Wet-resistant cardboard production: a hard challenge

New opportunities have been created for corrugated cardboard manufacturers due to increasing awareness of the environmental benefits and added value of using their products as a substitute for plastic packaging.

Guaranteeing wet resistance isn't easy. Factors such as machine parameters, paper quality, glue line strength all contribute to creating a product that must be high quality and have stable characteristics. In fact, it is not uncommon that a delivery consisting of thousands of square meters is returned due to a few boxes having wet resistance that is slightly below agreed specifications.

The most extreme example of wet-strength requirements is packaging for "Bananeros," demanding guaranteed wet strength that protects bananas from transported from South America by sea to ports all over the world. Similarly, inadequate packaging used for transportation of kiwi fruit from New Zealand can lead to an entire load being spoiled. In both cases, fruit crushed in a damaged crate will ferment, releasing ethylene gas and triggering accelerated maturation and rotting of fruit in packaging nearby.

Shipping of bananas in Ecuador: Only one crushed box of bananas can affect the whole load of fruit!

Photo by the author, Guayaquil Harbor – Ecuador.

Other parameters are important as well as those listed above. Different levels of wet resistance are required depending on the purpose of boxes, listed below:

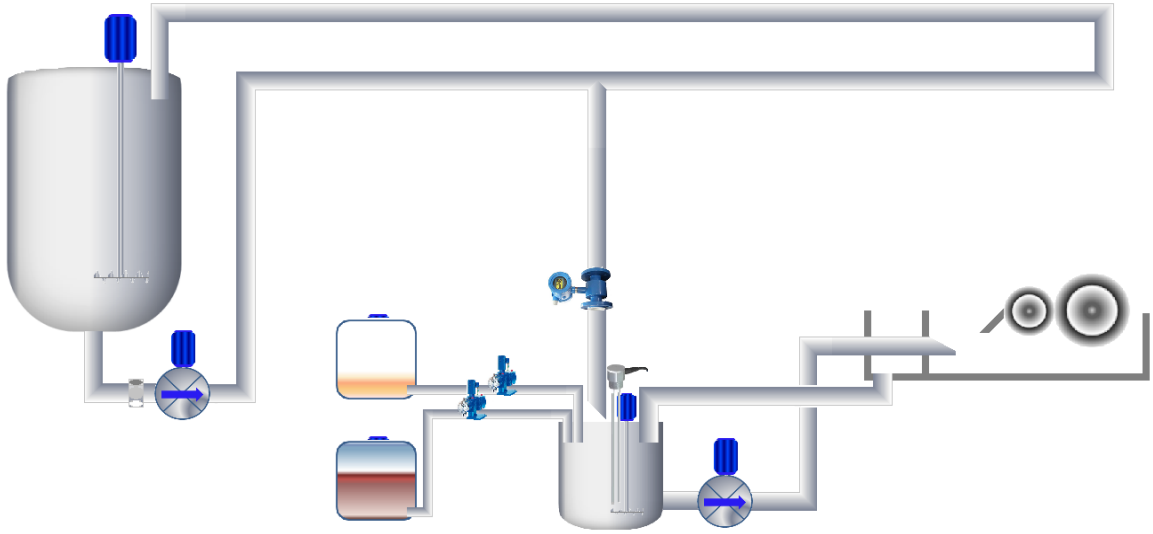
- MRA (Humidity Resistant): For low-weight boxes, with limited mechanical resistance needs, intended for low humidity environments and short-term product packaging.
- WRA (Water Resistant): For the production of boxes for fresh agricultural products, bonding and papers must ensure good protection of products for a few days in refrigerated and high humidity environments.
- WPA (Waterproof): Cardboard with extreme resistance characteristics, produced with high weighted papers and able to pass particularly stringent tests (FEFCO 9: 80% after 24 hours, wet Pin adhesion test higher than 40 Newton), used for shipping and storage in environments such as refrigerated rooms and other high humidity environments.

The main tricks.

Kraft liners and Semi-chemicals are almost essential prerequisites for obtaining the required characteristics. When producing MRA grades, these can be replaced with lower-performance, high-grade paper qualities. The next-generation products for surface paper processing that replace paraffin can also help to achieve the required characteristics.

Wet-strength resins can also be an indispensable additive in glue formulations, 1 to 2.5% depending on wet resistance requirements. These glue formulas generally require a higher percentage of starch, (solid content from 27 to 30%).

Storage times are also very important for glues. In fact, moisture resistant resins inevitably lead to a gradual increase in viscosity and gel temperature as well as a loss of wet resistance effect on bonding. After about 8 hours of storage, the deterioration of their reactivity is almost total. To overcome this inconvenience, it may be useful to minimize storage time by reducing the amount of product formulated at one time, or modify the distribution piping to allow the dosing of resins immediately before the glue is used (c.d. proximity system).



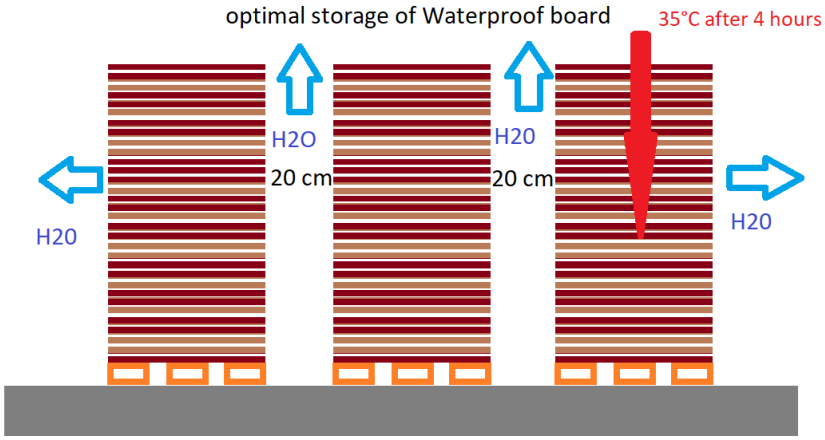
Example of a proximity system

Another helpful adjustment can be made to machine parameters. It is useful to increase glue dosage by 20-25%, both to the Single Facer and Double Baker, while taking care that the cardboard sent to the stacker has sufficiently "soft" glue that is a bit higher moisture than normal cartons in order to allow better mobility and increased performance due to a complete reaction of resins.

However, this can cause some issues on the dry end because the wetter glue tends to soil the slitter-scorer knives more quickly, which risk bad bonding on the box edges due to increased stress on the cardboard. The use of suitable lubricants (which, let's not forget, must be approved for use on food packaging), reduces the occurrence of weakened edges, and increases the life of knives.

Example of fruit and vegetable cardboard with a weak bonding problem *due to slitter-scorer knives, the worst of this phenomenon leads to problems sealing stacked boxes.*

Photo by the author.



The last step to ensuring a high quality product is the maturation phase in storage. This is often overshadowed by logistical needs being increasingly oriented to just-in-time production. A quality, resistant wet cardboard MUST spend a minimum of 6 hours in stock, before moving to the box to allow the resins time to react completely. In addition, the batteries must be arranged in order to ensure the evacuation of water vapor and residual water, while being protected from air currents and temperature fluctuations. One way to assess the correct maturation of the cardboard is to measure its temperature after 4-5 hours in stock; temperatures in the range 35-40C at the innermost part of the stack are an indication of good product storage management.

In conclusion, achieving high quality standards of mechanical wet resistance is the result of the use of high-quality raw materials, correct adhesive formulation, optimization of machine parameters and correct management of the finished product in the storage and converting phase.

Kemind Ltd. has a wide range of products and services specifically developed to enable maximum results. We deliver resins that are resistant to starch and glue as well as barrier products for surface treatment of cards. Our team of highly qualified technicians provide assistance during the entire production process, from preliminary testing to optimization of machine parameters for reaching requirement standards.

The KEMIRESIN, BARRIKEM and KEMIOIL product ranges developed by Kemind, with almost forty years of specific experience in the field of additives for starch-based glue and chemicals for the machine maintenance, cleaning and lubrification, guarantee:

1) Full compatibility with food packaging.
2) Ease of use.
3) Full compliance with safety regulations regarding emissions of toxic volatile substances.
4) Stability of productions.
5) High reactivity.
6) No interaction with other components and additives.
7) Null effect on the texture and other features and functionality of the glue.
8) Packaging suitable for every need (jerrycans, drums, I.B.C. containers).

Our logistics network is able to ensure rapid delivery of the product, both in Europe and in the countries of the Mediterranean basin, in the countries of the African continent and throughout the Middle East area, even in the case of emergencies due to stock rupture.

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

The development of the application is guaranteed by the presence, in industrial tests, 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 in MENA area allows our customers to always have a simple, direct and fast relationship with our commercial network.

For any information needed, contact us via e-mail to info@kemind.it , you will be promptly contacted by our expert staff.