

## Drying Green Holly & stains

The fresh-cut timber remains clear and creamy-white all through in log for months.

But freshly-machined surfaces start to develop a greyish stain in air in a few minutes, which continues to develop for an hour or two. This is very variable in colour (from pink to green) but is predominantly grey. It is also variable in pattern - some parts of a log will show stain banding on growth rings (in heartwood) & others just a few cm away will not. The stain seems stable once the wood is dry. Surface condition seems to make a difference (smoother sanded surfaces stain less) but coatings and sealants do not. After 24hrs the staining reaches in 2mm or so. The wood shavings also darken in an hour or so (tending to go greenish-grey).

Boil heating the green/wet wood, as advocated in some old books and used by Nigel Fleckney (<http://www.english-hardwoods.com/>) has two effects - the staining initially occurs very rapidly and also it is more uniformly grey. This staining can be produced with over-vigorous sanding or a blowlamp. It is unclear what temperature is needed but clearly <100C. Heating beyond the 'staining temperature' (as in boiling) on the other hand causes permanent bleaching of the wood including any induced stain. I think this is a purely thermal effect, it can be obtained as easily with a blowlamp or a hot dry fan oven as by boiling, though even 10 minutes in a fan oven makes the wood start to dry & crack and the boiling water prevents this (though the hot wood from the boil can crack very rapidly as it dries).

The most striking experiments are on 80mm dia (100 mm long) turned pieces, two of which were boiled in water. The first was in the water only for 10 minutes, and was then divided on a lathe to show the interior minutes afterwards (that is on a freshly-cut surface, though it looks much the same if cut 12 hrs later). You can see a stained ring inside a few mm of bleached wood, then a few mm of stained wood and then an unchanged interior (just beginning to stain naturally in air after a few minutes).

I assume that what is happening here is that the outer bleached wood has got to about 100C in 10 mins and is bleached; the stained ring has only got to some lesser 'staining temperature' in this time and the core has not heated much and is unchanged. So as the wet wood heats it firstly stains and then bleaches - so the ring will move in with time in the boiling water until it disappears at the centre and the wood is all bleached.

To test this I re-boiled this first sample for 20 mins, with the result shown below - exactly as expected with a smaller stained ring but otherwise the same.

The other similar piece was allowed to boil for about 1.5 hours and seems fully bleached, and remains so. It does develop cracks very fast on coming out of the water though, so maybe letting it cool in the water would have been a better idea.

So it seems these effects are chemical, based on something in the wood and something in (or lost to) the atmosphere. I have experimented with chemicals, pH etc. without finding anything interesting. The wood registers 24% on my meter (more-or-less full scale) and feels cool & damp (rather than wet) to the touch when freshly cut.

Assuming that you just need to get the temperature to near 100C to bleach the timber the heating time needed is just how long it takes the wood to heat through (like cooking). But the thermal conductivity of wood is reported as pretty variable so it is hard to calculate; it is probably better to try and see! What one can say is that one expects the thickness dependence for planks to be roughly quadratic - so double the thickness would take four times as long and so on. So if 2" planks take an hour 4" should take 4 hours etc. Smaller blanks such as I used will be quicker because the heat can come in from all sides.

I was trying to keep the wood soft like green timber but white - and this seems to work.

One cannot entirely get rid of existing staining in dry timber by heating, as you can when the timber is wet. The dried staining does change, becoming more yellowish, but does not disappear on heating (or on reboiling so moisture does not help).

But things, particularly with 'natural' (unheated) staining are clearly more complex than this. My original interest was sparked by my making two bowls from green wood (from opposite halves of the same log). One was allowed to dry in room air and distorted (to about 20% major/minor axis difference elliptical) as expected but also cracked and stained - the stain being now tricky to machine off (eventually sanded off) because of the (expected) severe distortion. The other was dried over a month, in a sealed plastic bag with dry wood shavings changed every few days. This eventually distorted just as much but did not crack - **and nor did it stain** (and has not since). I am not clear whether this was due to the wood shavings or because the second bowl, unlike the first, was also sanded smooth before being dried. The bag was black but darkness does not prevent staining normally. Both bowls are now creamy white and fully dry.

*Pictures of freshly-cut cross sections after boiling for 10 mins (left) & 20 mins.*

