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Cost in use JONCRYL® Dispersions & resins for printing applications

Reduce application costs without sacrificing performance

BASF printing & packaging

Market dynamics & customer expectations

JONCRYL cost in use products

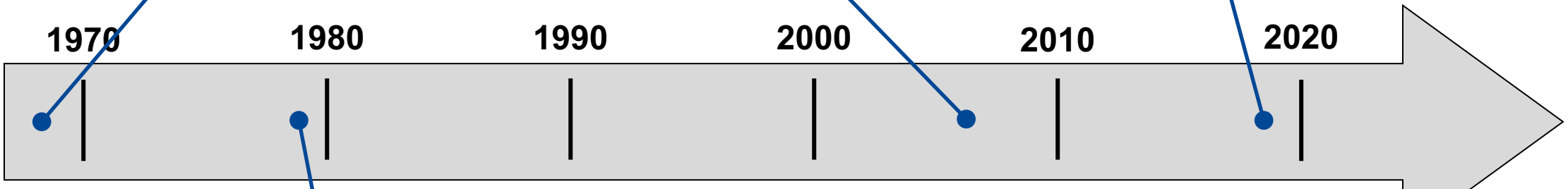
BASF history in printing & packaging

Over 50 years of expertise in styrene-acrylic resin products

1960's:
Johnson Polymer, part of SC Johnson, develops **Styrene-Acrylic Resins** for floor coating applications.

2006:
BASF AG acquires styrene-acrylic resins business and assets from JohnsonDiversey, Inc.

2019 & Beyond:
BASF continues to build on strong legacy in styrene acrylic resins and innovate for the future.



1970's & 1980's:
JONCRYL styrene acrylic resins enable printing industry conversion to water-based inks and coatings; particularly in paper & paperboard applications.

BASF printing & packaging team builds on vast industry experience and technical expertise to deliver **market-leading JONCRYL products**.

BASF printing & packaging

Major raw material supplier to graphic arts & packaging industries

BASF printing & packaging

- Major supply partner to ink and OPV formulators for paper & paperboard, flexible packaging, and functional coatings.
- Production of JONCRYL styrene-acrylic resins and dispersions in Wyandotte, MI: '*Center of Expertise*' with local R&D capabilities.
- Strengthened by BASF backward-integration into raw materials, vast supply network based on 'Verbund' concept.

BASF brings market-leading solutions to the graphic arts market based on large-scale, and consistent production of high-quality & innovative products.

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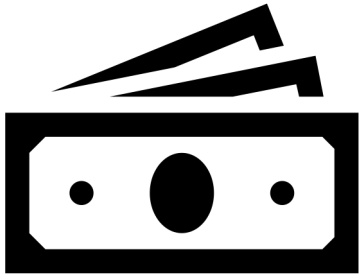
Market dynamics & customer expectations

JONCRYL cost in use products

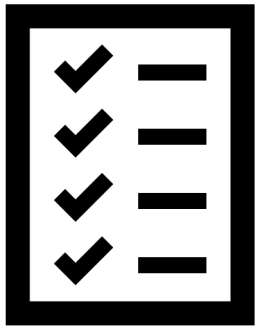
Current dynamics in the printing market

Industry challenged to meet the demands of today's consumer



Cost pressure

- Raw material fluctuations
- Cost pressure up value chain: Supplier ← Printer ← Brand
- Complexity & SKU reduction



Sustainability & compliance

- Sustainable sourcing, efficient production, & waste management
- Global compliances
- Low VOC & worker safety

Productivity

- Packaging market driving growth
- High speed, automation, & focus on consistency.
- Short runs, personalization

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Evolution of customer expectations

Adapting to new market dynamics in printing industry

Cost pressure:

- Fluctuating raw materials **threaten profitability**, even endanger customer retention
- Tight competitive landscape means bids can be won/lost by **slim margin**
- **All costs scrutinized** in order to gain every possible efficiency

Compliance & sustainability:

- **Sustainable** inks & coatings: Sourcing, efficiency, waste reduction, etc…
- Broad **regulatory compliance** becoming important for global brands and customers
- Fight for talent- Improving **worker quality of life** through low VOC, a hiring differentiator

Productivity:

- Seeking **reliable supply chain** to keep up with growing market sectors
- Printers looking for easy-to-use, consistent, and efficient products that **perform as well as existing**
- Packaging/e-commerce **changing performance requirements**

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Market dynamics & customer expectations

JONCRYL cost in use products

BASF cost in use portfolio

Enabling customers to increase efficiency of their formulations

Product	Type	Description
JONCRYL 689-A	Solid Resin	Versatile solid resin for cost efficiency in printing inks and OPV applications
JONCRYL 2190H-A	RC Emulsion	Acrylic emulsion with added dilutability for ink and varnish applications
JONCRYL 659-A	Colloidal	Efficient colloidal emulsion for use in inks for corrugated board and kraft paper applications

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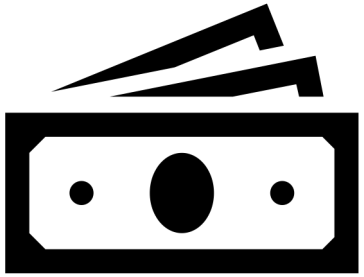
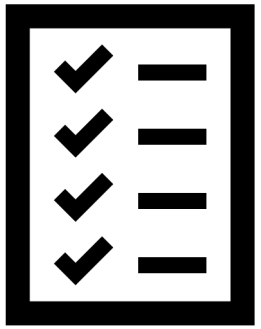
JONCRYL cost in-use products

Helping ink formulators offer effective solutions to today's printers



Cost pressure

- Improve cost-in-use through efficient dilution profile
- Keep (and improve) performance qualities of existing offerings



Sustainability & compliance

- Swiss-A Compliance
- FDA Clearance*
- Low VOC

Productivity

- Dilutable products improve production & RM efficiency
- Versatile, compatible with standard ink & OPV components across broad application areas.

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*Contact your account manager for more information

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JONCRYL 689-A

Versatile resin with efficient dilution profile

JONCRYL 689-A

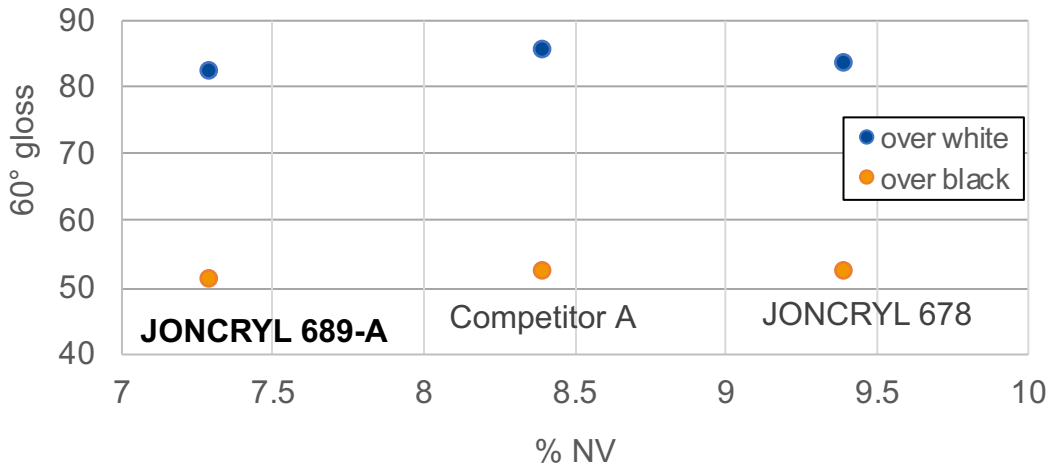
Versatile solid resin for cost efficiency in printing inks and OPV applications.

Key features and benefits:

- Very efficient dilution profile enables lower-solids inks.
- Enhances gloss, resolubility, and holdout of inks and OPV's.
- Glycol ether free

Property	Typical value
%NV	> 99
MW	13,000
Acid value (solids)	205
Tg (°C)	104

Resin performance: Gloss vs. % NV



JONCRYL 689-A provides comparable gloss performance at lower solid level.

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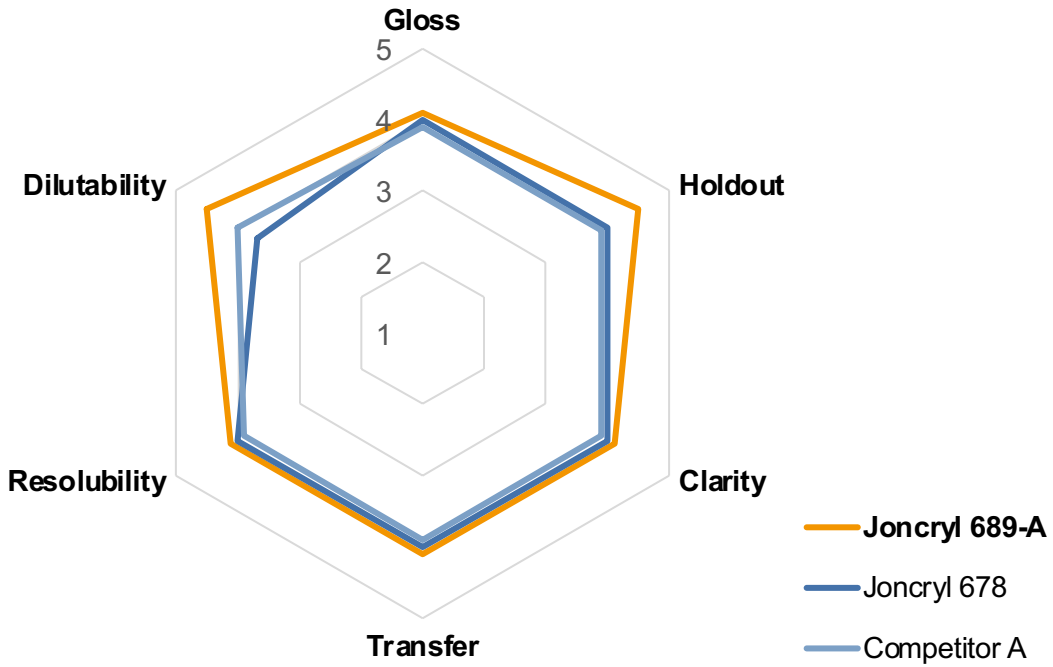
JONCRYL 689-A

Provide performance advantages vs. industry mainstay, JONCRYL 678, and competitive products.

OPV performance at equal viscosity



Product performance comparison:

- Dilutability enables similar performance using less resin.
- Hold-out improved vs. competitive offerings

JONCRYL 689-A provides gloss, holdout, and resolubility in a variety of applications, including:

- Label Inks
- Folding Carton Inks
- Corrugated Inks
- Overprint Varnish (OPV)

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JONCRYL 2190H-A

Acrylic emulsion with performance and cost advantages

JONCRYL 2190H-A

Hard, non-film forming acrylic emulsion with added dilutability for ink and varnish applications.

Key features and benefits

- Cost-in-use savings
- Versatile and fast drying for high-speed applications
- Provides enhanced gloss and holdout in flexographic & gravure formulations
- Glycol ether & HAP free
- low VOC, Swiss A compliant

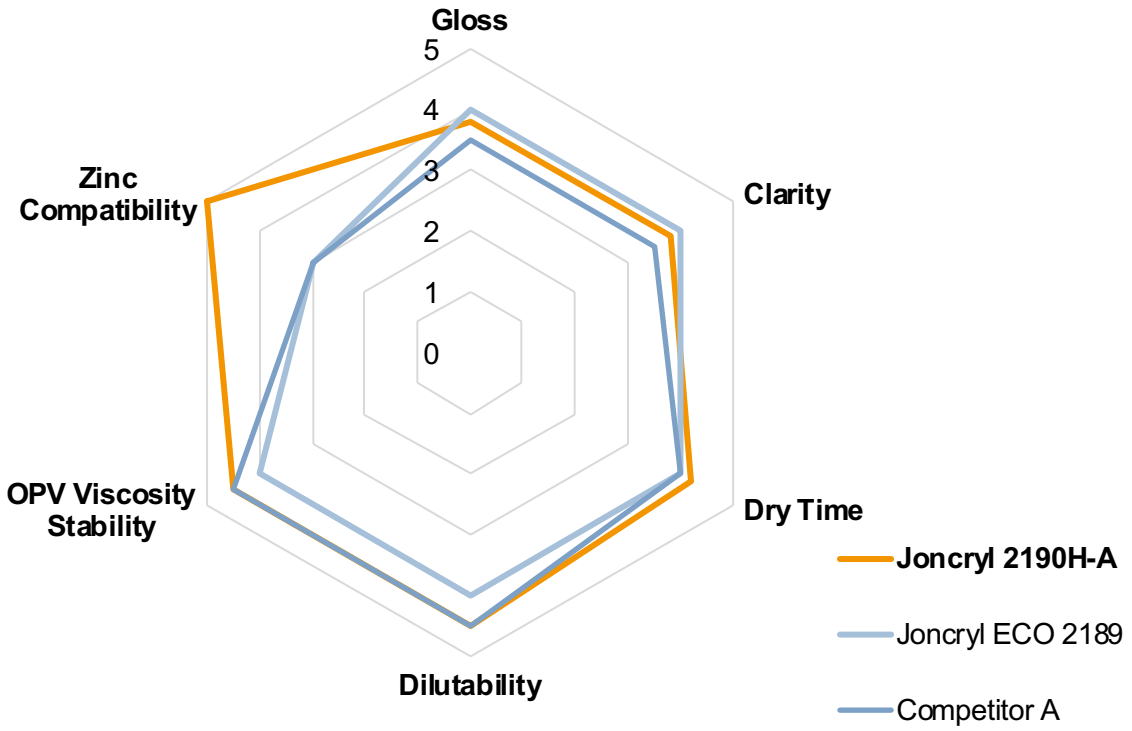
JONCRYL 2190H-A vs. JONCRYL ECO

Provides cost in use savings through formulation of inks and coatings with lower polymer solids.

JONCRYL 2190H-A

Provides efficiency & differentiated performance vs. existing JONCRYL ECO 2189 & competitive offerings

Hard emulsion performance



Product performance comparison:

- Improved viscosity stability in OPV applications
- Faster dry time for high-speed applications
- Greater zinc oxide compatibility increases versatility

Improve versatility of:

- Folding Carton Inks
- Corrugated Inks
- Overprint Varnish (OPV)

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JONCRYL 659-A

Efficient colloidal supporting cost-in-use savings for inks

JONCRYL 659-A

Efficient colloidal emulsion for use in inks on corrugated board and Kraft paper applications.

Key features and benefits

- Low cost-in-use due to its high molecular weight and dilutability
- Excellent transfer and color strength
- Good press performance, no misting
- Good compatibility in combination with emulsions and pigment concentrates

Cost in use calculator- *example*

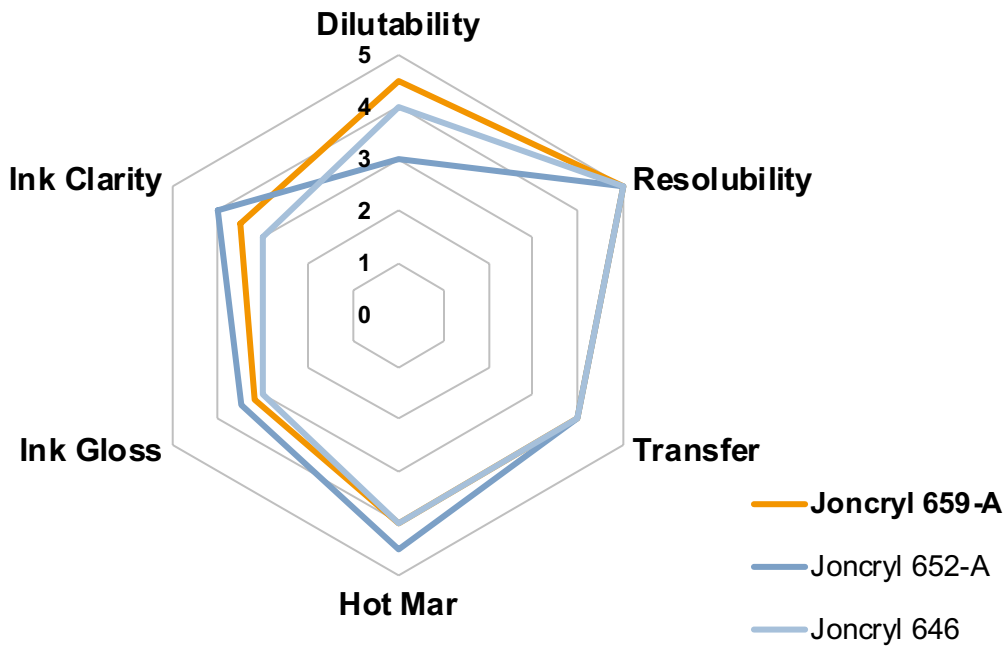
	JONCRYL 142	JONCRYL 659-A
Solids in ink	7.5%	6.5%
volume ink (lb)	100,000	100,000
Solids in ink (lb)	7,500	6,500
Solids colloidal	40%	44%
Colloidal needed (lb)	**18,750**	**14,773**

JONCRYL 659-A supports **21% reduction** of colloid needed to achieve similar performance.

JONCRYL 659-A

Dilutability combined with hot mar & clarity benefits

Colloid Performance



Product performance comparison:

- Efficient dilution profile provides cost savings
- Exhibits excellent balance of clarity, dilutability, and heat resistance with high resolubility.

Use JONCRYL 659-A to enhance dilutability, heat resistance, and resolubility of:

- Folding Carton Inks
- Corrugated Inks
- Overprint Varnish (OPV)

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BASF paper & paperboard portfolio

Leading products for use in water-based inks and coatings

Label Inks	Corrugated Inks	Folding Carton Inks	Specialty Inks	Overprint Varnish
Resins for resolubility: ***JONCRYL 689-A*** JONCRYL 680, JONCRYL 678 JONCRYL ECO 675 **Resin solutions for pigment dispersions:** ***JONCRYL HPD 496-A*** JONCRYL HPD 296 JONCRYL HPD 196 JONCRYL ECO 75 **RC Emulsions for narrow web ink vehicles:** JONCRYL 2664, JONCRYL 2350 ***JONCRYL 2190H-A*** JONCRYL ECO 2189 & 2177 JONCRYL 89, JONCRYL 77	**Colloidal emulsion for corrugated ink vehicles:** ***JONCRYL 659-A***, JONCRYL 655, JONCRYL 142, JONCRYL 646 **Opaque ink vehicle emulsions:** JONCRYL 631, JONCRYL 633 **Resin solutions for pigment dispersions with opaque polymers:** JONCRYL 60, JONCRYL 63 **Resin solutions for pigment dispersions:** ***JONCRYL HPD 496-A*** JONCRYL HPD's 296, 196, & 96 JONCRYL ECO 75 **RC emulsions for post-print corrugated ink vehicles:** ***JONCRYL 2190H-A*** JONCRYL ECO 2189 & 2177 JONCRYL 89, JONCRYL 77	**Resins for resolubility:** ***JONCRYL 689-A*** JONCRYL 680, JONCRYL 678 JONCRYL 67 **Resin solutions for pigment dispersions:** ***JONCRYL HPD 496-A*** JONCRYL HPD's 296, 196, & 96 JONCRYL 63, JONCRYL 60 **RC emulsions for flexographic and gravure ink vehicles:** JONCRYL 2660, JONCRYL 2646 JONCRYL 2350, JONCRYL 2178 ***JONCRYL 2190H-A*** JONCRYL ECO 2177 JONCRYL 1670, JONCRYL 617-A JONCRYL 77, JONCRYL 74-A	**Heat resistance:** JONCRYL 585, 1695 **Alkaline resistance:** JONCRYL 537 **Metallic inks**: JONCRYL 2136-A, 1655 **Alcohol/Chemical resistance:** JONCRYL 538-A **Grease resistance:** JONCRYL 74-A, 1670 **Steam resistance:** JONCRYL 98 **Envelope inks:** JONCRYL 100	**Resins:** ***JONCRYL 689-A*** JONCRYL 693, JONCRYL ECO 684 JONCRYL 682, JONCRYL 678, JONCRYL ECO 675 **Resin solutions:** JONCRYL ECO 84, 75, 60, 50 **RC emulsions:** JONCRYL 2660, JONCRYL ECO 2189 ***JONCRYL 2190H-A*** JONCRYL ECO 2177, JONCRYL 2178 JONCRYL 1695, JONCRYL 1680 JONCRYL 1670, JONCRYL 1612, JONCRYL 660 DPM, JONCRYL 617-A, JONCRYL 585, JONCRYL 538-A, JONCRYL 537, JONCRYL 98 JONCRYL 89, JONCRYL 77, JONCRYL 74-A

Low Maintenance Vehicle (LMV) Resin: JONCRYL LMV's 7085, 7025, **RC Emulsion:** JONCRYL LMV's 7040, 7050, 7051 **Colloidal Emulsion:** JONCRYL LMV 7014

There's a JONCRYL for every application.
To learn more, visit our website: www.basf.us/paperboard

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