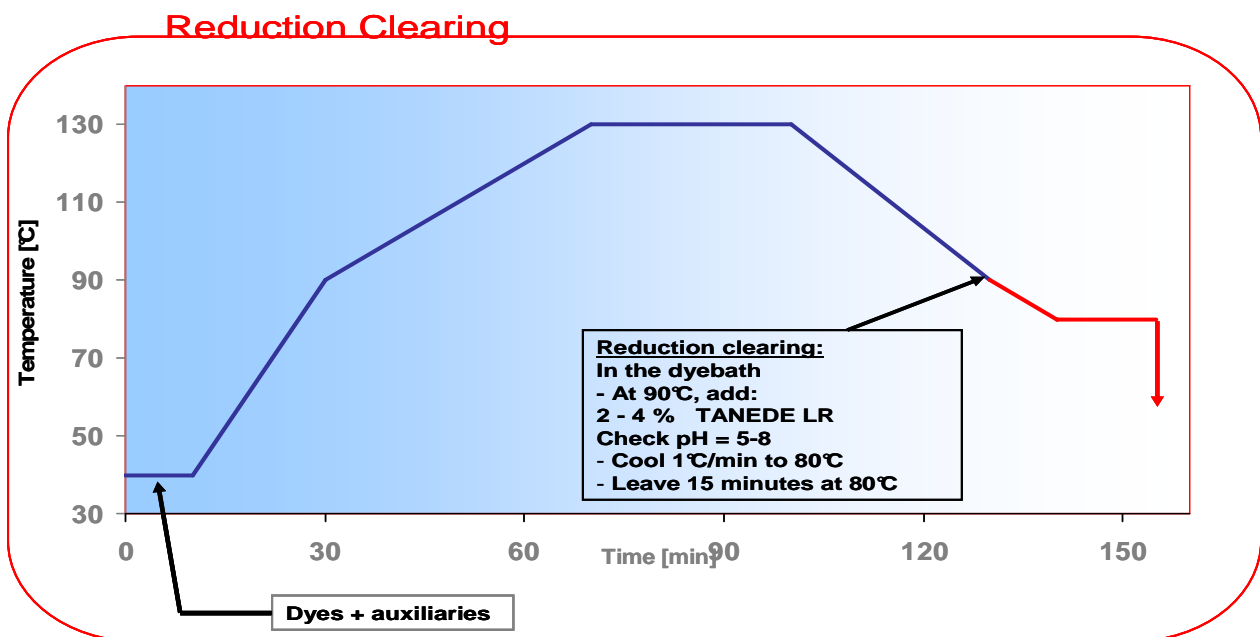
Reduction clearing

TANEDE® LR can be used normally as reducing agent in the reduction clearing of polyester. However, the fact that the TANEDE® LR has a strong reduction action at slightly acid to neutral pH's, making the product very suitable for addition as reduction clearing agent in the dye bath of a polyester dyeing.

Instead of dropping the bath after the dyeing and carrying out a separate reduction clearing, the TANEDE® LR is added to the dye bath itself. This means a big reduction in process time, water consumption and energy.

Because the dye bath at the end of the dyeing is normally around pH=5 and the TANEDE® LR itself is alkaline, the resulting pH of reduction clearing will be around pH=6. This is an optimal pH for TANEDE® LR.

This will result in an almost neutral end pH. Without additional treatments, the pH of the fabric is at the level that is often required (for instance due to Öko-Tex 100 regulations). So additional neutralization, as in a standard process, is not necessary. The process is as follows:



Special reduction clearing process

TANEDE® LR can also be applied in a padding process for reduction clearing in continuous applications, e.g. PES car safety belts.

A possible recipe could be:

Other applications

The blend PAC/Co is often bleached using chlorite. A peroxide bleach is normally not possible, due to yellowing of the PAC under alkaline circumstances. For environmental reasons, the use of chlorite is banned. A good alternative, using TANEDE® LR, was found in the combination of an acid-reductive pretreatment, followed by a low-pH peroxide bleach. A good white of the cotton was achieved, without yellowing of the PAC. At this slightly acid pH, the TANEDE® LR is performing very well as reducing agent. Recipe recommendation:

Stripping

In case of faulty dyeings, a partial stripping of the dyes can be accomplished by using TANEDE® LR in the stripping recipe as reducing agent. Because TANEDE® LR is not a very strong reducing agent, for this application relatively large amounts are required.

Machine cleaning

A possible recipe/procedure for machine cleaning including TANEDE® LR:

Continuous reduction clearing

- 20 – 40 ml/l TANEDE® LR
- pH neutral
- Steam 1 – 2 minutes at 100°C
- Hot wash

Discontinuous PAC/co bleaching

Liquor ratio: 10:1

Reductive pre-treatment: 85°C – 30 mins

- PLEXENE® APR pH 4.5
- TANATERGE® LFN 01 1 ml/l
- TANEDE® LR 5 ml/l

drop bath and rinse at 70°C

Peroxide bleach: 70°C – 60 mins

- TANNEX® RENA Liquid 01 1.5 ml/l
- NaOH 38°Bé 1.5 ml/l
- H₂O₂ 35% 10 ml/l

drop bath, rinse at 70°C, 50°C and cold

Machine cleaning

Fill equipment to 2/3 full with water & add:

- TANEDE® LR 0.5 – 2.0 ml/l
- MERSE® RTU 3.0 ml/l
- NaOH 100% 2.0 – 4.0 ml/l

Fill up and if possible heat to 95 - 130°C and leave for 30 minutes. If the operating conditions allow it, blow out immediately. If this is not possible, allow to cool and empty the bath at the highest possible temperature. Then rinse thoroughly while warm to remove any contamination.

IMPORTANT REMARK



During processes using TANEDE LR at slightly acid pH, sulphur-containing vapours can arise. Therefore we only recommend this process step in closed equipment!

General

Comments on ecological and toxicological properties are contained in the safety data sheet for TANEDE® LR. At all times good hygienic and industrial practices should be followed.

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