

PECOGEL[®] HYDROGEL COSMETIC INGREDIENTS

TECHNICAL PRODUCT BROCHURE

Description

PECOGEL Hydrogel Cosmetic Ingredients are a family of patented aqueous hydrogels comprised of vinylpyrrolidone polymers or copolymers and hydrophilic polyurethane. These biocompatible materials form interpolymers with unique rheological and film-forming properties, plus the ability to complex with a wide range of organic molecules such as dyes, anti-microbials and UV absorbers; and, to act as protective colloids.

General Properties

PECOGEL Hydrogel Cosmetic Ingredients are aqueous or SDA-40 ethanol solutions which dry to films that are clear, tack-free, flexible and glossy. Despite their aqueous origin, dried films do not easily redissolve upon contact with water. Instead, they swell and become slippery. When redried, these films return to their original, clear; tack-free and glossy state. While resisting removal with water alone, they are, depending on composition, more or less easily removed with warm water and soap or detergent.

The **PECOGEL** product line consists of the **A Series** and three chemically different aqueous-based polymers comprised of the homologous **H**, **GC**, and **S series** products. The **PECOGEL A series**, while chemically equivalent to the aqueous **PECOGEL H series**, utilizes SDA-40 ethanol as a solvent. All polymers within each series can be used effectively in their concentrated or diluted forms – and all polymers possess the ability to complex and immobilize specific organic species such as dyes.

PECOGEL products are substantive to hair and skin – especially the cationic **GC series**. All **PECOGEL** products add body, luster, and improved slip and comb-out properties to hair. Dry films will absorb moisture from the atmosphere and swell until they reach equilibrium, without developing tack.

Pecogel Homologous Product Series

PECOGEL H Series – Nonionic General Purpose Hydrogels

Listed in order of increasing hydrophobicity:

PECOGEL H-12

PECOGEL H-115

PECOGEL H-1220

PECOGEL H series Hydrogel Cosmetic Ingredients are nonionic aqueous solution interpolymers of polyvinylpyrrolidone (PVP) homopolymer and hydrophilic polyurethane. The INCI designation is “VP/ Polycarbamyl Polyglycol Ester”. Product grades within the **H series** differ in both total polymer concentration and in the ratio of the two polymer components. **H series** products exhibit varying degrees of water resistance as dried films, depending on this polymer ratio. In general, as the concentration of polyurethane in **PECOGEL** hydrogels increases, resistance to water removal in dried films also increases.

PECOGEL A Series

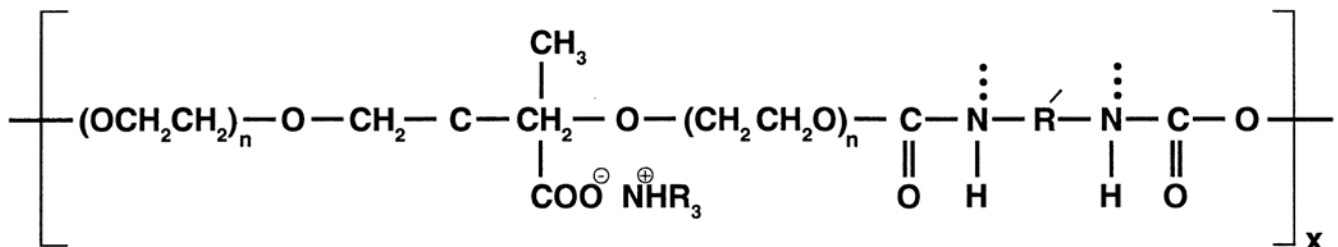
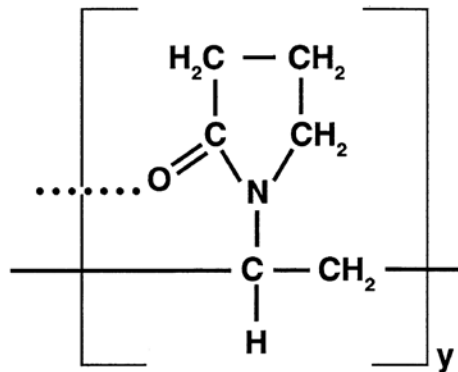
PECOGEL A-12 is a 12% nonionic solution of an interpolymer of PVP and hydrophilic polyurethane in SDA-40 ethanol. The INCI designation is "VP/Polycarbamyl Polyglycol Ester". **PECOGEL A-12** has the same film forming properties as **PECOGEL H-12**, but is much faster drying and is designed for anhydrous systems.

Similarly, **PECOGEL A-115** has the same film characteristics as **PECOGEL H-115** except that it is faster drying.

Currently, **PECOGEL A-12** and **PECOGEL H-115** are the only products offered in this line, however, other polymer ratios in SDA-40 ethanol are available upon request.

PECOGEL[®] H and A SERIES

INCI: VP/Polycarbamyl Polyglycol Ester



R = Ethyl **x = Polyurethane Polymer**
 / **y = PVP**
R = Aromatic **x+y = PVP/Polyurethane Hydrogel**

PECOGEL GC Series – Cationic Hydrogels for Hair Care Applications

Listed in order of increasing hydrophobicity:

PECOGEL GC-310

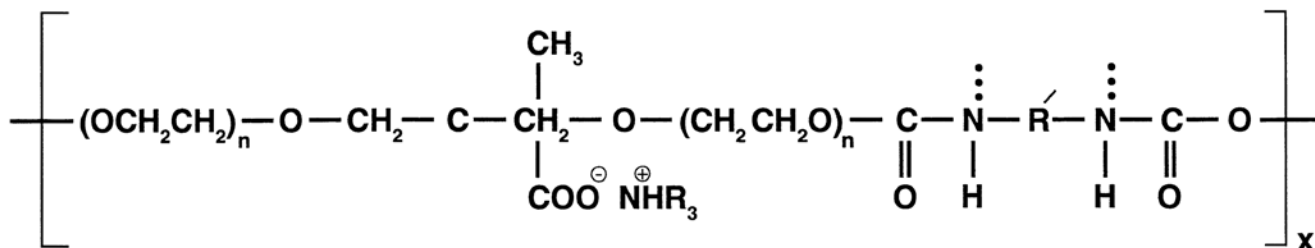
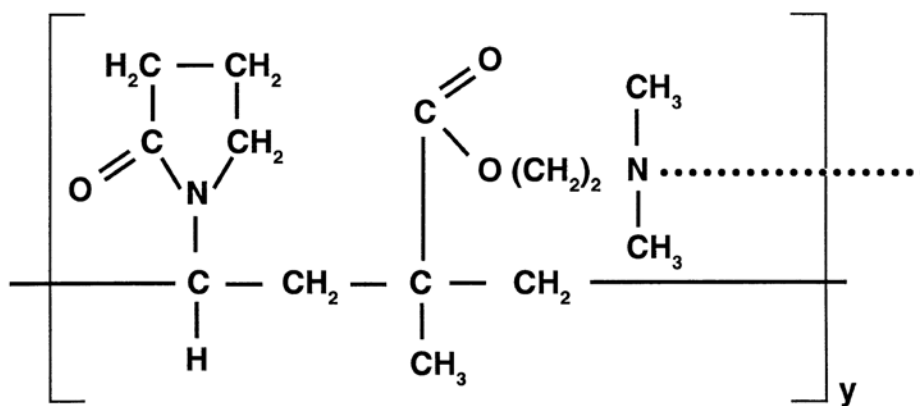
PECOGEL GC-1110

PECOGEL GC series hydrogels are cationic aqueous solution interpolymers of cationic PVP copolymers and hydrophilic polyurethane. Their INCI designation is “VP/Dimethylaminoethylmethacrylate/ Polycarbamyl Polyglycol Ester”. These products possess greater substantivity to hair and skin than **H series** products while maintaining the same excellent film properties. Individual **GC series** hydrogels differ in the ratio of the two polymeric components.

PECOGEL GC-1110 is somewhat more water-resistant in dry film form than **PECOGEL GC-310**, while **GC-310** has more cationic character than **GC-1110**.

PECOGEL[®] GC SERIES

**INCI: VP/Dimethylaminoethylmethacrylate
Polycarbamyl Polyglycol Ester**



R = Ethyl

x = Polyurethane Polymer

R' = Aromatic

y = PVP Dimethylaminoethylmethacrylate

x+y = PVP/Dimethylaminoethylmethacrylate/Polyurethane Hydrogel

PECOGEL S Series – Silicone Containing Nonionic Hydrogels

Listed in order of increasing hydrophobicity:

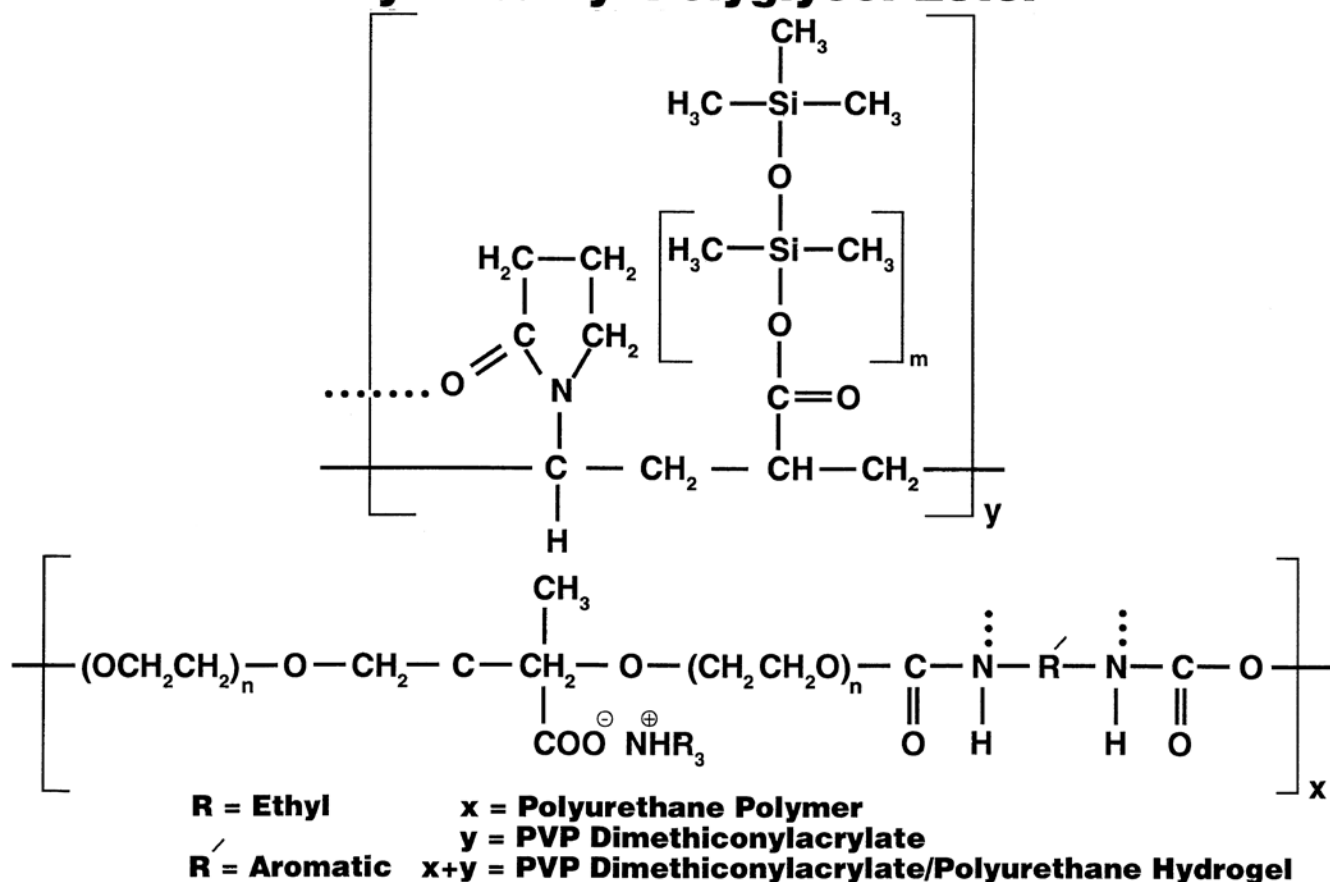
PECOGEL S-2120

PECOGEL S-1120

PECOGEL S series Hydrogel Cosmetic Ingredients are nonionic aqueous solution interpolymers of unique silicone-containing copolymers of polyvinylpyrrolidone and hydrophilic polyurethane. Their INCI designation is “VP/Dimethiconylacrylate/Polycarbamyl Polyglycol Esters”. Unlike all other **PECOGEL series**, **S series** hydrogels exhibit low solution viscosities and non-pituitous flow behavior. In addition to the same excellent film properties exhibited by the **H** and **GC series**, **PECOGEL S series** products appear water-insoluble in dry film form. Furthermore, **PECOGEL S-2120** contains more dimethiconylacrylate than does **PECOGEL S-1120**.

PECOGEL[®] S SERIES

**INCI: VP/Dimethiconylacrylate
Polycarbamyl Polyglycol Ester**

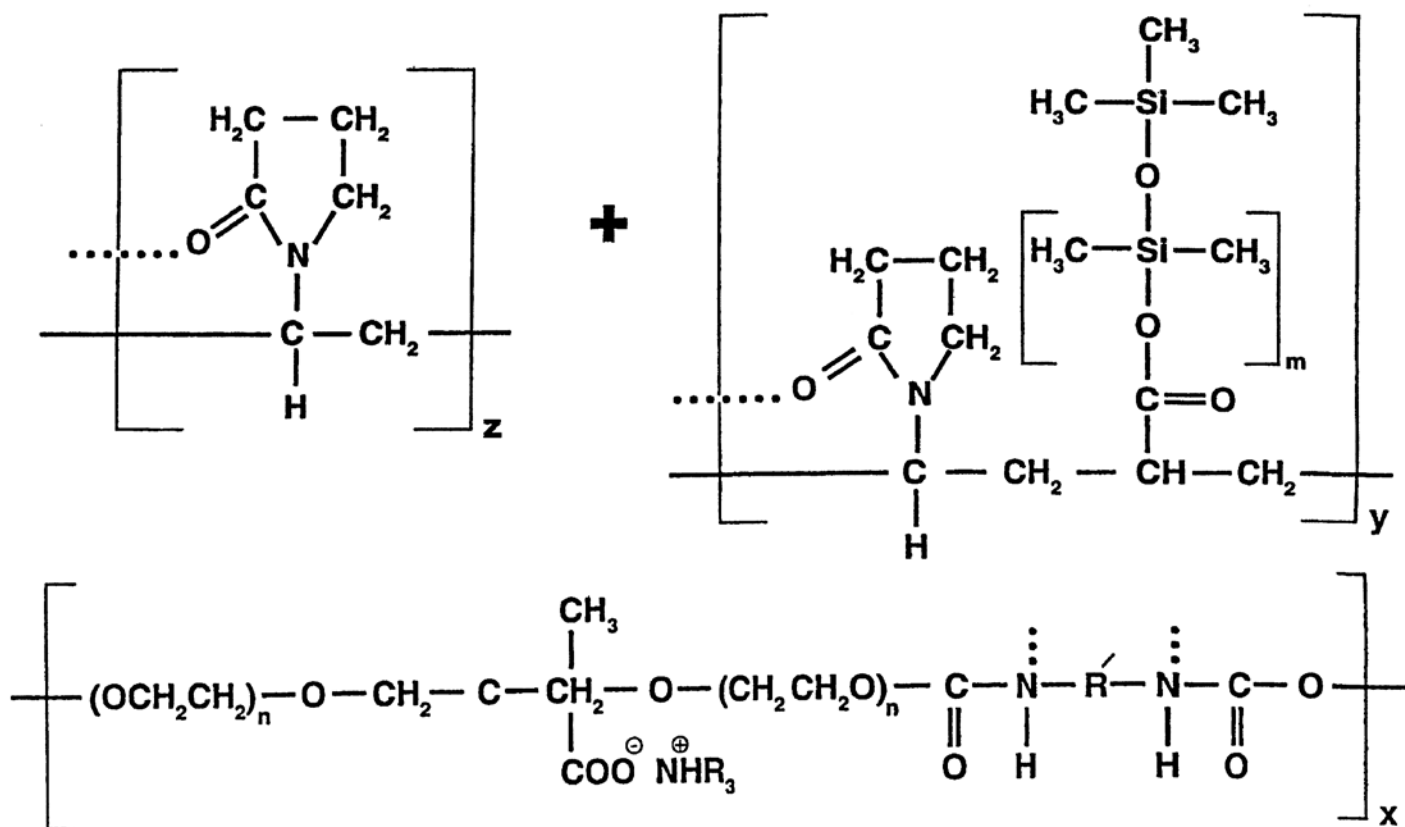


PECOGEL HS-501

PECOGEL® HS-501 cosmetic hydrogel is a 20% polymer solution in water. Like other PECOGE[®] cosmetic hydrogels, PECOGE[®] HS-501 forms a flexible, non-tacky film when dry and the film is slippery when wet. However, its component parts synergistically complex to form a thicker, tougher film than any of its components and is completely insoluble in water when dry.

PECOGEL[®] HS-501

INCI: VP/Dimethiconylacrylate/Polycarbamyl Polyglycol Ester/ VP/Polycarbamyl Polyglycol Ester)



R = Ethyl

R' = Aromatic

x = Polyurethane Polymer

y = PVP Dimethiconylacrylate

z = PVP

x+y = PVP Dimethiconylacrylate/Polyurethane Hydrogel

Typical Hydrogel Properties

PECOGEL Hydrogel Cosmetic Ingredients vary in their physical properties as well as their chemical compositions. These differences are summarized in the following table:

| PECOGEL * | %TOTAL Polymer | PVP:PUR Ratio ** | Viscosity Cp | Brookfield LVT @25°C |
|-----------|----------------|------------------|--------------|-----------------------|
| H-12 | 12% | 3:1 | 5,000 | Spindle #4; 60 RPM |
| H-115 | 15% | 1:1 | 8,000 | Spindle #4; 60 RPM |
| H-120 | 20% | 1:2 | 7,000 | Spindle #4; 60 RPM |
| A-12 | 12% | 3:1 | 30,000 | Spindle #4; 30 RPM |
| A-115 | 15% | 1:1 | 5,500 | Spindle #4; 12 RPM |
| GC-310 | 10% | 3:1 | 10,000 | Spindle #4; 30 RPM |
| GC-1110 | 10% | 1:1 | 50,000 | Spindle #4; 6 RPM |
| S-1120 | 20% | 1:1 | 1,750 | Spindle #3; 30 RPM |
| S-2120 | 20% | 2:1 | 1,750 | Spindle #3; 60 RPM |
| HS-501 | 20% | 1:1 | 4,000 | Spindle #4, 30 RPM*** |

*All aqueous-based hydrogels, the H, GC and S series, plus HS-501 are inhibited with 0.5% glydant and all typically exhibit a pH in the neutral range in 1.0% aqueous dilutions. Exception: PECOGE L H-115 contains 0.5% Germall 115 as an inhibitor.

** Weight Ratio of Polyvinylpyrrolidone or PVP Copolymers to Polyurethane.

***Model – CPS Brookfield

SOLUBILITIES

| | Castor Oil | Ethanol | Cyclomethicone | Mineral Oil | Propylene Glycol | Isopropyl Myristate | H ₂ O |
|----------------|------------|---------|----------------|-------------|------------------|---------------------|------------------|
| PECOGEL A-12 | i | m | i | i | m | i | d |
| PECOGEL A-115 | i | m | i | i | s | i | s |
| PECOGEL H-12 | d | m | i | i | s | i | s |
| PECOGEL H-115 | i | m | i | i | s | i | s |
| PECOGEL H-1220 | d | s | i | i | d | i | d |
| PECOGEL GC-310 | d | i | i | i | s | i | d |
| PECOGEL GC-110 | i | i | i | i | s | i | d |
| PECOGEL S-1120 | d | d | i | i | d | i | d |
| PECOGEL S-2120 | d | d | i | i | d | i | d |
| PECOGEL HS-501 | i | m | i | i | m | i | m |

d = dispersible
i = insoluble

s = soluble @ 5%
m = miscible (soluble @ all proportions)

Health and Safety

PECOGEL Hydrogel Cosmetic Ingredients are non-comedogenic, orally non-toxic and have a primary skin irritation index of zero.

In addition, toxicological studies on **PECOGEL GC-310**, **H-15** and **H-1220** have shown them practically non-irritating to eyes, while **H-12** and **S-1120** have a primary ocular irritation index of zero.

Cosmetic & Personal Care Applications

Given their unique combination of properties, **PECOGEL** Hydrogel Cosmetic Ingredients are useful in cosmetic and personal care products as...

* **FILM FORMERS/HAIR CONDITIONERS**

- To create long eye lashes from aqueous-based mascaras
- To add body and luster to hair in shampoos, mousses and conditioners
- To provide spray control in low VOC hair sprays
- As a base for waterproof sunscreen products
- Waterbased nail lacquers (**HS-501**)

* **LUBRICANT/SLIP PROMOTERS**

- To improve comb-out in hair care products (especially wet-comb) and add lubricity to after-shaves and other skin care products
- To improve slip and “roll” in dry powders

* **COMPOLEXING AGENTS**

- To immobilize dyes in hair colorants and UV absorbers in sunscreens

* **GELLING AGENTS**

- To provide an excellent base for face mask

* **FRAGRANCE RELEASE CONTROLLERS**

- To provide fragrance release with heat and moisture

* **VISCOSITY BUILDERS**

- To add body and richness to skin lotions and hair care products such as conditioners

* **HUMECTANTS**

- To provide skin moisturization since the hydrogels retain water in the polymer matrix

FORMULATIONS

Typical formulations utilizing **PECOGEL** products are described in the following section. These formulations, although tested, are offered only as a guide. Formulators are encouraged to develop formulations based on their specific requirements.

SUNSCREEN CREAM

| Phase A | |
|--|--------|
| Deionized Water | 59.00% |
| Butylene Glycol | 5.00 |
| Carbomer (Carbopol Ultrez 10)2 | 0.50 |
| Phase B | |
| PELEMOL PTP ¹ (Pentaerythrityl Tetrapelargonate) | 5.00 |
| PELEMOL GTIS ¹ (Glyceryl Triisostearate) | 5.00 |
| Cetearyl Alcohol | 2.00 |
| Octyl Methoxycinnamate | 7.50 |
| PHOENOXOL T ¹ (Cetearyl Alcohol (and) Cetareth-20) | 4.00 |
| Phase C | |
| Triethanolamine (99%{ | 0.50 |
| Deionized Water | 3.00 |
| Phase D | |
| PECOGEL H-12 ¹ (VP/Polycarbamyl Polyglycol Ester) | 8.00 |
| Phase E | |
| MIKROKILL COS ³ (Phenoxyethanol & Caprylylglycol & Chlorphenesin) | 0.50 |

Procedure: Dissolve the glycol in the Phase A water. Disperse Carbomer in this solution. When dispersion is uniform, heat Phase A to 70-75°C with adequate agitation. Heat Phase B to 75-80°C with adequate agitation. Add Phase B to Phase A with adequate agitation. Cool AB to 50-55°C and add Phase C with adequate agitation. Add Phase D to ABC with adequate agitation. When ABCD reaches 45°C, add Phase E with adequate agitation. Continue agitation until 35°C is reached.

1 Phoenix Chemical, Incorporated; 2 Noveon; 3 Arch

MASCARA

| Phase A | |
|---|--------|
| PECOGEL H-12 (VP/Polycarbamyl Polyglycol Ester) ¹ | 20.00% |
| Polysorbate 80 | 2.50 |
| Propylene Glycol | 5.00 |
| Triethanolamine, 99% | 3.00 |
| Talc Lo Micron #1 | 4.00 |
| Black Iron Oxide | 3.00 |
| Deionized Water | 45.50 |
| Phase B | |
| Stearic Acid XXX | 5.50 |
| Carnauba Wax | 5.00 |
| Candelilla Wax | 6.00 |
| Preservative | 0.50 |

Procedure: Heat Phase A to 75°C with stirring. Mix until dissolved. Heat Phase B in separate vessel to 75°C. Mix until dissolved. Add Phase B to Phase A and mix to ambient temperature.

1 Phoenix Chemical, Incorporated