

Understanding Lignin

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As framers we hear numerous terms and phrases being banded around; their meanings are often a complete mystery and are not fully explained in any 'glossary of terms.' Perhaps it is a fear of being seen as uneducated that stops us asking our mentors questions such as, 'What is Lignin/Lignin-Free?' and 'Acid Free (see RRL 002; Aug2014.)' The aim of this Read, Reflect and Learn short article is to provide framers with an understanding of what constitutes Lignin and the term Lignin-Free

Different types of lignin are found in all plants; they form a natural occurring bonding element in plants that holds the wood fibre together. Lignin repels water and allows the plant to move water through its veins and hence its function is to regulate the uptake of liquids in plants.

Whilst lignin is not in itself an acid however, when it degrades it gives off carboxylic acids. It degrades as it ages in light and/or air and is part of what makes wood chemically dangerous to paper conservation. As board and paper made from woodpulp deteriorate the acids given-off include; tannic, formic and acetic (approx pH values¹) acids. These may be considered as weak acids in comparison to other more virulent acids that may affect the breakdown of cellulose such as nitric and/or sulphuric acids which are classed as strong acids.

To explain this a little more; essentially there are two types or classes of acids, strong and weak. Strong acids, of which there are few, ionise, or breakdown completely when dissolved in water whereas those acids of biological origin are weak as only a proportion breakdown in water. As a result the breakdown of lignin can be associated with the discolouration of paper and less of a factor in its brittleness when compared to those acids associated with air pollutants.

The definition of "Lignin-Free" is used to describe paper or board with a Lignin content of less than 1%; below 1% test results tend to become too inaccurate. Paper mills use a specific test known as KAPPA which is also used to denote lignin content in FATG Mountboard Standards. Kappa numbers refer to a test for the degree of lignification of pulps and a KAPPA number of 5 or less is sometimes used to denote "Lignin-Free."

¹ Comparison of approximate pH values of acids mentioned in this article:

Acetic - pH 2.5 - 3.0

Formic - pH 2.3

Nitric - pH 1.0

Sulphuric - pH range 0.3/2.1

Following the delignification of wood pulp what remains is cellulose. The purest form is alpha cellulose is found in cotton as it contains no lignin in its natural form. Hence, alpha cellulose may be termed as “lignin-free”

As far as mountboard is concerned there is no lignin content in Cotton Museum board as it is made completely from 100% cotton fibres and hence its expense. Conservation Board must be made from chemically purified wood pulp or cotton fibre with an alpha cellulose content of minimum 84%. Further, the lignin content must be less than 0.65% equivalent to KAPPA Number 5 or less.

There are no specific requirements regarding alpha cellulose or lignin content for Standard Board.

Questions:

1. What is the function of Lignin in plants?
2. Why does the bevel on Ligneous mounts discolour?
3. What speeds up this process?
4. How can lignin be removed from wood and what is the resulting material called?
5. Describe the difference between Strong and Weak acids?
6. What effect do Strong Acids have on paper and board?
7. What is a KAPPA number and what number denotes Lignin-Free?
8. What plant provides the purest form of cellulose for paper-making?
9. What percentage of alpha cellulose is present in board meeting Conservation Level?
10. What level of lignin is allowed (a) in Conservation board? (b) in Standard mountboard?