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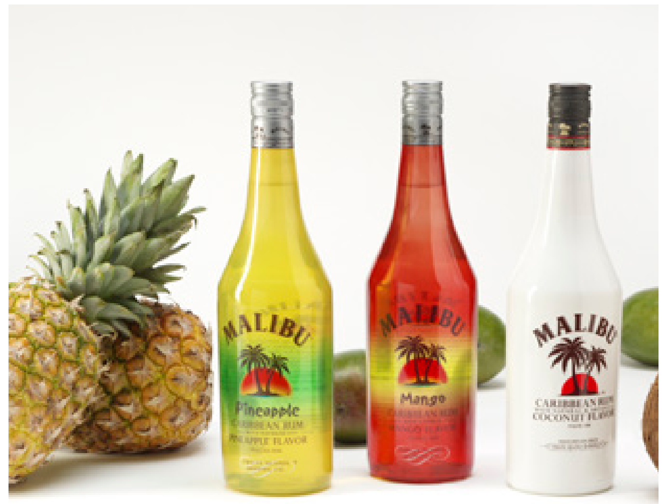
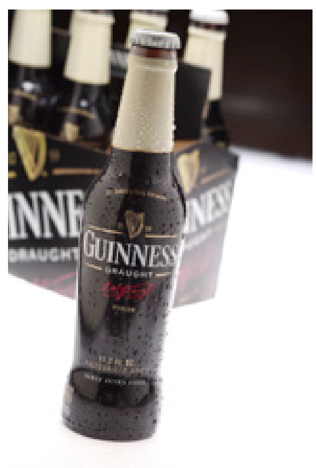
Eastman cellulose esters—technical tip

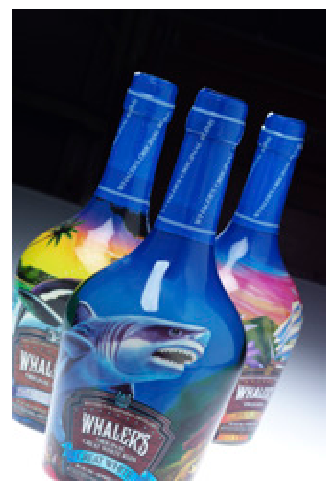
Eastman cellulose esters in inks for shrink film applications

Introduction

The information provided in this technical tip outlines some of the benefits that ink manufacturers and printing ink converters can expect when formulating with Eastman CAP (cellulose acetate propionate). CAP–based inks can resolve many of the problems associated with other ink systems used in shrink wrap printing while providing excellent print quality, good wash-up, and a variety of other performance benefits.







Shrink film is a rapidly growing application area for liquid inks. This process allows the application of durable, eye-catching, and decorative designs onto substrates such as Embrace™ copolyester, PVC, and OPS (oriented polystyrene) used for bottles and other containers. Eastman CAP and CAB (cellulose acetate butyrate) have many excellent qualities for use as binder resins in inks for shrink sleeve applications.

Whether the sleeve-shrinking process is by steam or dry heat and/or on glass or plastic substrates, Eastman CAP provides superior quality when compared to other resin systems.

In addition to sleeve applications, Eastman CAP and CAB-based inks also provide excellent performance in applications such as PVDC-coated food packaging and retort "boil in the bag" printing. This broad application range allows ink manufacturers and converters the option of consolidating their range of toners. This results in easier, quicker, and more cost effective printing and production.

Table 1 **Advantages of using Eastman cellulose esters in shrink film applications**

Advantage	Result
Temperature resistance	Compared to nitrocellulose systems, inks formulated with Eastman CAP resins have superior heat resistance. This quality allows steam or dry heat shrinking with no adverse effect to the design color or white brilliance.
Blocking	Compared to other systems, inks based on Eastman CAPs have superior solvent release qualities preventing issues such as blocking in the printed reel.
Reduction in "wet look"	Wet look is a common problem for steam-shrunk sleeves. Inks based on Eastman CAP have shown much less wet look 24 hours after shrinking when compared to nitrocellulose systems.
Moisture resistance	A common problem in steam-shrunk applications is ink transfer to the bottle when the sleeve is removed. Inks based on Eastman CAP have greater moisture resistance and do not transfer onto the plastic or glass bottle. This may be a problem when other ink systems are used.

Formulating shrink film inks with Eastman cellulose esters

Inks for shrink film applications containing cellulose esters are commonly based on combinations of cellulose esters and cobinders, usually acrylic resins.

Such inks can either be reverse printed, where the outer surface of the substrate provides the gloss and protection, or surface printed. The performance requirements for each application can, therefore, vary.

Commonly in shrink film applications, a backing ink is applied as the final ink (commonly referred to in the U.S. as a "flood coat"). It must have excellent opacity, heat resistance, and adhesion to the substrate and/or previously applied ink layers. A typical white backing ink formulation is shown in Table 2. This formulation would be reduced to application viscosity using a blend of 3:1 ethanol to ethyl acetate.

Table 2 **White backing ink formulation (flood coat)**

Ingredient	Weight %
n-Propanol	**35.0**
n-Propyl acetate	**15.0**
Eastman CAP-504-0.2	**5.0**
Acrylic resin[a]	**10.0**
Wetting aid	**1–3**
Antifoam	**2–5**
TiO_2 pigment	**25.0**
PE wax	**1–5**
Total	**100.0**

[a]*Paraloid B-44—The Dow Chemical Company or suitable acrylic*

The decorative designs on a shrink sleeve are achieved using standard pigments but often incorporate metallic and other special effect pigments to provide pleasing aesthetics to the printed article. The colored or special effect inks are also formulated with cellulose esters. A typical starting point formulation is shown in Table 3. This formulation would be reduced to application viscosity using a blend of 3:1 ethanol to ethyl acetate.

Table 3 **Colored ink formulation**

Instruction	Ingredient	Weight %
Pregrind prior to use	Eastman CAP-504-0.2	**5.0**
	Pigment	5–15.0
	Ethyl acetate	15.0
	Ethanol	30.0
	Plasticizer[a]	1–3.0
Blend with pigment grind	*n*-Propyl acetate	15.0
	Acrylic resin[b]	10.0
	Retarder solvent	2–5
	Plasticizer	2–5
	Total	**100.0**

[a] *Eastman SAIB, Triacetin, or suitable plasticizer*

[b] *Neocryl B814–DSM Neoresins or other suitable acrylic*

Since such inks are required to adhere to the shrink film, adhesion promoting additives are often incorporated.

PEI (reacted poly-ethyleneimine) is the most often used adhesion promoter for these types of inks, but titanates and zirconates are also suitable. Eastman cellulose esters can be used with all three of these types of adhesion promoters. For more information, see the technical tip, Adhesion Promoters for Cellulose Ester-Based Inks, TT-63.

Technical evaluation of Eastman CAP vs. nitrocellulose in shrink film ink

To demonstrate the superior performance of Eastman CAP, the white ink formulation in Table 2 was evaluated against a commercial nitrocellulose-based shrink wrap ink obtained from a leading European ink producer.

Procedure

The inks were printed, side-by-side onto PVC shrink film and evaluated for adhesion and scratch resistance. A cylindrical sleeve was fabricated using the printed substrate and the overlapping seam glued using a cyanoacrylate adhesive. The sleeve was then placed around a glass beverage bottle and shrunk around the container using steam.

The assembled bottle was stored at ambient temperature for 7 days before removing the film and evaluating the appearance of the ink film and bottle surface.

Figure 1 shows ink transfer from the area of the film printed with the nitrocellulose-based ink system onto the bottle. No ink transfer was observed from the Eastman CAP-based ink, demonstrating the superior performance of this system.

Figure 1 **Ink transfer to bottle with nitrocellulose-based ink system**

White ink transfer to bottle

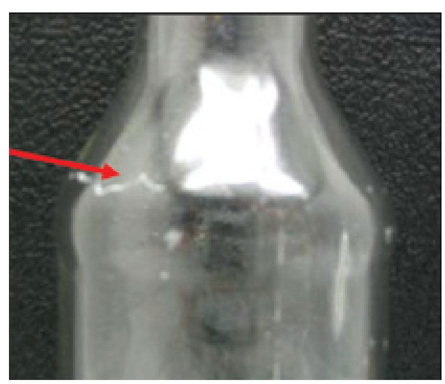
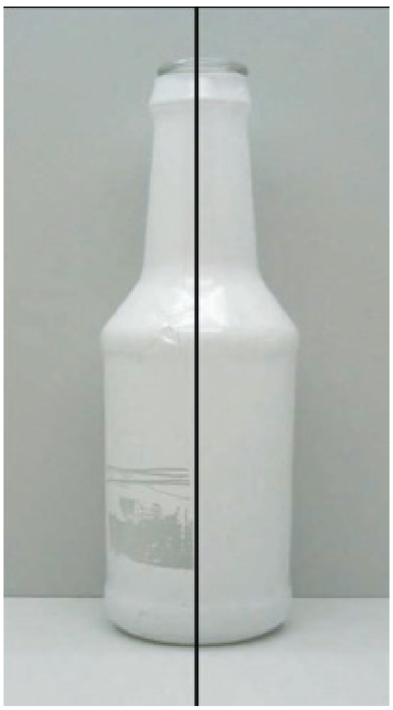


Figure 2 shows the printed film that has been reapplied to the bottle following a tape adhesion test after steam shrinking. This obviously indicates a breakdown of the nitrocellulose system as a result of the steam shrinking process. The Eastman CAP-based ink formulation has maintained its excellent adhesion characteristics.

Figure 2 **Tape adhesion results**



Conclusion

This study clearly serves to highlight the performance advantages of Eastman CAP-based ink systems for use in high quality shrink wrap applications. In addition, it explains why many leading ink companies utilize cellulose esters in their shrink films

For more information on the use of Eastman cellulose ester products for inks and graphics arts, contact your Eastman representative.

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