The Effects of High Humidity in the Paper and Corrugated Printing Industries

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What is humidity?

In simply terms, humidity is a measure of how much water there is suspended in the air. However, it can be classified in more than one way, with climate scientists and meteorologists typically using two principal definitions.

The first is **specific humidity**. Also known as the ‘moisture content’ - this is a measure of how much water vapour there is in relation to the total mass of water vapour and air combined. It is measured in grams of water vapour per kilogram of moist air.

The second is **relative humidity (RH)**. This is a measure – expressed as a percentage – of how ‘saturated’ the air is. In other words, how much water vapour the air contains compared to the maximum it could contain.

**Average Yearly Humidity**

The most humid places in the world are located near the equator and the coast. Generally, the most humid cities are in South and Southeast Asia.

Cities such as Kuala Lumpur, Jakarta, and Singapore have very high humidities year-round because of their proximity to the equator and water.

### Location |Av. humidity
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Kuala Lumpur, Malaysia | 74%-86%  
Jakarta, Indonesia | 90%  
Singapore | 84.2%

(source: Wikipedia, the free encyclopaedia)
How do we measure humidity?

Relative humidity can be measured by using a hygrometer, which is available in both mechanical and electronic models. Hygrometers measure the amount of moisture in a particular environment, usually by calculating temperature and pressure changes. Digital hygrometers are often used in industrial premises for quick and accurate humidity readings.

Humidity is also measured on a global scale using remotely placed satellites. These satellites are able to detect the concentration of water in the troposphere* at altitudes between 4 and 12 km (2.5 and 7.5 mi). Satellites that can measure water vapour have sensors that are sensitive to infrared radiation. Water vapour specifically absorbs and re-radiates radiation in this spectral band. Satellite water vapour imagery plays an important role in monitoring climate conditions (like the formation of thunderstorms) and in the development of weather forecasts.

(*Troposphere – the lowest region of the atmosphere)

What specific problems are caused by high humidity in the paper and corrugated printing industries?

Both paper and board are hygroscopic materials that tend to reach equilibrium with the humidity of the surrounding environment, causing product dimensions to change. Equilibrium relative humidity is the value at which the paper neither absorbs nor releases moisture from/to the surrounding environment, whereas absolute humidity refers to the amount of moisture contained in paper as a percentage of its total mass.

These two parameters are measured using specific instruments, both at the paper mill (before packaging), and once unpacked, before printing. The equilibrium relative humidity of paper varies depending on its grammage and the type of paper; in principle, the reference values can be assumed to be:

- 45-50% for natural paper
- 50-55% for coated paper
- 55-60% for board

(source: PrintWiki – the free encyclopedia of print)

In excessive humidity (>65% RH), the following problems may occur:

- Jams due to incorrect paper feed, caused by corrugation of the edges of the sheets.
- Erasure and/or crumpling caused by the corrugated edges of the sheets.
- Sheets stick together, especially with coated paper (paper that is too moist loses resistivity, so the sheets tend to adhere to one another).
- With print and apply labels, edges may lift or curl, causing labels to eventually fall off.
- Added moisture can cause labels to fade quickly, rendering them useless.
- Soft pressure adhesives may fail altogether, while ink may smudge or smear in high humidity.
What are the current solutions?

- **Store paper and labels in an enclosed space**

  This space should be dry, flat, and easily accessible. Typically, it should also remain at room temperature with a relative humidity of 40-60%. Keep the space away from doors, windows, and vents to protect it from temperature and humidity fluctuations. Store paper and labels on a low shelf or rack to reduce their exposure to the high temperatures often found on higher racks. Finally, when storing label rolls for barcode label printers, stack them vertically or utilise rack storage.

- **Label media needs to be chosen carefully**

  Some label stocks should only be used and applied at cooler temperatures and will become soft, tacky and difficult to apply if used in hot, humid facilities. A label stock approved for high temperatures and humidity needs to used where applicable.

- **Keep paper and labels in original packaging until ready to use it if possible**

  This will prevent physical damage (tearing, wrinkling, folding, etc.) and preserve the paper’s quality (moisture content, weight, etc).

- **Store printing equipment in a climate-controlled enclosure**

  A heavy-duty, industrial-strength enclosure can protect printers from the surrounding environment. In addition to warding off dust and debris, it can provide a consistent temperature and humidity. This will ensure that printers remain operational no matter how dry, humid, hot, or cold the ambient air.

- **Measure and control the level of humidity**

  Printers require a consistent level of humidity, typically somewhere in the range of 40-60% relative humidity. Measure the amount of moisture in the air regularly using a hygrometer, and then add or remove humidity as needed. Heating systems and air conditioners can remove humidity from the air; humidifiers and evaporative coolers can add humidity.
Does laser coding provide an advantage and can coating technology help?

As a viable alternative to print & apply labels, high resolution inkjet and waxjet solutions, the combination of laser technology with unique light-sensitive coatings (Photonic Printing), can provide a fast and highly efficient method of applying variable high contrast, high quality information. This can include barcodes, date & lot codes, QR codes, graphics and sequential batch numbers onto corrugated boxes and shelf ready packaging (SRP).

Photonic printing brings a number of advantages to production environments:

- Eliminate inks and solvents from production lines.
- Realises the operational efficiencies of laser marking systems on end-of-line applications.
- Minimal preventative maintenance and servicing.
- Laser reliability reduces unscheduled downtime.
- Higher throughput rates due to faster coding.
- No waste disposal considerations – no label backing waste or ink.
- Late stage customisation of packaging – reduced SKUs and inventory.

Given the inherent flexibility of this type of technology, advances in coating formulations has led to the development of specific coatings for use in high humidity environments.

The coating formulations have been optimised to provide unsurpassed product stability and excellent flow properties in geographical areas where high humidity is present. Used in combination with an appropriate CO₂ laser marking system, high humidity coatings deliver important sustainability benefits, by eliminating label backing waste and/or hazardous ink disposal from supply chains. Designed to be heat, moisture, scuff and high rub resistant, the coatings provide a stable image density that does not deteriorate.

For use on corrugated board, paper and folding cartons, high humidity coatings can be used for case coding in a variety of applications, including food & beverage and e-commerce on either brown or white paper and board substrates, and is also suitable for non-direct food contact packaging applications. High rub resistant coatings that are designed specifically for supply chain resilience, which are ideally suited for industrial, construction or logistical applications, are also available.

Conclusions

As a result of global warming, increases in both temperature and specific humidity is projected to intensify throughout the 21st century. With this comes the clear and ongoing challenge to production environments, particularly the paper and corrugated printing industries, where the control of relative humidity is paramount in order to achieve an optimum continuity of operations.

DataLase has a unique history of creating innovative and technically advanced patented solutions to some of the major issues faced by supply chains operating in the most demanding of conditions. Their high humidity coatings provide a viable solution to the problems caused by using label media for case coding applications in humid environments.

To find out more about how DataLase can support your business and help increase your supply chain sustainability

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