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Calcium Carbonate

tech tips

Problem

Calcium compounds leach, build up, and overwhelm the printing system, causing either plate scumming or plate blinding with blanket and roller glaze impeding the transfer of ink and necessitating frequent but ineffective wash-ups.

Description

Sappi uses calcium carbonate in the basesheet as a filler and in the coating as a pigment. Most, if not all, competitive papers also contain calcium carbonate as both filler and pigment. It provides brightness and a more blue-white shade than clay. Calcium carbonate is used in neutral or alkaline papermaking, which results in a more permanent sheet than acid papermaking. Paper permanence is desirable for reduced yellowing and brittleness of paper as it ages. This is especially important in the manufacturing of books and archival materials. Acid sheets contain little, if any, calcium carbonate. This is because foam is generated when calcium dioxide is released from calcium carbonate in an acid environment. Therefore, acidic sheets typically contain more clay.

Sappi has used calcium carbonate in its paper for over 30 years. In general, it has been used in coated papers since the 1930's.

There are significant benefits to the use of calcium carbonate in the alkaline papermaking process, some of which include:

- An environmentally responsible process.
- Meets ANSI/NISO and European ISO 9706 standards for paper permanence suitable for archival purposes.
- Increased opacity and brightness.
- Faster ink set for quicker turns.
- Cost-effective paper manufacturing process.

Almost all of the North American uncoated wood-free sheet capacity uses the alkaline or neutral papermaking process with calcium carbonate as a filler and pigment. Some printers have experienced scumming problems when printing alkaline uncoated paper and have determined that calcium carbonate is often the causal factor. Sizing is difficult to obtain on an uncoated sheet when using alkaline papermaking chemistry. This may cause increased fountain solution absorption, which can contribute to scumming problems.

Causes

Fountain Solution

There are different types of calcium carbonates. Some may contain free lime, which may be more prone to leaching into the fountain solution. Highly acidic

or overly aggressive fountain solutions can further impact this tendency, especially on uncoated papers. Although the calcium compounds are essentially insoluble in acid-based fountain solutions, calcium carbonate can adversely react to the acid to form calcium ions, which when combined with other ions such as citrate, can leach out onto the rollers as a hard, white glaze. This leaching can cause the pH and conductivity of the fountain solution to increase. This condition coupled with non-image blanket build can reduce the effectiveness of the fountain solution and contribute to a scumming or toning problem. If this condition is suspect, the contaminated fountain solution should be analyzed to determine whether calcium carbonate or free lime has been absorbed. The comparison of the calcium ion concentration in fresh fountain solution and fountain solution that has been in contact with alkaline paper will indicate whether calcium carbonate or free lime has been leached from the paper.

Sappi insists on comprehensive test reports from our suppliers in support of ISO statistical processes to ensure high quality calcium carbonate and the absence of free lime.

Ink Set and Dry Rates

Calcium carbonate may help improve ink setting by pulling oils or solvents out of the ink more rapidly than clay. The pore volume of the coating (the amount of small openings in the coating) is one factor that determines the rate of oil or solvent removal. If a large number of small pores are present, more oil or solvent can be removed and the ink will set faster. The pigment particles size and shape of the clay and calcium carbonate used in the coating will determine the pore volume.

Any potential chemical effect of calcium carbonate should be addressed by the ink/coating suppliers as some inks and coatings are more sensitive to chemistry changes than others. If the calcium carbonate contains free lime, problems may occur either directly with the ink or through fountain solution chemistry changes that may affect the ink. Ink, aqueous, or UV coating suppliers would have more knowledge of their specific products and any problems related to chemical sensitivity.

Press and Ink

Trace amounts of calcium can be found in some ink formulations with higher levels typically present in magenta. Correlating to hardness, calcium is also present in untreated tap water. Chemical incompatibilities in some isolated and extreme instances with respect to water, fountain solutions, ink, and paper can cause break down and build-up which can create printing problems. It is important to note that calcium carbonate contamination severe enough to overwhelm the printing system is usually the result of cumulative build-up that results in the absence of preventative maintenance. Though more typically

experienced in high volume web printing with uncoated paper where calcium carbonate is used as relatively unsealed basestock filler, some symptoms might include:

- Progressively poor ink transfer usually seen as dot sharpening.
- Ink roller stripping.
- Fountain solution progressively becoming more alkaline if not buffered for alkalinity.
- High conductivity gain of fountain solution.
- Excessive foaming of fountain solution only when contamination is present. Compare the performance of fresh solution with contaminated solution, within the same system, since foaming is often the result of over agitation and the mixing of air.
- Build-up of calcium on the ink rollers. This typically appears as a white haze which is not easily removed with conventional roller wash.
- Build-up or piling in the non-image area of the blanket.
- Progressive toning or scumming as a result of increased alkalinity, poor water receptivity, poor ink transfer, and accelerated plate wear.

Options and Solutions

Press and Chemistry Considerations

- Monitor fountain solution pH and conductivity before, during, and after each job.

  Use the least amount of etch possible with a buffered pH of 4.0 or higher.

  Drain, clean, and flush circulation tanks weekly. Avoid using solutions with detergents or surfactants that may adversely affect the printing system.

  Conductivity recommendations can range from 1100 to 1800 mmhos (µS/cm) over base-water depending upon choice of solution. Maximum conductivity necessitating a fresh solution mix is usually in excess of 2200 mmhos (µS/cm). Consult with supplier.
- Hard tap water contains calcium which can adversely react to fountain solution causing ‘calcium soaps’. Tap water can also vary in source and conductivity from day to day. Monitor tap water conductivity daily, and consider a water treatment system which is specifically designed for the lithographic print process.
- As a weekly maintenance consideration or when contamination is suspect, ink rollers should be de-oxidized in addition to a regular roller wash. Consider either of the following:

  Deoxidizing solutions (consult graphic arts supplier).

  Vinegar and hot water.

Calcium Carbonate (continued)

Avoid using solutions with detergents or surfactants that may adversely contaminate the printing system. Be sure to follow up with a regular roller wash to ensure proper ink receptivity. Consult with supplier regarding a regular maintenance plan.

- If magenta or red pigmented inks seem to be causing the most problem, consult with ink supplier.
- The use of calcium-alkali cures and anti-piling additives in the fountain solution has been successful as a preventative measure. Consult with supplier.
- Test fountain solution for the presence of calcium carbonate by comparing fresh and suspect samples.
- Check roller durometer and settings for proper specification to insure good ink transfer.
- Convertible bridging of dampener and inker, either integral or non-integral, can affect ink transfer and ink/water balance.