Cellulose esters for shrink film applications

Better processing performance and appearance in printing inks
Content

- Segment overview
- Advantages of using CAB and CAP
- How CAB and CAP address challenges
- Comparing CAP to nitrocellulose
- Conclusion
Segment overview
What is a shrink film ink?

- Shrink film ink enables durable, eye-catching designs reverse printed onto flexible substrates that shrink onto containers under the influence of heat.

- Substrates include: PET, OPS, PVC

- Desired attributes of shrink film ink include:
  - Durability
  - Flexibility
  - Excellent adhesion
  - Vibrancy of color
  - Fade resistance
  - Safety and compliance
Shrink-film (PET, OPS, PVC) 
Colored inks 
Backing white 
Reverse printed gravure or flexo 

Ink formulations must be compatible with these processes and retain long term durability and appearance in the final application.
Advantages of using CAB and CAP
CAP and CAB in printing inks

Advantages for shrink film applications

- **Improves processing performance**
  - Low density
  - High melting range
  - Fast solvent release
  - Oil and grease resistance

- **Improves appearance and long term durability**
  - UV stability
  - Good pigment dispersion
  - Carrier for pigments and dyes
  - Good scuff resistance

- **Delivers compliance & safety**
  - FDA cleared*
  - Low flammability

* Check with your Eastman representative or distributor regarding safety clearances for your region
CAP in shrink film inks

Performance and appearance advantages

**Improves processing performance**

- **Superior heat 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 a design’s color or white brilliance.

- **Less 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.

**Enhanced moisture release**

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 thus do not transfer onto the plastic or glass bottle. This may be a problem when other ink systems are used.

**Improves appearance and durability**
Comparing CAP to nitrocellulose
# Sample Ink Formulation

## White Backing Ink Formulation, Gravure Applied

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Wt. %</th>
</tr>
</thead>
<tbody>
<tr>
<td>n-Propanol</td>
<td>35.0</td>
</tr>
<tr>
<td>n-Propyl acetate</td>
<td>15.0</td>
</tr>
<tr>
<td><em>Eastman</em> cellulose acetate propionate (CAP-504-0.2)</td>
<td>5.0</td>
</tr>
<tr>
<td>Acrylic resin (e.g., Paraloid B44 Dow)</td>
<td>10.0</td>
</tr>
<tr>
<td>Wetting aid</td>
<td>1-3</td>
</tr>
<tr>
<td>Antifoam</td>
<td>2-5</td>
</tr>
<tr>
<td>TiO₂ pigment</td>
<td>25.0</td>
</tr>
<tr>
<td>PE wax</td>
<td>1-5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>
## Sample ink formulation

### Colored ink formulation, gravure applied*

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Ingredient</th>
<th>Wt. %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-grind prior to use</td>
<td>Eastman CAP-504-0.2</td>
<td>5.0</td>
</tr>
<tr>
<td></td>
<td>Pigment</td>
<td>5-15.0</td>
</tr>
<tr>
<td></td>
<td>Ethyl acetate</td>
<td>15.0</td>
</tr>
<tr>
<td></td>
<td>Ethanol</td>
<td>30.0</td>
</tr>
<tr>
<td></td>
<td>Plasticiser (SAIB or Triacetin)</td>
<td>1-3.0</td>
</tr>
<tr>
<td>Blend with pigment grind</td>
<td>n-Propyl acetate</td>
<td>15.0</td>
</tr>
<tr>
<td></td>
<td>Acrylic resin e.g. NeoCryl B814 – DSM Coating Resins</td>
<td>10.0</td>
</tr>
<tr>
<td></td>
<td>Retarder solvent</td>
<td>2-5</td>
</tr>
<tr>
<td></td>
<td>Plasticiser</td>
<td>2-5</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

*Since such inks are applied directly onto the substrate, they may require an adhesion promoter such as titanium complex or polyethyleneimine. For more information see the technical tip, Adhesion Promoters for Cellulose Ester-Based Inks, TT-63.*
Design of experiment
Comparing CAP and nitrocellulose

- 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 with the overlapping seam being 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.
Evaluation of results

CAP compared to nitrocellulose

The CAP-based formulation provides better adhesion in both phases (before and after shrink/store).

Note: scratch resistance tested and film replaced on bottle for display purposes.
Conclusion
Conclusions

- This study highlights the performance advantages of CAP-based ink systems for use in high quality shrink wrap applications and explains why leading ink companies utilize cellulose esters for such applications.

- Literature available at Eastman.com
  - Cellulose Esters in Printing Inks for Shrink Film Applications, EU (TT-64)
  - Adhesion Promoters for Cellulose Ester Based Inks, EU (TT-63)
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