新开源制药
NKY PHARMA

TECHNOLOGY

# PolyViscol® & OraRez®

*Polymers for Cosmetics & Oral care*

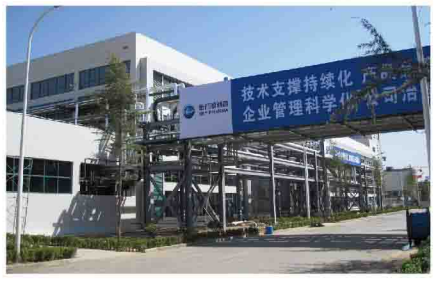
## Products Guide

博爱新开源制药股份有限公司
BOAI NKY PHARMACEUTICALS LTD.

# COMPANY INTRODUCTION

Boai NKY Pharmaceuticals Ltd (NKY, stock code: 300109) was the first domestic company to develop and manufacture polyvinylpyrrolidone (PVP) series products in China. With more than 27 year's experience in PVP production coupled to a dedicated commitment to quality improvement and management, NKY has become the largest Chinese producer of PVP's and third largest globally.

In April of 2013, construction of NKY's new plant with 138800 $m^2$ of land and 50000 $m^2$ of structure was completed, making it the production center for our PVP and PVM/MA polymer families. The new facilities include production capacity of: 12,000 tons/year GBL; 6,000 tons/year 2-pyrrolidone; 6,000 tons/year NVP; 2,500 tons/year PVM/MA copolymer; 2,000 tons/year MVE and 10,000 tons/year PVPs.



Our product offerings include: GBL, 2-P, NVP monomer, PVP K series, Copovidone, VP/VA copolymer series, PVPP, PVP-I complex, vinyl ether intermediate and PVM/MA copolymers. NKY is the only domestic company capable of manufacturing PVP K-12 (powder and liquid) and PVP K60, K-90 and K-120 powders.

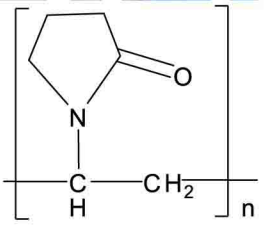
All pharmaceutical, cosmetic, food and oral care products are manufactured under strict cGMP guidelines in the new facilities, making it a model for China's excipient and food ingredients manufacture.


With the establishment of the R&D Center in Boai and the Technical Research Center in Tianjin, NKY is committed to R&D and the development of new products and technologies to bring new solutions and value to their customers. We are continuously striving to become the most trusted partner to our customers by providing materials that meet their quality requirements and enhance their finished product's performance.

The company continues to develop new technologies and capabilities to better serve its market as can be attested by the many company patents and distinctions. Recently, NKY has been awarded the distinction as National Torch Plan high-tech company, qualifying the company as a State-level high-tech enterprise. On a provincial level, our technical R&D center has been qualified as a Jiaozuo innovation center and our company as an environmentally responsible enterprise.

We provide high quality products for our customers in more than 60 countries world-wide.


| | |
|---|---|
| Trade Name: | PolyViscol® K |
| INCI/CTFA Name: | Polyvinylpyrrolidone |
| Description: | Homopolymer of Vinylpyrrolidone |
| Monomer unit molar mass: | 111.14g/mol |
| CAS-No. : | 9003-39-8 |




**Properties**:
Clear aqueous solutions obtained for all concentration levels; Polymers are non-ionic, neutralization not required; Capable of stabilizing suspensions, emulsions and dispersions; High compatibility with inorganic salts, many resins and other cosmetic raw ingredients; Resultant films have high capacity for water absorption.

**Specification**:

| Products | Appearance | Mv | K Value | Main applications |
|---|---|---|---|---|
| PolyViscol® K12 | Powder | 2500 | 10-15 | Solubilizer/dispersant for pigments in cosmetics |
| PolyViscol® K15 | Powder | 8000 | 13-18 | |
| PolyViscol® K17 | Powder | 10000 | 15-19 | |
| PolyViscol® K30 | Powder | 60000 | 27-32 | Hair sprays, hair gels, skin care creams |
| PolyViscol® K30L | 30% aqueous solution | 60000 | 27-32 | |
| PolyViscol® K60 | Powder | 380000 | 55-65 | Hair gels, facial masks |
| PolyViscol® K60L | 40% aqueous solution | 380000 | 55-65 | |
| PolyViscol® K85L | 20% aqueous solution | 950000 | 76-89 | |
| PolyViscol® K90 | Powder | 1300000 | 88-96 | Hair gels |
| PolyViscol® K90L | 20% aqueous solution | 1300000 | 90-100 | |
| PolyViscol® K120 | Powder | 3000000 | 105-130 | Strong hold hair gel |
| PolyViscol® K120L | 11% aqueous solution | 3000000 | 105-130 | |

**Applications**:
Film former and thickener for hair styling products, e.g. hair gels, mousses, pump sprays; Emulsion stabilizer in creams and lotions; Dispersant for hair colorants; Foam stabilizer; Destainer and gelling agent in toothpastes; Thickening agents for oral and optical preparations.

PolyViscol® K series products are used extensively in a wide range of applications in hair care, skin care and oral care products. The products are used in formulations where viscosity modification and film forming properties are required. PolyViscol® K series are particularly well suited for use in hair styling products; especially clear hydro or hydro-alcoholic formulations. Typical examples include the following applications.

• Hair gels; • Hair mousses; • Liquid hair setting preparations; • Pump sprays

Hair styling formulations containing 3-5% of PolyViscol® K30 result in medium hold products, while concentrations of 7-9% result in strong hold styling products (Figure 1).

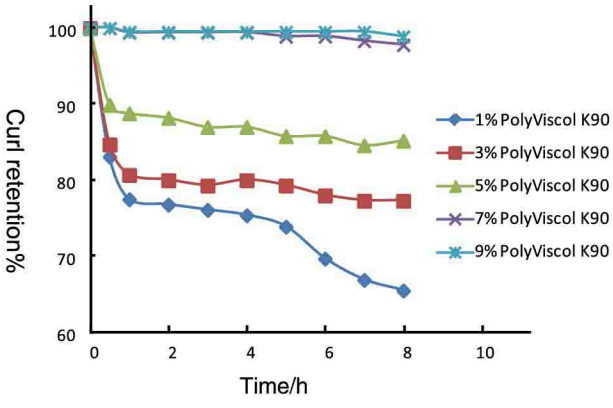



Figure 1: Curl retention comparison for varying concentrations of PolyViscol® K30 solutions at 30 °C and 60% RH.

Hair styling formulations containing 3% or more PolyViscol® K90 result in strong hold styling products (Figure 2). The use of PolyViscol® K90 also reduces the brittleness of the resultant hair styling film making the resultant film more durable.

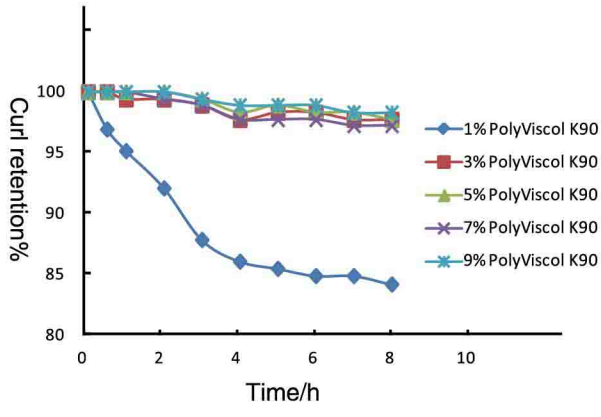



Figure 2: Curl retention comparison for varying concentrations of PolyViscol® K90 solutions at 30 °C and 60% RH.

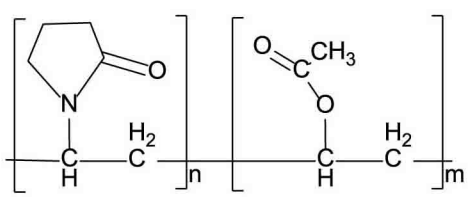
Classic hair styling gel containing PolyViscol® K90 & K30 No. H-AR-2010003

| | % | Ingredient | Supplier |
|---|---|---|---|
| A | 0.50 | Carbopol® 980 | Noveon |
| | 49.50 | Deionized water | |
| B | 0.40 | Aminomethyl propanol | |
| C | 10.00 | PolyViscol® K90L 20% aqueous solution | NKY |
| | 10.00 | PolyViscol® K30L 30% aqueous solution | NKY |
| | 0.10 | Disodium EDTA | |
| | q.s | Perfume | |
| | q.s | PEG-40-Hydrogenated Castor Oil | |
| | q.s | Preservative | |
| | 29.2 | Deionized water | |


# POLYMERS FOR COSMETICS

# PVP/VA

| | |
|---|---|
| Trade Name: | PolyViscol® VA |
| INCI/CTFA Name: | VP/ VA Copolymer |
| Chemical description: | Copolymer of Vinylpyrrolidone/Vinyl acetate |
| Monomer unit molar mass: | VP - 111.14g/mol VA - 86.09g/mol |
| CAS-No. : | 25086-89-9 |



**Properties**:

Aqueous solutions are non-ionic, neutralization not required; Resultant films are hard, glossy, and water-removable; Tunable viscosity, softening point and water sensitivity depending on VP/VA ratio; Good compatibility with many modifiers, plasticizers, spray propellants and other cosmetic ingredients.

**Specification**:

| Products | Appearance | K Value | Main applications |
|---|---|---|---|
| PolyViscol® VA64 | Powder | 26-34 | Water base hair gel, hair spray, strip-off facial mask |
| PolyViscol® VA64W | Aqueous solution | 26-34 | |
| PolyViscol® VA64E | Ethanol solution | 26-34 | Ethanol bases hair spray and mousse |
| PolyViscol® VA37E | Ethanol solution | 26-38 | |
| PolyViscol® VA73W | Aqueous solution | 26-34 | Hair gel, facial mask |
| PolyViscol® VA73E | Ethanol solution | 26-38 | Hair gel and mousse |
| PolyViscol® VA55E | Ethanol solution | 26-38 | Hair spray |

**Applications**:

Film-forming agents and fixatives in hair care products, e.g. hair styling sprays and pumps, hair gels, styling lotions and mousses. Film-forming agents in skin care products, e.g. facial masks.

PolyViscol® VA series copolymers are an excellent choice for film forming and hair-fixing agents. The incorporation level of vinyl acetate can adjust copolymer properties to give films having varying flexibility and water sensitivity. This tunable composition allows PolyViscol® VA copolymers to be used over a broad range of hair products including: hair sprays, gels, mousses and setting lotions.

Hair styling formulations containing more than 3% PolyViscol® VA64 result in strong hold styling products (Figure 3).

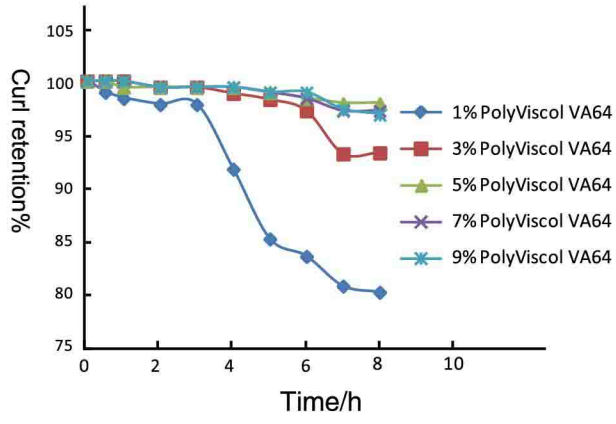



Figure 3: Curl retention comparison for varying concentrations of PolyViscol® VA64 solutions at 30 °C and 60% RH.

Increased incorporation levels of VA units in PolyViscol® VA copolymers has a significant effect of reducing the moisture uptake of resultant films (Figure 4). This results in an improvement of the high humidity curl retention and reduced tack for resultant hair styling products. The films containing higher levels of VA units also possess a more natural/soft feel on the hair. Increasing VA levels also increase the polymer's hydrocarbon compatibility for application in hair sprays using hydrocarbon propellants.

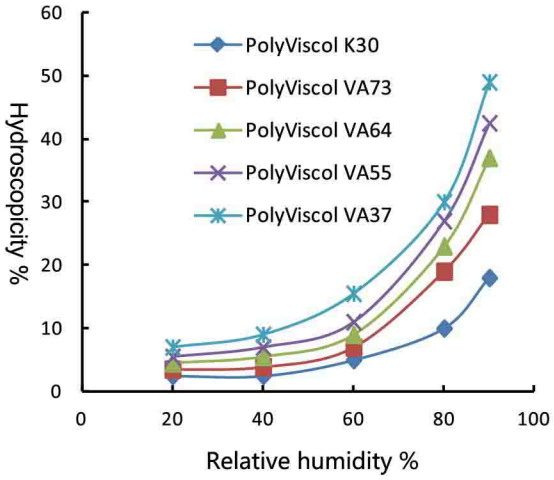



Figure 4: Water absorption at varying humidity levels for various PolyViscol® VA films and PolyViscol® K30 film at 25 °C.

Regular Hold Styling Gel with PolyViscol® VA64 No.H-AR-2010001

| | % | Ingredient | Supplier |
|---|---|---|---|
| A | 0.50 | Carbopol® 980 | Noveon |
| | 40.00 | Deionized water | |
| B | 0.70 | Triethanolamine | |
| C | 3.00 | PolyViscol® VA64 powder | NKY |
| | 0.10 | Disodium EDTA | |
| | q.s | Perfume | |
| | 1.50 | PEG-40-Hydrogenated Castor Oil | |
| | q.s | Preservative | |
| | 54.2 | Deionized water | |

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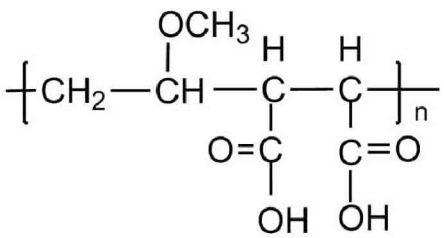
# POLYMERS FOR COSMETICS

# PVM/MA

Trade Name: OraRez® W
Chemical description: Free acid of the copolymer of methyl vinyl ether-co-maleic anhydride
CAS No. : 25153-40-6




**Properties**:
Soluble in water and alcohols; Excellent wet adhesive strength; Bioadhesive; Strong chelating/complexing properties; Solution and film properties adjustable via carboxylic acid neutralization/reaction.

**Specifications**:

| OraRez®W | 20P | 100P |
|---|---|---|
| Appearance | White to off-white powder | |
| PH (5% in aq. soln.) | 1.5-2.5 | 1.5-2.5 |
| Moisture%max | 6.0 | 6.0 |
| Specific viscosity SV (1% aq. soln.) | 0.4-1.5 | 4.0-10.0 |
| Heavy metals ppm max. | 10 | 10 |

**Application**:
**Oral Care**: OraRez® W serves as a mucosal/dental adhesive resin for toothpastes and mouth washes providing long-lasting tartar control in combination with fluoride and pyrophosphate. Enhanced mucosal retention and delivery of drugs and actives. Active solubilizer. Buccal adhesive.
**Skin Care**: Bioadhesives, moisturization, active delivery, hydrogels, film former, chelator.

## Oral Care:

OraRez® W forms protective films on teeth surfaces that resist erosion from saliva and acidic beverages. Dental tubes can be effectively protected to reduce dentinal hypersensitivity (Clin Oral Invest (2013) 17: 775-783).

The addition of OraRez® W to toothpaste and mouth wash products can increase the effectiveness of active retention in the oral cavity to make products more efficacious at reducing both plaque and tartar formation (J Clin Dent, 2010, 21 [Spec Iss] 93-123).

The strong complexing and film properties of OraRez® W is an important ingredient in oral formulations focused on reducing dental caries. A combination of OraRez® W/pyrophosphate/sodium fluoride is able to dissolve tartar seeds before they can grow into tartar crystals (US patent 4,183,914).

The excellent mucosal adhesive properties of OraRez® W makes it an excellent ingredient choice for buccal adhesive and mucosal delivery systems.

## Skin care:

OraRez® W when used in the combination with such ingredients as: glycerin, glyceryl acrylate/ acrylic acid copolymers, propylene glycol can be the basis for moisture enhancing formulations. Resultant systems show excellent lubricity and impart a silky after-feel to skin creams and lotions.

The bioadhesive properties of OraRez® W makes it an excellent choice for the development of bandage adhesives (skin friendly) and hydrogels for wound care and active delivery.

The unique polyelectrolyte structure and binding properties of OraRez® W makes it an excellent choice for developing new advances in biomedical and skin care formulations focused on: drug transport systems, enzyme mobilization, nucleic acid and protein binding and “smart” active delivery systems.

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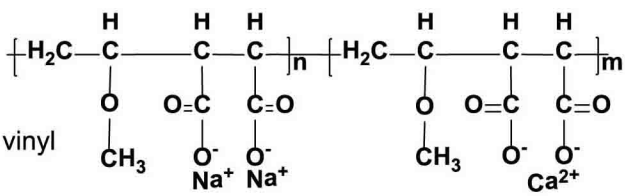
# POLYMERS FOR COSMETICS

# PVM/MA



Trade Name: OraRez® MS

Chemical description: Mixed calcium/sodium salt of methyl vinyl ether-co-maleic acid copolymer

CAS-No. : 62386-95-2

**Properties**:

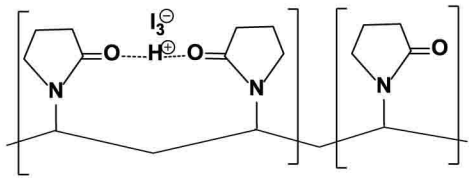
Water soluble polymer; Excellent wet adhesive strength; Strong cohesive forces due to calcium bridges; Excellent mucosal adhesive; Highly viscous aqueous solutions; Low toxicity.

**Specification:**

| OraRez® MS | Specification |
|---|---|
| Appearance | Free flowing white or off-white powder |
| pH(1% in water solution) | 6.0~7.0 |
| Moisture (%max) | 10 |
| Calcium (%) | 11~16 |
| Tap density (g/cm3) | ≥ 0.5 |
| Total bacteria count (CFU/g) | ≤ 500 |
| Yeast/mold (CFU/g) | ≤ 200 |
| E.coli (CFU/g) | Negative |
| Staphylococcus aureus (CFU/g) | Negative |
| Salmonella (CFU/g) | Negative |

**Application**:

OraRez® MS is an outstanding oral mucosal adhesive suitable for denture adhesive formulations. The ionic bridges inside the OraRez® MS molecule results in both adhesive and cohesive adhesion to generate long lasting and durable oral denture adhesive systems. OraRez® MS acts as an adhesive cushion between the denture and gums to strongly adhere the denture to the gums and reduce the likelihood for irritation due to a loose fitting denture. The use of OraRez® MS based denture adhesives is an essential component for obtaining natural and comfortable feeling dentures.



Trade Name: KoVidone® -I
INCI/CTFA Name: PVP-Iodine
Chemical description: Complex of Polyvinylpyrrolidone with Iodine
Synonyms: PVP-Iodine, Povidone Iodine, Povidone Iodinated, Polyvinylpyrrolidone-iodine complex, PVP-I
CAS-No. : 25655-41-8
Pharmacopeia Monographs: Conforms to current USP/NF, Ph. Eur.

**Properties**:
Broad spectrum biocide; Water soluble, also soluble in: ethyl alcohol, isopropyl alcohol, glycols, glycerin, acetone, polyethylene glycol; Film-forming; Stable complex; Less irritating to skin and mucosa; Non-selective germicidal action; No tendency for generating bacterial resistance.

**Specification**:

| KoVidone®-I | CP2010 | USP36 | EP7.5 |
|---|---|---|---|
| Appearance | Free-flowing, reddish-brown powder | | |
| Available Iodine (%) | 9.0-12.0 | 9.0-12.0 | 9.0-12.0 |
| Iodine (% maximum) | 6.6 | 6.6 | 6 |
| Heavy Metals (ppm maximum) | 20 | 20 | -- |
| Ash (% maximum) | 0.1 | 0.025 | 0.1 |
| Nitrogen Content (%) | 9.5-11.5 | 9.5-11.5 | -- |
| pH Value (10% aqueous soln.) | - | -- | 1.5-5.0 |
| Loss on Drying (% maximum) | 8 | 8 | 8 |

**Applications:**
Disinfectant mouth rinses; Antiseptic skin cleansers and surgical scrubs; Pre and post operative antiseptic skin cleansers; Antiseptic powders and ointments for treatment of minor cuts and abrasions; Anti-dandruff shampoos; Control of skin infections and ulcers; Antiseptic vaginal gels, suppositories and douches; Broad antiseptic veterinarian applications such as: teat dips, prevention of local infections and surgical preparations; Treatment of bacterial and fungal infections in fish breeding farms and minimizing infection of fish eggs; Disinfecting wipes for equipment and apparatus treatment.

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# POLYMERS FOR COSMETICS

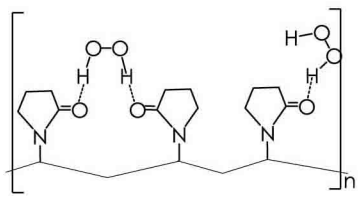
Trade Name: WhiVidone®

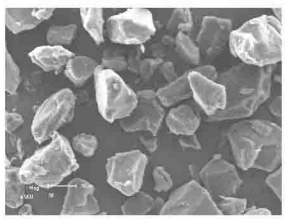
Chemical description: Vinylpyrrolidone polymer complex with hydrogen peroxide, PVP/$H_2O_2$ Complexes;
WhiVidone® 30: complex of KoVidone® K30 & $H_2O_2$
WhiVidone® 90: complex of KoVidone® K90 & $H_2O_2$
WhiVidone® XL: complex of PolyKoVidone® XL & $H_2O_2$

CAS NO.: 9003-39-8, 7722-84-1

**Properties**:

Polymer complexes retain most of the properties of the parent KoVidone® polymers; Safe and stable form of hydrogen peroxide; Films rapidly release hydrogen peroxide on contact with water or saliva; Can be easily formulated as gels, liquids, tablets and films without taste or odor.





**Specification**:

| WhiVidone ® | 30 | 90 | XL |
|---|---|---|---|
| Appearance @ 25°C | Free-flowing white powder | | |
| Identification | Conforms to standard | | |
| Hydrogen peroxide (weight %) | 17.0-20.0 | 16.0-20.0 | 16.0-20.0 |
| Moisture (calculated as % total volatiles - % hydrogen peroxide) % max | 5 | 7 | 5 |
| Nitrogen content (%) | 8--12 | 8--12 | 7--12 |
| Heavy metals (includes only As, Hg & Pb, AES-ICP) ppm max | 10 | 10 | 10 |

**Application**:

Tooth whitening/bleaching; Stain removal/bleaching agents for denture cleanser tablets; Contact lens cleaners; Wart treatment; Canker sore treatments; Topical antiseptics: Wound cleaners; Ear wax removers.

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