ABOVE GROUND WOOD PRESERVATION AND PROTECTION

The Scandinavian Approach to Wood Protecting Stains and Finishes

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SUMMARY

During the last 30 years focus has been on preserving/protecting wood without losing its natural appearance, keeping the wood grain visible, etc. Especially in the Scandinavian countries, this has become an extremely popular way of coating their "above ground" wood. But, also for many areas this is now a very attractive way of coating the wood, meaning, staining the wood to the desired effect. During the years the product development has come far to achieve the right solution to long term durability, easy recoatability, appearance, etc.

This paper will deal with problems within this aspect as well as look into the special decay problems they are having in Scandinavia, where opaque waterbased stains have been used.

Wood is an extremely durable material that has long been recognized for its versatile and attractive engineering and structural properties, as well as for its esthetic look and its ability to put people at ease with it.

During the past 15-20 years, much research work has been done on wood itself: - its ultra-structure, its chemical composition and related properties. The knowledge obtained in this fundamental work has been utilized greatly in the development of wood preservatives and protectives.

We want to preserve and protect the wood in order to keep it longer. Wood is an extremely durable material, even under adverse conditions, but the durability depends upon the environment, and of course, as stated, upon the wood species itself and how it is used and preserved/protected.

The amount of wood used is so high that a great deal of the normally more durable types have been felled and new trees, more quickly growing, have been planted to be used in the future. However, it is well known that, generally, these types are more sensitive to attack and degradation than the more slowly growing types. In addition to this, timber is used more fresh (which saves money for storage, etc.) than before, which also causes much more trouble, as it is normally more sensitive in use.

WHAT CAN HAPPEN TO THE WOOD?

Weathering gives greyish shades and a very dry appearance which does not happen if the wood is protected in the correct way. Also, biological attack is a major concern.

How do we prevent these things from happening, or at least reduce them?

This we do through:

1. Proper building construction.
2. Chemical treatment (the preservation).
3. Physical barriers (the protection).

Structural protection is without doubt a most important matter. But it will not be a concern of this paper. Any preservation or treatment is meant as a kind of insurance for keeping the wood in as good a condition as long as possible.

WHAT IS WOOD PRESERVATION?

Wood preservation:
is a chemical treatment giving protection against wood destroying fungi and/or insects. Used for untreated or poorly maintained wood.

Wood preservation (or impregnation as it is also called) is carried out through application where penetration takes place with different product types and different application methods.

WHAT IS WOOD PROTECTION?

(Often also called wood stains or natural finishes)

Wood protection:
is protection of the wood by a surface coating. Will protect against weather, dirt and surface biological discoloration.

About 30 years ago the wood stains (the protection) appeared as alternatives to the conventional paint and varnish coatings.

The idea behind the protection:
(the wood coating system)

the term "wood coating system" is used as it depends on many factors how the products are combined. Some of the factors are already mentioned, eg. as wood species, where it is used, for what, etc.

In some cases it may even be necessary to use special 2-pack wood coating systems to obtain sufficient durability.

Treatment Type	Physical Protection (Barrier)	Biological Preservation/ Protection against none or more of: -
Preservation		
Wood Preservatives (often clear)	Water - repellent Priming or none	Wood destroying fungi Fungi Insects Blue Stain Surface Mould
Stains		
Wood Protection Transparent	Good weather resistance	Blue Stain Surface Mould Insects
Wood Protection Semi-transparent	Long weather resistance	
Wood Protection Opaque	Long weather resistance	
Paint		
Paint Opaque	Long weather resistance	Blue Stain Surface Mould Insects

The requirements of the wood coating systems are as follows:

1. Good Penetration
2. Good effect against wood destroying organism
3. Good effect against blue stain
4. Good effect against surface moulds
5. Reduce splitting in the wood
6. Reduce dimensional changes
7. Good weather resistance (including good resistance to light)
8. Good resistance against water uptake
9. High water diffusion ability
10. Short drying time
11. Easy to apply
12. Easy to coat and recoatable

All these requirements are included of course to different degrees. If they were all fulfilled, the product development could be stopped as the ideal solution would then be present. However, the requirements are fulfilled up to the best knowledge of today.

WHY ARE WOOD STAINS BECOMING SO POPULAR BOTH FOR DO IT YOURSELF, CRAFTSMEN AND INDUSTRY?

No doubt the answer is mainly the easy way to handle these products combined with the esthetic possibilities, such as keeping the wood structure visible. (given in point 12 above)

The users were tired of the conventional coatings, for example, the peeling off, the difficult maintenance, the coverage of the wood, etc. The stains are easy, as before retreatment the dirt is just removed. No sanding is usually required. The reason for the easy handling is that the coating erodes away and leaves a smooth surface for recoating.

Like all other dreams , there are of course disadvantages. If these stains are much exposed to the weather, they "erode" too quickly and therefore need to be recoated, often every year. The users were, however, for a long time satisfied with the stains as they were, as they felt they had found a better solution to their wood coating problems.

However, approx. 15 years ago a new epoch started as the waterbased products entered the market, as well as wood protection with higher solid content. The former was due to the wish for more environmentally acceptable products and the latter due to the wish for longer durability (meaning longer periods before before recoating).

It would seem that development is moving more towards paint-like types again. It is a conflict, no doubt. As known a stain consists of solvent (which can be water), resin, biocides, pigments, and additives. The desire for longer durability makes even heavier demands on all components.

Therefore, product development within the protective application field during the last decade has been concentrated on the aim of keeping the above mentioned good properties, but with longer durability. Increase of solid content (in fact the binder content) has a good effect, but if no special binders etc. had been developed, together with very lightfast pigments and the right additives found, it would not be possible to have a product which meets the demands of today. The increase in solid content generally reduces the penetration into the wood.

Also, the requirements of a well prepared substrate (wood surface) have increased with the heavier demands on durability.

Regarding the binder, it must, for example, be very flexible and elastic, be open for water diffusion, and must work together with the movement of the wood, otherwise peeling-off will occur.

Of course, all factors in the formulation of a stain are important, however, the binder is much more critical and essential than first recognized to be years ago.

To optimize the factors mentioned being important for the wood coating system we have to give and take.

The binder/vehicle for a wood stain must enable it to adhere well and erode from the top for easy maintenance and no damage to the wood.

The wish is a binder which breathes from behind and is "closed" to water or vapour from the front.

It is possible to find binders which can do that.

The erosion from the top is also essential as mentioned before. Under our climate conditions, the right formulated (solvent-based) stain will erode 10-15 microns per year, without losing adhesion. Again, the waterbased stains have a little different way of aging, but much effort is spent in finding the right solution.

The biocides for the stains are a part of a whole discussion on its own and many things could have been taken up in this paper especially in respect of environmental hazards and biological effects.

Regarding the change from solvent-based, semi-transparent protectives to waterbased, a really good solution is just around the corner, as earlier said. Approx. 15 years ago many firms introduced acrylic based products into the market. It was obvious that the coating was not able to protect the wood surface sufficiently in order to avoid peeling-off rather quickly. The lignin in the wood cells was broken down. Since th much work has been done everywhere. Our investigation shows that today waterbased alkyds or mixtures of alkyds with some acrylics fulfill to a greater extent the requirements for durability etc. The same is not required for opaque wood stains, where pure acrylics are acceptable. Waterbased formulations have normally less penetration than solvent-based formulations.

<u>WHEN WE TEST THE WOOD COATING SYSTEMS IT IS VERY IMPORTANT TO MAKE THE TEST ON THE DESIRED WOOD SPECIES.</u>

Many basic tests are carried out currently on any new formulation ideas, but the most valuable way to test the wood coating systems are to expose them to natural conditions. Some places will give faster, but still reliable results, for example, exposure in the mountains. The influence of the ultraviolet light and weathering in general is extraordinarily pronounced at these heights. These results are valuable to have for further exposure tests of the better systems for the desired geographica areas and application.

I am often asked the question if wood can be kept natural, meaning no colourant at all, just clear coating. It is a complex matter , but the answer is yes, as long as a very careful application and follow up is done. However,it is obvious that those systems are very sensitive to any poor construction or short cuts in preparation and pretreatments before the topcoat.

A NEW STAIN FAILURE DISCOVERED IN SCANDINAVIA

Stains are very widely used, and sometimes (often on salesman's demands) the treatment schedule is made more simple. This happened, for example, to the opaque acrylic waterbased stains. They are extremely easy to apply, have an attractive appearance, etc. Most often it wasn't mentioned that a preservative should be used on new or weathered wood before application. But there is always a catch to things if they become too simple.

Around 1982, rumours were heard that wood had started to deteriorate underneath some waterbased stains. Some groups started to investigate the matter and found proof that this actually was happening and even to a greater extent than originally believed. However, the question was, to what degree has it happened and why.

There are many theories and discussion points about this matter. It has been observed that overall, a wood destroying fungi called DACRYMYCES STILLATUS was present where the problems were occurring.

But why has it mainly happened when this type of stain is used compared to paint or solvent-based stains etc.

One theory is that the waterbased stains are too openpored and therefore the wood stays too wet too long and fungi will grow. This will especially be the case where there are heavy rainfalls and high humidity for longer periods of time.

Also, due to the fact that no preservative was used and the construction was not the best , this wood was more vulnerable. The biocides in these types of products will probably have to changed.

However, it has been investigated that with;

1. Newly preserved wood
2. Double vacuum treated wood
3. "sealed" wood, sealed with a formulation that has a low solid content (binder content)

no decay from this fungi has taken place.

CONCLUSION

Stains are an extremely interesting subject, because it is so difficult to optimize the properties without losing others and also because it means a lot costwise to all involved parties, not the least being the consumer.

From my point of view, we have come far, but we still have some way to go before we have all the answers to a "maintenance-free" wood coating system.

HOWEVER, WOOD IS HERE TO STAY.