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Technical Papers

Water-Based Coating Solutions: A sustainable alternative to Plastic

Abstract: *India's Plastic Waste Management (PWM) Rules make paper the best replacement option for plastic packaging. There are several challenges in using paper for packaging, including poor barrier properties. The use of barrier coatings can improve barrier properties when using paper, which is crucial in increasing its viability as a packaging material. Paper packaging combines the best features of two materials, environmentally friendly paperboard and good barrier properties of water-based coatings. Along with being recyclable and repulpable, eco-friendly water-based coating technology imparts moisture, gas, water, oil, and grease barrier to paper packaging. Further more, water-based coatings impart heat seal properties to paper while providing excellent print receptivity that enhances package aesthetics.*

Key Words: *1. Plastic Waste Management, 2. Sustainable Packaging, 3. Recyclable, 4. Repulpable, 5. Barrier Coatings, 6. Water-based Coatings*

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Introduction

Plastic is one of the most widely used and convenient materials in the production of packaging. However, India's recent Plastic Waste Management Rules are limiting the use of plastic packaging because recyclability is a significant challenge when using plastics for packaging, plastic is not biodegradable, and it accumulates in landfills and pollutes the environment. Paper has gained tremendous popularity because of its recyclability. It is also renewable and biodegradable. Paper provides versatile and responsible packaging solutions for product manufacturers, retailers, and consumers. It is the best replacement option for plastic and is useful for the packaging of several products. However, utilizing paper has several limitations compared to plastic. The use of barrier technology can overcome some of the limitations of paper. Improving paper's barrier properties is seen as a crucial step in increasing its viability as a packaging material. Water-based coatings can compensate for the missing performance and barrier properties of paper.

Process, Results & Discussions

One of the biggest challenges faced by an Indian leading E-commerce company is its packaging. They use all sorts of materials including plastic, paper, bubble wrap, air packets, tape, and cardboard cartons for their packaging, which has to protect their products throughout transport to avoid any damages. The Plastic Waste Management Rules have forced this company to explore sustainable and recyclable alternatives to replace their existing packaging structures. With the push towards sustainability, repulpability, and recyclability, water-based technologies are gaining acceptance.

Paper bags with water-based coatings are an alternative to plastic bags because they offer a recyclable option with the required barrier properties, while also eliminating the use of adhesives in the bag manufacturing process.

E-commerce brand's existing packaging products:

- Plastic bags for pantry items/whole foods
- Transparent plastic envelope for receipts (glued onto their outer cardboard /plastic packaging)
- Plastics bags for dry items, electronics, etc.

E-commerce brand's switch to paper bags with Michelman's water-based coatings:

Table – 1: Heat Seal Coating Product Details for Inner Side of the Bag

Recommended coat weight	3-4 gsm / dry
Solid Content	38%
Suggested coating method	Gravure/ Roller coater
Suggested drying condition	100ºC, Hot Air dryer
COBB Value	<10

The benefits of Michelman's heat seal coating for the inner side of the bag include:

• Heat sealable at 140 C • Recyclability • Repulpability • Print receptivity

Table-2: Water Repellent Coating Product Details For Outer Side of the Bag

Recommended coat weight	5-6 gsm dry
Solid percent	50%
Suggested coating method	Roller coater
Suggested drying condition	100ºC, Hot Air dryer
COBB Value	<5

The benefits of Michelman's water repellent coating for the outer side of the bag include:

- Water repellence
- Recyclability
- Repulpability
- Print receptivity

Other Applications for these coatings include envelopes for invoices, paper bags for bakery items, dry foods etc., and packaging for fresh fruits and vegetables.

Figure 1-Envelopes for invoices

Figure 2-Paper bags for dry food, bakery items, etc.

Figure 3-Packaging for fresh fruits and vegetables

(Images are for representational purposes only.)

An Indian bakery brand's existing packaging included paper boxes coated with polyethylene (PE) for bakery items and disposable plastic containers for food items. Because of increased government regulations, this environmentally conscious bakery brand wanted a replacement for their PE coated boxes. They decided to switch to water-based coated paper boxes and containers with the appropriate oil and grease resistance.

Coatings can also impart oil and grease resistance to paper packaging, including disposable-food take out boxes used in restaurants, for sweet boxes, and seafood packaging. These coatings offer FDA compliant options and are recyclable and repulpable.

Table-3: Oil and Grease Resistant Coating Product Details

Recommended coat weight	3-5 gsm
Suggested coating method	Gravure, Flexo
Suggested drying condition	100ºC, Hot Air dryer
KIT Value	8-10
COBB Value	<5

The benefits of Michelman's oil and grease resistant coating:

- Oil and grease resistance
- Water repellence
- Recyclability
- Repulpability
- FDA compliant options for direct food contact

Other applications for this oil and grease resistant coating include take-away containers, ice cream boxes, and sweet boxes.

Figure 4-Take-away containers

Figure 5-Sweet boxes

(Images are for representational purposes only.)

Water-based barrier and functional coatings are a suitable replacement to polyethylene, especially for paper cups. Paper cups are an alternative to plastic cups. However, disposable paper cups are a significant sustainability issue because, contrary to common belief, they are not recyclable. Their plastic lining ensures that they rarely make it to a recycling plant, and they are not biodegradable.

Current paper cups are made out of paper and are coated with low-density polyethylene (LDPE) or wax to prevent liquid from leaking out or soaking through the paper. Replacing the PE in paper cups with water-based coatings not only eliminates the plastic lining used in conventional paper cups but also eases the recycling and repulping process. Along with its recyclable and repulpable properties, it also provides excellent water, oil, and grease resistance and very high seal strength. It has been tested successfully for hot, cold, and deep-freeze applications. A gravure or rod coater can do the coating. This solution is suitable for frozen foods, hot and cold beverages, fried snacks, etc.

Figure 6-Paper cup applications

(Images are for representational purposes only.)

The benefits of Michelman's water-based barrier and functional coatings as a replacement to polyethylene:

- Water-based, green chemistry
- Recyclability and repulpability
- Water, oil, and grease resistance
- Oxygen and moisture barrier.
- Heat sealable
- FDA compliant options
- Down-gauging

Paper plates are alternatives to plastic plates, however similar to paper cups; they are not easily recyclable as they are coated with low-density polyethylene (LDPE) or wax to prevent food items from leaking out or soaking through the paper.

Table-4: Water-Based Coatings for Paper Plates Product Details

Recommended coat weight	4-5 gsm dry
Solid Content	34%
Suggested coating method	Airknife/ Rod / Gravure
Suggested drying condition	100ºC, Hot Air dryer
KIT Value	8-10
COBB	<10

The benefits of Michelman's water-based coatings for paper plates:

- Oil and grease resistance
- Water repellence
- Can sustain high temperatures during thermophilic moulding process
- FDA complaint options for direct food contact
- Recyclability and repulpability

Conclusion

Michelman's dedication to innovating a sustainable future is well represented in their investment in the Mumbai-based Michelman Innovation Centre for Coatings (MICC). This state-of-the-art packaging incubator is strategically designed to serve the needs of India and its surrounding markets to allow for the fast & efficient development of sustainable packaging. Their holistic approach of dedicated space, collaborative innovation, and technology enables all members of the packaging value chain, including brand owners, film producers, and converters, to access the tools needed to develop innovative and sustainable solutions for the natural environment and their businesses. Michelman has a long tradition of innovation and sustainability with water-based chemistry. Because of this, their technology experts offer all members of the packaging value chain the ability to collaborate and decrease the time it takes for the commercialization of improved and environmentally-friendly flexible packaging. Businesses can partner with their technology experts to become Plastic Waste Management Rules compliant. Collaboration with Michelman's technical and market experts accelerate the concept-to-commercialization cycle with innovations to produce packaging that offers:

Figure 7-Paper plate application

(Images are for representational purposes only.)

- Recyclable structures
- Brand appeal and enhanced graphics
- Increased shelf life and food safety
- Increased productivity and efficiency
- Waste reduction and down-gauging

References

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