

Sustainability in Packaging using Cold Foil Metallic Transfer

Multiple studies validate recyclability/repulpability of cold foil decoration in packaging

Introduction

For consumer brand and product managers seeking sustainable packaging with impact, paperboard packaging decorated with cold foil metallic transfer is a well-researched choice. Past studies have demonstrated the value of foil enhancement to packaging, including attracting attention and holding attention longer, while influencing purchase intent.^{1,2} But what about sustainability? This whitepaper explains how well-designed paperboard packaging can meet both manufacturer and consumer sustainability requirements, while positively influencing the purchase decision.

The Components

Beginning with the substrate, paperboard certified by governing bodies such as the Forest Stewardship Council (FSC) or the Sustainable Forestry Initiative (SFI) ensures adherence to strict documentation requirements tracking chain of custody from forest to end user. Certification not only ensures that paperboard is derived from responsibly managed forests, it provides a method to help prevent deforestation, preserve biodiversity, and protect human rights.

Next, various ecologically-produced water- and agri-based inks are now viable options and a good step toward reducing use of heavy metals such as lead, cadmium and barium, and solvents common to the commercial printing industry. It's interesting to note that non-toxic biodegradable, vegetable-based inks were in standard use prior to the 1960s and are gaining traction as brand owners seek sustainable packaging solutions.

Metallic ink differs from other inks by using metal particles such as aluminum, copper, bronze, silver or gold. The research referenced in this report demonstrates recyclability and repulpability of packaging decorated with cold foil metallic transfer material vs. metallic ink.

Consumer Behavior Research

From the 2023 Buying Green Report we learn that seventy-nine percent of consumers are looking for products in sustainable packaging. In addition, seventy-eight percent of consumers indicated they were likely to purchase more personal care products in sustainable packaging in the future. The study found that consumers are seeking clarity when it comes to sustainable packaging claims, as fifty-nine percent search product packaging for sustainability and recyclability information.⁵

According to a report by McKinsey & Company, younger consumers (Gen Z and millennials) and higher-income consumers generally reported the most willingness to pay more for sustainable packaging. Also of note, consumers generally see packaging producers and brand owners—rather than themselves, retailers, or regulators—as responsible for driving sustainability in packaging. Thirty-nine percent of respondents globally ranked environmental impact as extremely or very important, which was similar to thirty-eight percent in

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2023 and up from twenty percent in 2020. Circularity is the key sustainability characteristic that consumers use to determine whether packaging is sustainable. In this same global study, compostability is ranked highly by US consumers.⁴

THE STUDIES

Pira Report

The Pira Report, conducted in 2010 for the Foil & Specialty Effects Association (FSEA), tested the repulpability of foil-decorated paper samples. The two testing methods used aimed at replicating industrial conditions for deinking and for standard recycling. Both methods included repulping the material to be evaluated along with clean paper pulp, then screening the pulp through a slotted screen. The cold foil process was tested at 100% coverage.

The study concluded that cold foil decorated samples tested would cause no problems in repulping. Furthermore, samples tested “would not give rise to problems with stickies or with visible specks of undispersed polymer—‘hickies’ or ‘fisheyes’—in the paper.” And finally, the report concluded that “the higher density of the metallic particles from the foil indicates they can be separated by thin stock centrifugal cleaners (‘hydrocyclones’).”⁵

Georgia Tech Report

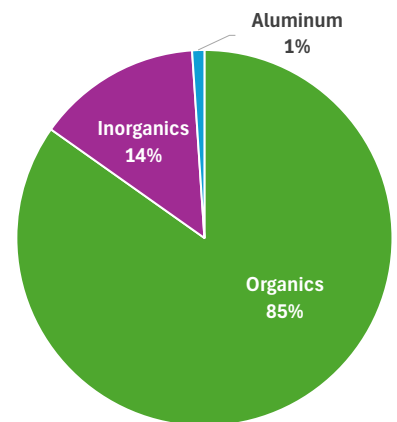
Ten years after the Pira Report, the FSEA commissioned a second report to affirm the feasibility of repulping foil decorated paper, and to distinguish it from the use of foil laminated paper and board, “which can be a more difficult product to recycle or repulp.”

For this study, FSEA supplied Coated-One-Side (C1S) 12 pt. card stock with foil stamped coverage ranging from 50%-100% per sheet. Following simulated industrial conditions, the samples were repulped. Rejects (.1%) and screen yield (75%) were calculated. A 75% yield is considered very high (compared to conventional chemical pulp at 45-50%) because more lignin and hemicellulose remain in the fiber.

The first step was to determine the composition of the paper samples. 200 grams of oven dry paper materials were repulped to yield a fiber slurry. After finding the total mass of the slurry, the value of organics and inorganics was determined by ashing. Total aluminum content was measured after acid leaching of the ash. (See image at right).

Next, reference samples of a Kleenex paper towel were tested for repulping, yielding little change in screen yield (~75%) and rejects (< .1). The rejects collected may be polymer components of the coatings.

In proving sustainability of cold foil decorated packaging, it is imperative that the aluminum foil is removed so as not to affect the properties of the reclaimed paper fibers. The presence of aluminum was measured in accepted fine particles at 0.11. The aluminum content in filtrate was 5.65. The filtrate particles can be washed away from the accepted fibers during the screening process.



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Finally, the reclaimed fibers were measured for fiber morphology to give an indication of future performance. Test findings indicated fibers are comparable to typical softwood pulp fibers.

The report concludes that:

- Cold Foil-decorated paperboard could be repulped to yield 75% fibers with very low rejects.
- Residual aluminum content can be removed during screening.
- Reclaimed fiber length is comparable to typical softwood pulp fibers.
- Physical strength tests to hand sheets from reclaimed decorative papers were similar to recycled paper towel fibers.
- Therefore, it is feasible to repulp the metallic foil decorated papers as it is done in common recycling settings.⁽⁶⁾

Van Dyk Report

The Van Dyk Report (March 2024) was also commissioned by the FSEA to proactively demonstrate that transfer metallic decorated paper and board do not create problems in the recyclability/repulpability of paper and/or board in a common repulping process.

According to its website, Van Dyk Recycling Solutions leads the North American market with over 340 Materials Recovery Facilities (MRFs) and 2,400 recycling and sorting systems installed to date. FSEA contracted with the Van Dyk Technology Center in Norwalk, Connecticut, the largest material test center in the recycling industry. The Van Dyk testing center is designed to simulate various recycling challenges.

Using a multifunctional optical sorting system, the test equipment was able to determine the difference between paper and aluminum/ferrous materials. The hi-res optical sensors can distinguish between fiber grades. The testing recovered the cellulose fibers and separated what is recyclable and what needs to go to landfill.

The study tested twenty samples each of eight different folding carton and greeting card styles with 25%-75% transfer metallic coverage. The test results proved the samples to be fully 100% sortable.

The Van Dyk study concludes:

- None of the metallic decorated samples were sorted out and destined for landfill.
- Fiber-based transfer metallic decorated materials are recyclable and are currently most likely being sorted by MRFs (materials recovery facilities) to be included in the recycling stream.”⁽⁷⁾

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The Process

Cold foil can be applied to a substrate inline during the offset lithographic printing process with extremely tight hairline registration. In addition, process and spot color inks may be printed on top of the cold foil application to create infinite choices in color metallic effect. Various other effects can be achieved using holographic and specialty foils. This method provides a high quality upscale look and feel in packaging combined with production efficiency.

Benefits of Sustainable Paperboard Packaging Decorated with Cold Foil:

- Recyclability
- Repulpability
- Range of thickness – coating weight is usually lower than ink
- On press inline application
- Tight registration for fine detail, small fonts and knockouts



Aesthetically, metallic transfer delivers stunning visual effects, with a high end reflective finish.

Consumer Behavior

A 2013 FSEA white paper states that foil enhanced packaging attracts and holds consumer attention longer than packaging without foil.⁽⁸⁾ A second study in 2016, conducted by The Sonoco Institute of Packaging Design and Graphics at Clemson University, validates the earlier study and adds data about purchase behavior. The second test included a foil-enhanced, unknown brand created solely for the study. The test brand outperformed known, national brands in the purchase decision-making process.⁽⁹⁾

Conclusion

Consumers are seeking clarity about packaging sustainability. When shopping for personal care products, they hold manufacturers and brand owners responsible for providing clear information about package recycling. Paperboard packaging featuring cold foil metallic transfer decoration is more appealing from the shelf and is a scientifically proven, sustainable (recyclable and repulpable) choice.

1. An Initial Study into the Impact of High-Visibility Enhancements on Shelf Presence, FSEA, 2013;
2. Eye Tracking as a Tool in Package and Shelf Testing, Tobii Technology AB, November 2008.
3. 2023 Buying Green Report; <https://www.triviumpackaging.com/media/pe5hfxsp/2023buyinggreenreport.pdf>.
4. Sustainability in Packaging 2025: Inside the Minds of Global Consumers; <https://www.mckinsey.com/industries/packaging-and-paper/our-insights/sustainability-in-packaging-2025-inside-the-minds-of-global-consumers>; McKinsey and Company article June 24, 2025.
5. Repulpability of foil-decorated paper. Pira Report, Pira reference: S 008909, prepared for Foil & Specialty Effects Association by R. N. Jopson and G. Collis, Pira International, United Kingdom, 2010.

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6. Repulping of Foil Decorated Paper, a study conducted by Rallming Yang, Ph.D., Georgia Tech's Renewable Bioproducts Institute and Commissioned by the Foil & Specialty Effects Association, November 2020.
7. Recycling of Fiber-Based Materials with Transfer Metallic Decoration. A study commissioned by the Foil & Specialty Effects Association and conducted by the Van Dyk Technology Center, March 2024.
8. An Initial Study into the Impact of High-Visibility Enhancements on Shelf Presence; Conducted 2013; revised 2014.
9. The Impact of High-Visibility Enhancements on Shelf Presence: A Second Study, commissioned by the Foil & Specialty Effects Association, in cooperation with The Sonoco Institute of Packaging Design and Graphic's CUshop; 2017.
https://fsea.com/wp-content/uploads/FSEA_WhitePaper_CoffeeStudy.pdf

About Colbert Packaging

Each day, since 1959, Colbert Packaging is committed to producing safe, smart, and sustainable packaging for customers who include some of the biggest names in the pharmaceutical, healthcare and consumer goods markets. Colbert's Kenosha, Wisconsin, facility produces offset and flexographic printed folding cartons, pressure-sensitive roll labels and package inserts; the Elkhart, Indiana, operation includes folding carton production and paper tray forming. Learn more at www.colbertpkg.com.

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