



Determination of pH of paper and board

According to ISO 6588-1



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pH of paper and board extracts

In conservation and restoration, the pH of paper or board is regarded an important parameter for assessing the condition of original documents or the ageing resistance of enveloping materials made of paper or board. Quality testing of ageing-resistant papers or boards according to EN ISO 9706 stipulates determination of the pH of an aqueous cold extract pursuant to ISO 6588-1 using calibrated pH electrodes. Compliance with EN ISO 9706 is considered fulfilled if a pH value of no less than 7.5 is obtained.

Enveloping materials made of paper or board that are required to meet quality standards specified for ageing resistance must have an alkaline reserve corresponding to an alkaline filler of at least two weight per cent of calcium carbonate [2% CaCO₃ (w/w)]. In case of unimpeded aqueous extraction of these materials in distilled water at 20 to 25 °C (cold extraction according to ISO 6588-1), a saturated solution of calcium carbonate is obtained, which has a theoretical pH of about 8.3. In practice however, lower pH values of about 7.5 are normally measured in such tests.



Alkaline filler

Measurement of the pH of paper poses some difficulties. Alkaline components, e.g. alkaline fillers or an alkaline reserve, contained in the paper are carbonates of alkaline earth metals with very poor aqueous solubility. This makes them particularly difficult to extract from sample materials.

A correct determination of pH is dependent on unimpeded extraction of soluble substances until saturation, because – as a sum parameter – the pH reflects the concentration of hydronium ions (H_3O^+) effective in the solution. Unfortunately, correlation of pH to concentration of alkaline filler in paper is not possible, since only small quantities of filler are soluble in the cold extract, making its capacity to raise the pH correspondingly low.

All that can generally be concluded from an acidic pH (i.e. $\text{pH} < 7.0$) after an aqueous extraction of paper, is the complete absence of an alkaline filler. A pH of > 7 indicates the presence of an alkaline component in paper, but does not permit any conclusions to be drawn about its concentration. A simple pH measurement therefore neither allows determination of the presence of an adequate quantity of alkaline filler in paper or board nor assessment of compliance with EN ISO 9706.

Cold extract test

ISO 6588-1 requires 2 g of sample material to be cut into 5x5 mm pieces and placed in an Erlenmeyer flask containing 100 ml distilled or demineralised CO_2 -free water at a temperature of 20 to 25 °C. An extraction period of one hour is specified with the closed flask agitated occasionally in order to mix the contents. The extraction solution must not to be stirred since the measurement is influenced by the stirring speed and absorption of atmospheric CO_2 by the solution.

The capacity of significantly compacted or sized paper and board qualities to absorb water is inadequate. Satisfactory extraction of these is not possible even when they contain high proportions of filler based on ground calcium carbonate (GCC). Quality testing of dense and hard-sized enveloping paper or board materials in line with the specifications of the standard, does not yield a usable result, because it is not possible to extract an adequate quantity of calcium carbonate due to the poor absorption of water. Hence, pH values significantly below 7 are measured for cold extracts. In deviation to the standard, such tests must either be conducted with stirred sample material or while constantly stirring at a moderate stirring speed, in



order to achieve an adequate dissolution of calcium carbonate. If a saturated solution of calcium carbonate is obtained within the extraction period specified by the standard, then the pH of this should be around 8.3. Due to the higher concentration of CO₂ in the aqueous extract, pH values of only around 7.5 are however measured when using these extraction techniques.

References

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