



Impact of Extreme Temperature on Paper base Packing Material in Delhi NCR

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Abstract

The paper explains the impact of extreme heat (50°C) in May and June 2024 on the corrugated box (CBB) industry in Delhi NCR, particularly its effects on the paper-based packaging supply chain. Corrugated boxes are essential secondary packaging materials used across industries, including FMCG, e-commerce, and manufacturing. During this heat wave, the moisture content of these boxes dropped significantly below the required 7–9%, leading to widespread rejection by quality departments and operational disruptions. This study explores the challenges faced by the industry, including production halts and damaged goods, as well as potential solutions such as adjusting production schedules, using humidifiers, and temporary acceptance of suboptimal boxes. The findings emphasize the need for pre-emptive measures, such as issuing summer-specific specifications for CBB production, to mitigate future risks arising from climate extremes.

Keywords: Corrugated Boxes (CBB), Extreme Heat Impact, Supply Chain Challenges, Moisture Loss, Packaging Industry, FMCG Industry.

Case Study: A leading FMCG company's Packaging Challenges During the Delhi Heatwave of May 2024

1. Overview

Delhi NCR was stuck with an extreme heatwave in the second week of May 2024 with temperatures rising up to 52° c and low humidity as low as 11%. This unprecedented heat is a severe challenge to the paper-based packaging industry, especially for corrugated boxes CBB used in the secondary packaging. For Britannia Industries which is a leading FMCG company, heat wave caused serious problem and exposed the weakness of used package.

1.1 The Problem

The corrugated boxes for Britannia meet specific specifications especially on a moisture content in the range of 7%-9% as required by its research and development section. This moisture level helps the boxes maintain their rigidity control and compression strength important in the protection of delicate bakery products such as biscuits when in transit and during storage. But during the actual heat, relative humidity at CBB was reduced to 2-3% upon its delivery to Britannia's factories.

First of all, it was identified that high temperature together with low relative humidity during the transit time of 24-48 hrs contributed to this moisture loss. What has happened is that the boxes that were acceptable within the specified standards at the time the supplier dispatched them became brittle and began to crack en-route. Thus, all incoming consignment were processed and rejected by the Quality Assurance (QA) team which led to production halts, lack of inventory and possible risks to selling at the retail level. Impact on the Business

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The inability to accept substandard packaging had cascading effects on Britannia's operations:

- **Production Halts:** The lines in the factories had to close down due to unsatisfactory levels of acceptable CBB, which resulted in labor wastage and payment of wages for nonproductive hours.
- **Supply Chain Disruptions:** Depot inventories were reduced so it became possible to find situations when the company's brands were not available at the retail shelves and, as a result, the potential consumers could not be reached.
- **Reputation Risk:** The rejection of CBB posed a danger to the packaged products; this was because they could annoy or alert the consumer, lead to dealer disputes, and known brands could suffer.

Problems with Current Material Used in Packaging

The brittleness and cracking of CBB during the heatwave highlighted several limitations in the material:

- **Moisture Sensitivity:** Due to the paper-based construction, CBB was extremely sensitive to relative changes in humidity and temperature, especially in severe heat.
- **Transit Vulnerability:** Long periods on transit were also found to have contributed to the degradation of the packaging since the products are subjected to several environmental conditions for long.
- **Inflexible Specifications:** The impossible 7-9% moisture did not cater for the variation in the environment during the heat weeks.

The most common reasons for rejection of a consignment are given as follows:

The consignments were rejected based on the specified moisture content at the arrival point of the machinery. Although the boxes retained sufficient compression strength, the cracking observed made them unfit for use because they provided insufficient protection to the products in handling and distribution.

The proposed and the implemented solution to address the issue

To address the crisis, several solutions were proposed:

1. **Nighttime Production and Dispatch:** Switching the production and transportation to the night to reduce the effect of heat to the people conducting the transit.
2. **Shrink Wrapping:** Applying shrink wrapping on CBB to check it from getting moisture, although this brought some extra lead time for the change.
3. **Use of Humidifiers and Stretch Wrapping:** Including the use of humidifiers, in storage and wrapping of boxes after to retain much moisture as possible. Nevertheless, these approaches took time and lot of resources before they were implemented.
4. **Temporary Relaxation of Specifications:** Permitting the acceptance of CBB that met compression strength that did not crack on receipt when the moisture content was below 7-9%.

2. Finalized Solution

Due to such pressures, Britannia saw the temporary elimination of such specifications as an initial action to be taken. Thus, after critical evaluation and discussions, the management of Britannia Industries limited decided to wholly adopt shrink wrapping as the ultimate solution for Corrugated box packaging that is affected by low and high temperatures. This approach became more feasible to guarantee the structural stability and also moisture content retention of corrugated boxes en-route since they passed through 52°C temperature which was prevalent in Delhi NCR in May 2024.

Why shrink wrapping was chosen

- **Moisture Retention:** Polyethylene shrink wraps enclose the corrugated boxes and firm them thus protecting the inner material from loss of moisture. This is important to keep the boxes at the right moisture content of 7-9% which is vital for the boxes strength as well as durability.
- **Protection Against Environmental Stress:** The wrap provides insulation for the boxes which means they don't come into contact with heaters directly and do not have to endure low humidity to dry which can lead to brittleness and cracking of the boxes.
- **Cost-Effectiveness:** Although shrink wrapping involves the initial purchase of equipment and materials it is a degree of 'bang for the bucks' option when it comes to safeguarding large volumes of packaging.
- **Ease of Implementation:** Shrink wrapping does not require a great deal of change in packaging lines and thus can be easily adopted by Britannia.

3. CONCLUSION

The extreme weather conditions witnessed in Delhi NCR during May & June 2024 – 52°C temperature raised concerns regarding the applicability of corrugated boxed (CBB) during peak summer season. Analysing the effect of these extreme conditions on the structural and functional performance of CBB, this research shows how moisture loss leads to compromised compression strength and durability among other CBB degradations. The results shown in the study prove that traditional packaging materials are vulnerable to temperature and humidity changes, which, in turn, affect supply chain and operations.

The scenario of Britannia Industries demonstrates how such susceptibilities unfailingly lead to production breakdowns, inadequate stock, and possible reputational problems. Although, temporary arrangement like nighttime dispatch and specification relaxation helped the companies to keep their operations sustainable in the short run, the ability of shrink wrapping as permanent solution to sustain the business was identified in the long run. For instance, shrink wrapping covers up the weaknesses of CBB by offering the aspects of moisture retention, protection against environmental changes and operational flexibility; flexibility in packaging reliability and supply chain elasticity.

The findings presented in this research accentuate the importance of developing climate-resilient approaches to packaging solutions as the global temperatures keep rising. This means that advanced heat-resistant coatings, enhanced adhesives and climate sensitive test methods are likely to be called for in the future. Companies have to understand that incorporating sustainable and thermal stability into packaging systems can no longer be a choice, but a necessity in the climate variant future.

By analysing this case study, the research establishes useful recommendations for policymakers, manufacturers, and supply chain managers to develop a framework that helps to make packaging material durable and adaptable as well as encouraging sustainable practices. In adopting such aspects, industries shall be in a position to build sustainable packaging system in the face increasing climate change challenges.

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