

FOAM IN STARCH-BASED CORRUGATED BOARD GLUES: CAUSES, ISSUES AND SOLUTIONS

One of the most common problems in the production of corrugated cardboard is the formation of foam in starch-based glues.

Foam (and entrained air) can cause production stoppages and quality problems such as superficial bonding, brittle glue line and improperly bonded spots on the surface of the board.

One example of problems caused by foam is what can happen in a glue preparation system with automated interlocked storage level control. In extreme cases, the foam causes the stock level probes to read quantities incorrectly, which causes insufficient glue to be added to the system, potentially causing damage to installations, high shear agitator break-down, storage tank vibration, insufficient glue viscosity due to excess stirring, and spills.

Even a modest presence of foam can trigger problems to the systems. For example, in the glue pan, the level control may incorrectly detect an excessive amount of glue, causing it to close the automatic inlet valve. This can lead to unbonded board or product spillage, which cause bad quality and wet cardboard, or glue on the walkable surface with consequent risks for the safety of the operators.



An example of formation of firm foam in the glue pan. In the upper left corner, the level probe (red) detects a false excess of glue and acts on the glue inlet valve, causing product loss of more than 200 meters of bottom DF unbonded paper of heavy Kraft-Semi chemical double BC flute.



Example of foam spilled from lower DF glue pan, the problem led to wet and warped board on operator side.

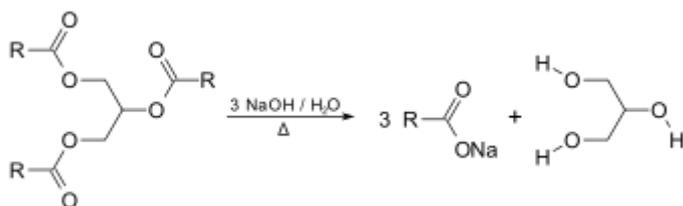
In addition to the above problems, foam increases the contact surface between the caustic soda in the glue and the carbon dioxide from the atmosphere. These carbonation reactions lead to acceleration of formation of limestone deposits on the glue rolls, which impairs distribution on the tip of the flutes, especially at high speeds.



Surface of a glue roll with significant limestone deposits, a problem which also contributes to the presence of foam in the glue.

Foaming can be traced back to several causes, the main ones are:

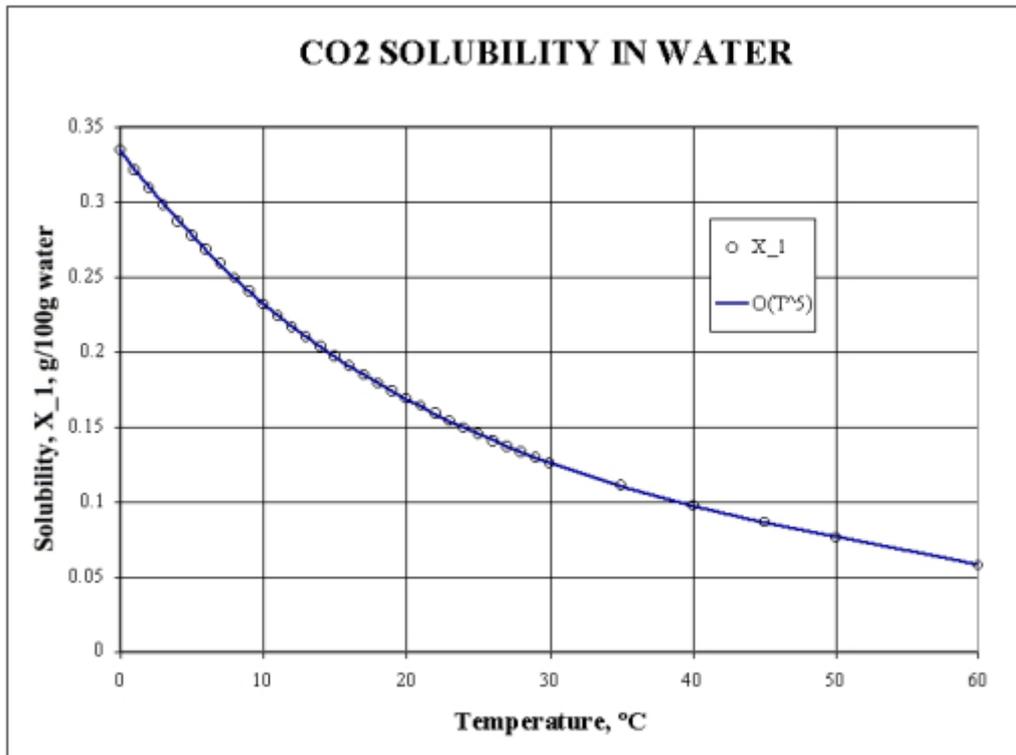
- 1) **Saponification** This is a reaction between the caustic soda used in the glue recipe and the residue of vegetal fatty substances of starch:



This is the same reaction used to produce the well-known Marseille soap, (Savon de Marseille). The surface tension of the glue is affected, leading to formation of a layer of compact, fine foam that is not too persistent.

- 2) **Soluble proteins** These tend to foam easily during to mechanical stirring or aeration. The exchange between atmospheric oxygen and glue is altered, which is a prerequisite for the onset of bacterial proliferation phenomena. This medium-persistence foam is composed of medium-small bubbles and rarely forms very thick layers.

- 3) **Dissolved gases** These are released from the water during preparation of the glue batch. It should be noted that a temperature increase (both due to the mechanical effect of the stirrer and the heating with direct steam) from room temperature, 15-25 ° C, to 35-40 ° C, reduces the solubility of dissolved gases and forms fine foam of limited thickness that is not very persistent.

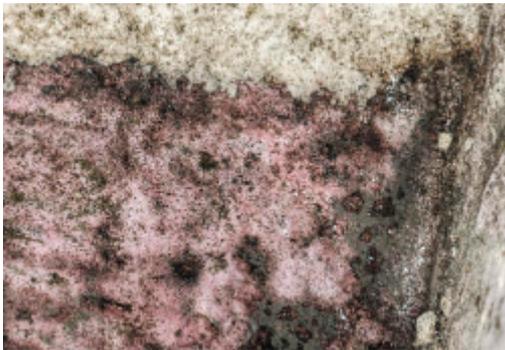


- 4) **Surfactant and soap residues** Foam can form in the recycled water from the washing phase of the flexographic circuits and from the chemical-physical purification plant. Generally, this not very compact, soft and with small bubbles, with medium persistency.



Example of foam in storage, caused by using recycled waters rich in surfactants and residues from paper and lubricating oil, the problem in the image caused a production stop due to incorrect reading by the storage level probe.

- 5) **Gas and bio gel formation** Gelatinous polymers are generated by bacterial and fungal metabolism. Primarily, the gas generated is carbon dioxide, produced by biological strains of Rizhopus, Pennicilium and Aspergillum. If anaerobic condition occurs, hazardous hydrogen sulfide, (H₂S) can be created by Desulfovibrium vulgaris, a species of sulfur-reducing bacteria. Note that these phenomena can be triggered by minimum levels of biological contamination and create particularly persistent foams with a compact and slightly filamentous appearance.
- 6) **Air Agitation in preparation and storage**, the action of the glue circuit pumps and the glue rolls all introduce air to the system. This foam is generally made up of larger bubbles, it is not very persistent and rarely creates quality problems. However, it can cause splashes of glue on the level probes of the gluer, compromising its correct functioning. Moreover, the presence of this type of foam is a symptom of plant problems (corroded gaskets, faulty pumps and valves, etc.).



Example of foam caused by bio gel from red bread mold at the bottom of a glue storage container.

Often, the consequences of foam in glues are not adequately considered because the foam is dealt with through ad hoc solutions to other problems. However, solving the actual cause of the foam can solve other issues such as:

- 1) Toxicity of the products used
- 2) Formation of flammable and dangerous vapors
- 3) Unpleasant smells transmitted to the finished product
- 4) Hygienic considerations for cardboard used in contact with food.
- 5) Interaction with the other components of the glue such as sodium hydroxide, borax, anti-damp resins and other additives
- 6) Insufficient bonding performance, impacting texture, variation of surface tension, decrease in wet strength characteristics of cardboard).

Kemind solutions

Based on more than 40 years' experience, Kemind has developed extensive knowledge and a full range portfolio of additives for starch glues that guarantee:

- 1) Full compatibility with food packaging
- 2) Ease of use
- 3) Null toxicity and a low environmental impact
- 4) Prolonged antifoam effect
- 5) Production stability
- 6) Minimum dosage
- 7) Wide range of efficacy
- 8) No interaction with other components and additives
- 9) Absence of unpleasant smells
- 10) Null effect on the texture, functionality and other characteristics of the glue
- 11) Tailored solutions for every need (drums, I.B.C., tank trucks)

Our logistics network can guarantee rapid delivery of our product, both in Europe, the African continent and throughout the Middle East, even in the event of emergencies.

Kemind's product range is fully CERTIFIED ISO 9001:2015 and provided to customers with analysis certificates, data sheets and safety sheets.

The on-site development of the application is guaranteed by the presence, in industrial trials, of our staff of technicians who provide users with the appropriate assistance in case of needs or technical problems of any kind.

Our labs provide useful technical support to customers, thanks to our qualified staff and the wide availability of analytical equipment.

Our network of agencies in Europe and MENA area provides our customers with easy, direct and fast commercial relationships.

Please contact us via e-mail at info@kemind.it with any questions, our expert staff will provide you with information promptly.

Villastanza di Parabiago, February 2021