CONTIPRO

SPECIALITY HYALURONAN CHEMICALS

product catalog

specialities@contipro.com
www.contipro.com

SPECIALITY HYALURONAN CHEMICALS

Contipro has been involved in Hyaluronan research for almost 30 years. Many hyaluronan derivatives and other specialities have been developed in our laboratories. The various chemicals in this catalogue are designed for scientists around the world to support their research and development.

Contipro is based in Central Europe and is the leading producer of Ultra pure Sodium Hyaluronate, exporting all over the globe. Larger quantities of the listed chemicals can be manufactured according to the customers needs.

Please contact us at *specialities@contipro.com*

For more information please find us at:
www.contipro.com

2019

List of products

Product	Range	Quantity	Price from	Page
SODIUM HYALURONATE WITH NARROW MOLAR MASS DISTRIBUTION				
Sodium hyaluronate with NMMD	5–20 kDa	100 mg	€ 1 520	40
Sodium hyaluronate with NMMD	20–30 kDa	100 mg	€ 1 520	40
Sodium hyaluronate with NMMD	30–40 kDa	100 mg	€ 1 520	40
Sodium hyaluronate with NMMD	40–60 kDa	100 mg	€ 1 750	40
Sodium hyaluronate with NMMD	60–80 kDa	100 mg	€ 1 750	40
Sodium hyaluronate with NMMD	80–100 kDa	100 mg	€ 1 750	40
Sodium hyaluronate with NMMD	100–120kDa	50 mg	€ 1 520	40
Sodium hyaluronate with NMMD	120–140kDa	50 mg	€ 1 520	40
Sodium hyaluronate with NMMD	140–160kDa	50 mg	€ 1 750	40
Sodium hyaluronate with NMMD	160–350Da	50 mg	€ 1 750	40
SET - Sodium hyaluronate with NMMD	5–110 kDa	220 mg	€ 1 950	40
SET - Sodium hyaluronate with NMMD	90–360 kDa	65 mg	€ 1 980	40
SODIUM HYALURONATE – LABORATORY				
Sodium hyaluronate - laboratory	8–15 kDa	1 g	€ 145	42
Sodium hyaluronate - laboratory	15–30 kDa	1 g	€ 145	42
Sodium hyaluronate - laboratory	30–50 kDa	1 g	€ 145	42
Sodium hyaluronate - laboratory	50–90 kDa	1 g	€ 145	42
Sodium hyaluronate - laboratory	90–130 kDa	1 g	€ 145	42
Sodium hyaluronate - laboratory	130–300 kDa	1 g	€ 145	42
Sodium hyaluronate - laboratory	300–500 kDa	1 g	€ 145	42
Sodium hyaluronate - laboratory	500–750 kDa	1 g	€ 145	42
Sodium hyaluronate - laboratory	750–1000 kDa	1 g	€ 145	42
Sodium hyaluronate - laboratory	1000–1250 kDa	1 g	€ 145	42
Sodium hyaluronate - laboratory	1250–1500 kDa	1 g	€ 145	42
Sodium hyaluronate - laboratory	1500–1750 kDa	1 g	€ 145	42
Sodium hyaluronate - laboratory	1750–2000 kDa	1 g	€ 145	42
Sodium hyaluronate - laboratory	2000–2200 kDa	1 g	€ 145	42
Sodium hyaluronate - laboratory	2200–2400 kDa	1 g	€ 145	42
SODIUM HYALURONATE - TECHNICAL				
Sodium hyaluronate - technical	8–15 kDa	1 g	€ 40	44
Sodium hyaluronate - technical	15–30 kDa	1 g	€ 40	44
Sodium hyaluronate - technical	30–50 kDa	1 g	€ 40	44
Sodium hyaluronate - technical	50–90 kDa	1 g	€ 40	44
Sodium hyaluronate - technical	90–130 kDa	1 g	€ 40	44
Sodium hyaluronate - technical	130–300 kDa	1 g	€ 40	44
Sodium hyaluronate - technical	300–500 kDa	1 g	€ 40	44
Sodium hyaluronate - technical	500–750 kDa	1 g	€ 40	44
Sodium hyaluronate - technical	750–1000 kDa	1 g	€ 40	44
Sodium hyaluronate - technical	1000–1250 kDa	1 g	€ 40	44
Sodium hyaluronate - technical	1250–1500 kDa	1 g	€ 40	44
Sodium hyaluronate - technical	1500–1750 kDa	1 g	€ 40	44
Sodium hyaluronate - technical	1750–2000 kDa	1 g	€ 40	44
Sodium hyaluronate - technical	2000–2200 kDa	1 g	€ 40	44
Sodium hyaluronate - technical	2200–2400 kDa	1 g	€ 40	44

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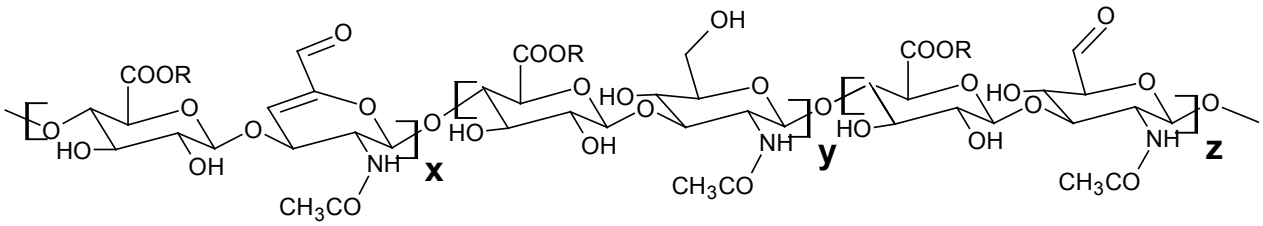
Sodium anhydroformyl hyaluronate

Synonyms:

Sodium 4,5-anhydro-6-oxo hyaluronate
Sodium 4,5(GlcNAc)-anhydro-6(GlcNAc)-oxo hyaluronate

Structural formula:



R = Na, H

Source:

Sodium anhydroformyl hyaluronate is chemically modified sodium hyaluronate (SH). Modification was achieved by oxidation and dehydration processes.

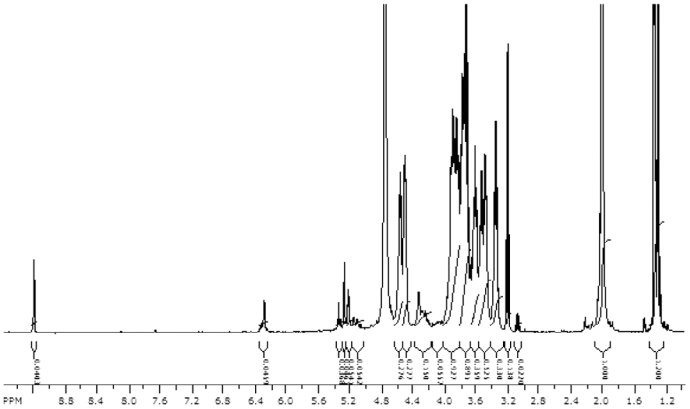
Identification:

Product characterized by NMR and by carbazole analysis of sodium hyaluronate.

Solubility:

Soluble in water, forms clear solution (up to 5.0 g/100 ml water for lower molecular weight material; a lower concentration for higher MW material). Soluble in alcohol-water mixture up to a concentration of 50% (v/v). Insoluble in aprotic solvents..

^{1}H NMR spectrum:



Benefits and possible use:

- Maintains cell viability
- Suitable for:
  - cross-linking [1-2]
  - the attachment of primary amino groups
  - the preparation of carriers for biologically active substances [1-2]

Specification:

Appearance	White to slightly yellow powder or granules	
pH	6.0–8.0	1% (w/v) aqueous solution, 25 °C
Dry matter	> 85%	
Degree of substitution (formyl)	3–8%	NMR
Degree of substitution (anhydroformyl)	2–5%	NMR
Molecular weight (kDa)	50–200	SEC-MALLS

Storage:

Store in the originally sealed packaging. If not used immediately after opening, avoid high humidity and UV light exposure. Store refrigerated (2-8 °C). Temperatures up to 40 °C during transport (short term only) do not affect the product.

Shelf-life:

This material is supplied with a minimum remaining shelf-life of 6 months.

Packaging:

Glass vial. 100 milligrams.

Price:

EUR 160/100 mg

Patents:

PCT/CZ2013/000091

References:

1. Bhakta, G., Rai, B., Lim, Z.X.H., Hui, J.H., Stein, G.S., van Wijnen, A.J., Nurcombe, V., (...), Cool, S.M, Biomaterials 33 (26), 2012, 6113-6122
2. Martínez-Sanz E.,Ossipov D.A., Hilborn J., Larsson S., Jonsson K.B., Varghese O. P. Journal of Controlled Release, 2011, 152 (2): 232–240Nicola Volpi. On-Line HPLC/ESI-MS Separation and Characterization of Hyaluronan Oligosaccharides from 2-mers to 40-mers. Anal. Chem. 2007; 79: 6390-6397.
3. Buffa R., Odstrčilová L., Šedová P., Basarabová I., Novotný J., Velebný V. Carbohydrate Polymers 2018, 189: 273-279.

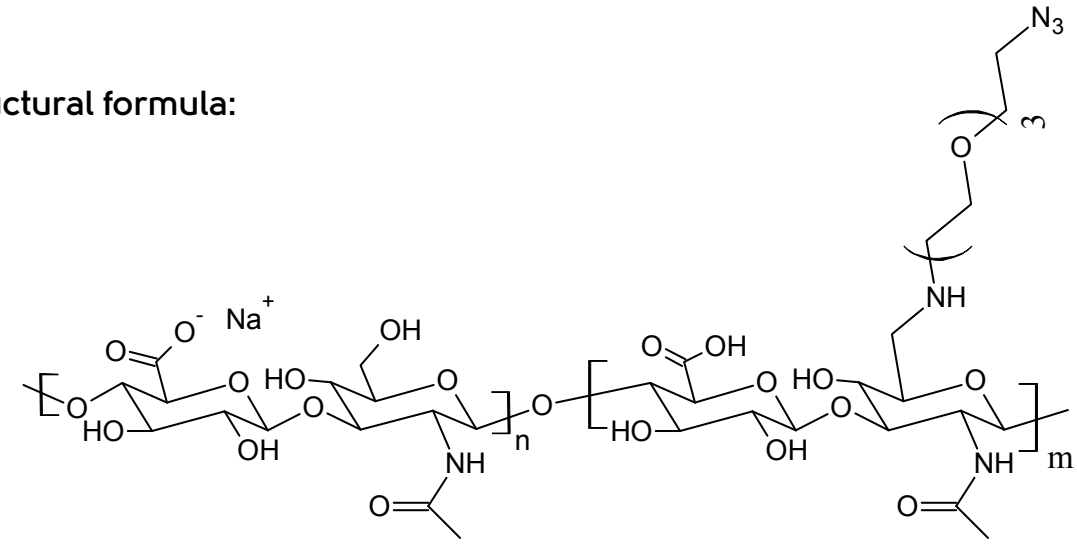
Notice:

Sodium azidyl hyaluronate

Synonyms:

Sodium azido-3,6,9-trioxaundecan-1-ylamino hyaluronate
6(GlcNAc)-(11-azido-3,6,9-trioxaundecan-1-ylamino) hyaluronate

Structural formula:



Source:

Product obtained by reductive alkylation using Sodium formyl hyaluronate as a substrate.

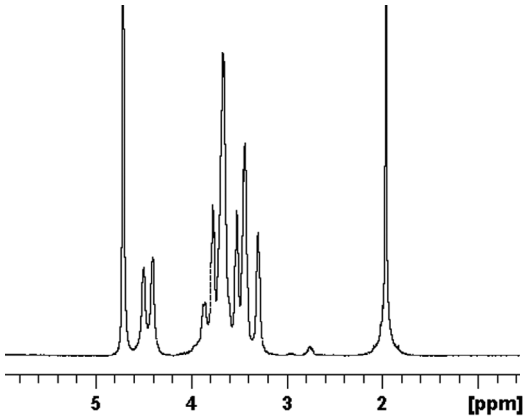
Identification:

Product characterized by NMR and by carbazole analysis of sodium hyaluronate (SH).

Solubility:

Soluble in water and forms a clear solution (up to 2.0 g/100 ml water for low molecular weight (MW) material; a lower concentration for high MW material).

^{1}H NMR spectrum:



Benefits and possible use:

- Suitable for cross-linking [1-2]
- Products of cross-linking via click-chemistry are suitable for cell or growth factor delivery
- Attachment of substrates carrying terminal alkyne groups via click chemistry [3-4]

Specification:

This material can be supplied with tailor-made MW according to the customer´s requirements, within a range of 50 to 600 kDa. Below is the most common range used.

Sodium azidyl hyaluronate (300–600 kDa)		
Appearance	white powder or granules	
pH	5.0–8.0	0.5% aqueous solution
Dry matter	> 85%	
Degree of substitution	5–15%	NMR
Molecular weight (kDa)	300–600	SEC-MALLS

Storage:

Store in originally sealed packaging. If not used immediately after opening, avoid high humidity and UV light exposure. Store refrigerated (2-8 °C). Temperatures up to 40 °C during transport (short term only) do not affect the product.

Shelf-life:

This material is supplied with a minimum remaining shelf-life of 6 months.

Packaging:

Glass vial. 1 gram.

Price:

EUR 380/1 g

Patents:

World patent WO 2012/146218

References:

1. Huerta-Angeles G, Němcová M, Přikopová E, Šmejkalová D, Pravda M, Kučera L, and Velebný V. Carbohydrate Polymers; 2012, 90(4):1704-1711.
2. Xiaohong H., Dan l., Feng Z., Gao C., Acta Biomater., 2011, 7(4): 1618-1626.
3. Hasegawa T., Mariko U., Munenori N., Chun L., Ah-Hyun B, Fujisawa T., Haraguchi S., Sakurai K., Shinkai S., Carbohydrate research, 2006, 341(1): 35-40.
4. K. Such G., Angus P.R., Johnston, Kang L.,, Caruso F., Progress in Polymer Science, 2012, 37(7): 985-1003.

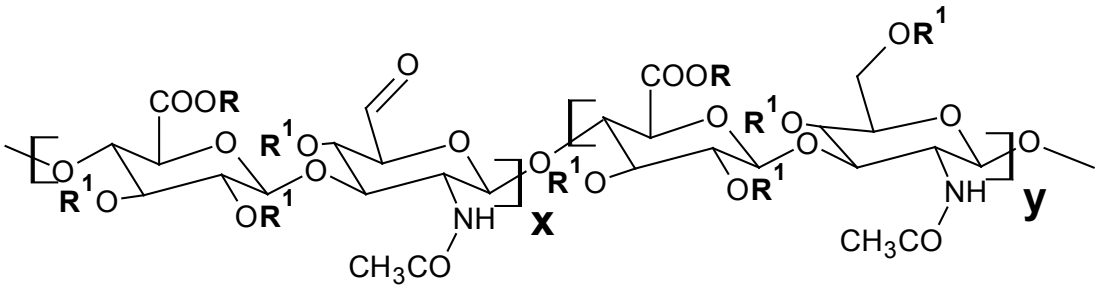
Notice:

Sodium butanoyl formyl hyaluronate

Synonyms:

Sodium butanoyl-6-oxo hyaluronate
Sodium O-butanoyl-6(GlcNAc)-oxo hyaluronate

Structural formula:



R = Na, H
R^1 = H, CO-$(CH_2)_2$-CH_3

Source:

Sodium butanoyl formyl hyaluronate is produced by chemical modification of native sodium hyaluronate (SH).

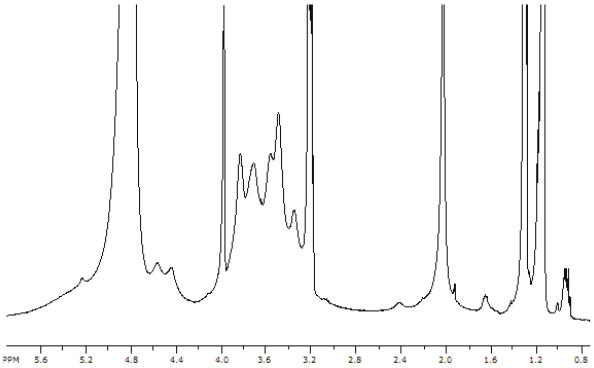
Identification:

Product characterized by NMR.

Solubility:

Solubility depends on the degree of substitution of butanoyl (DS) and molecular weight (MW) of the material.

^{1}H NMR spectrum:



Benefits and possible use:

- The unique structure of the product is able to dissolve less polar components in water [1]
- Suitable for:
  - the fabrication of biocompatible drug delivery systems [2-4]
  - covalent attachment of various amino compounds [4]
  - nanofiber- or microfiber-based membranes or scaffolds
- Cross-linking and encapsulation of various active ingredients

Specification:

Appearance	White powder or granules	
pH	5.0–8.0	1% (w/v) aqueous solution, 25 °C
Dry matter	> 85%	
Degree of substitution	10–50%	NMR (butanoyl)
Degree of substitution	4–12%	NMR (formyl)
Molecular weight (kDa)	20–350	SEC-MALLS

Storage:

Store in originally sealed packaging. If not used immediately after opening, avoid high humidity and UV light exposure. Store refrigerated (2-8 °C). Temperatures up to 40 °C during transport (short term only) do not affect the product.

Shelf-life:

This material is supplied with a minimum remaining shelf-life of 6 months.

Packaging:

Glass vial. 1 gram.

Price:

EUR 530/1 g

Patents:

World Patents WO 2010/105582, WO 2011/069475

References:

1. Šmejkalová, D., Hermannová, M., Šulaková, R., Průšová, A., Kučerik, J., & Velebný, V. Carbohydrate Polymers, 2012, 87(2), 1460-1466.
2. Gong J, Chen M, Zheng Y, Wang S, Wang Y. Journal of Controlled Release, 2012, 159(3): 312-323.
3. Kedar U, Phutane P, Shidhaye S, Kadam V. Nanomedicine: Nanotechnology, Biology and Medicine, 2010, 6(6): 714-729.
4. Šedová P., Buffa R., at all, Carbohydrate Research, 371, 2013, 8-15.

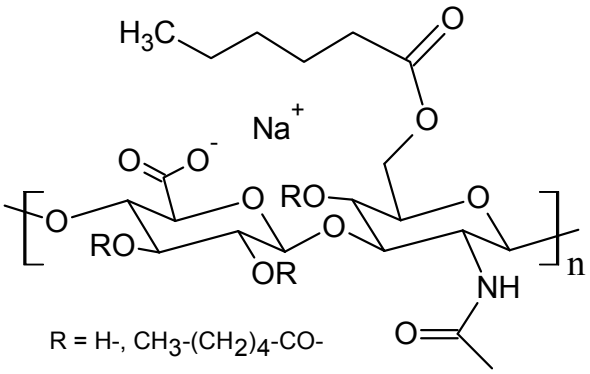
Notice:

Sodium caproyl hyaluronate

Synonyms:

Sodium hexanoyl hyaluronate
Sodium O-hexanoyl hyaluronate

Structural formula:



Source:

Sodium caproyl hyaluronate is produced by chemical modification of native sodium hyaluronate (SH).

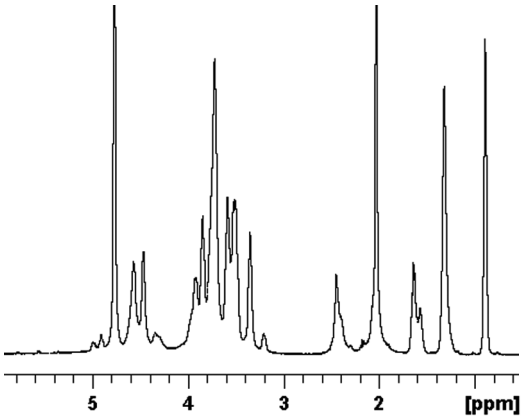
Identification:

Product characterized by NMR.

Solubility:

Solubility depends on the degree of substitution (DS) and molecular weight (MW) of the material.
DS 5-15% - completely water soluble material (up to 10% w/v for a lower MW material a lower concentration for higher MW material)
DS 15-40% - partially water soluble material
DS 40-70% - water insoluble material (for higher MW)

^{1}H NMR spectrum:



Benefits and possible use:

- The unique structure of the product is able to self-assemble and form cavities that can dissolve hydrophobic components in water [1]
- Suitable for:
  - the fabrication of drug delivery systems [2-3]
  - membranes for post-surgical adhesion prevention (minimal adhesion of cells to the derivative)
  - nanofiber- or microfiber-based membranes or scaffolds

Specification:

Sodium caproyl hyaluronate (150–350 kDa)		
Appearance	White powder or granules	
pH	5.0–8.0	0.5% aqueous solution
Dry matter	> 85%	
Degree of substitution	50–80%	NMR
Molecular weight (kDa)	150–350	SEC-MALLS

Storage:

Store in originally sealed packaging. If not used immediately after opening, avoid high humidity and UV light exposure. Store refrigerated (2-8 °C). Temperatures up to 40 °C during transport (short term only) do not affect the product.

Shelf-life:

This material is supplied with a minimum remaining shelf-life of 6 months.

Packaging:

Glass vial. 1 gram.

Price:

EUR 180/1 g

Patents:

Patent application PV 2012-842

References:

1. Šmejkalová, D., Hermannová, M., Šulaková, R., Průšová, A., Kučerik, J., & Velebný, V. Carbohydrate Polymers, 2012, 87(2), 1460-1466.
2. Gong J, Chen M, Zheng Y, Wang S, Wang Y. Journal of Controlled Release, 2012, 159(3): 312-323.
3. Kedar U, Phutane P, Shidhaye S, Kadam V. Nanomedicine: Nanotechnology, Biology and Medicine, 2010, 6(6): 714-729.

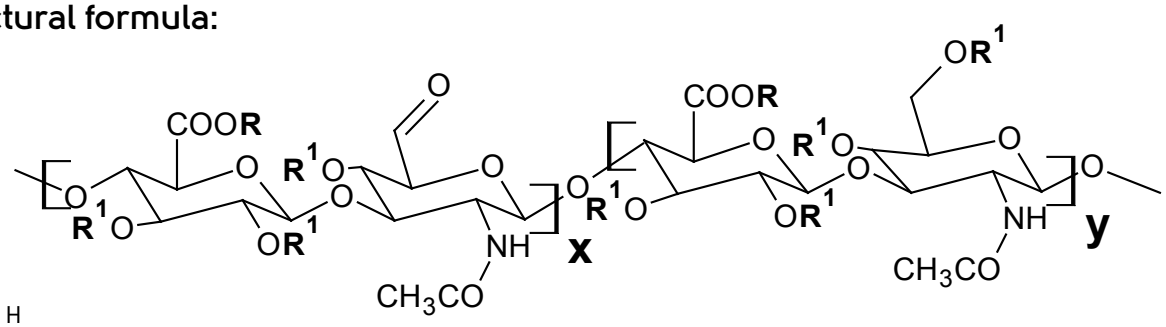
Notice:

Sodium caproyl formyl hyaluronate

Synonyms:

Sodium caproyl-6-oxo hyaluronate
Sodium O-hexanoyl-6(GlcNAc)-oxo hyaluronate

Structural formula:



R = Na, H
R1 = H, CO-$(CH_2)_4$-CH_3

Source:

Sodium caproyl formyl hyaluronate is produced by chemical modification of native sodium hyaluronate (SH).

Identification:

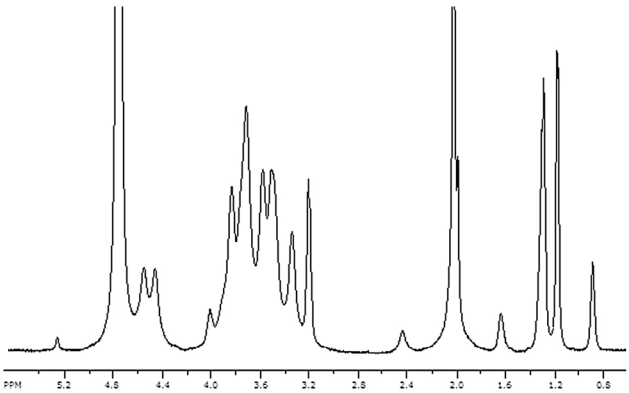
Product characterized by NMR.

Solubility:

Solubility depends on the degree of substitution (DS) and molecular weight (MW) of the material.

DS 5-15% - completely water soluble material (up to 10% w/v for a lower MW material a lower concentration for higher MW material)
DS 15-40% - partially water soluble material
DS 40-70% - water insoluble material (for higher MW)

^{1}H NMR spectrum:



Benefits and possible use:

- The unique structure of the product is able to self-assemble and form cavities that can dissolve hydrophobic components in water [1]
- Suitable for:
  - the fabrication of drug delivery systems [2-3]
  - membranes for post-surgical adhesion prevention (minimal adhesion of cells to the derivative)
  - nanofiber-or microfiber-based membranes or scaffolds
- Cross-linking and encapsulation of various polar or nonpolar active ingredients

Specification:

This material can be supplied with tailor-made MW according to the customer´s requirements, within a range of 10 to 300 kDa. Below is the most common range used.

Sodium caproyl formyl hyaluronate (50–200 kDa)		
Appearance	White powder or granules	
pH	5.0–8.0	1% (w/v) aqueous solution, 25 °C
Dry matter	> 85%	
Degree of substitution	20–50%	NMR (caproyl)
Degree of substitution	4–12%	NMR (formyl)
Molecular weight (kDa)	50–200	SEC-MALLS

Storage:

Store in originally sealed packaging. If not used immediately after opening, avoid high humidity and UV light exposure. Store refrigerated (2-8 °C). Temperatures up to 40 °C during transport (short term only) do not affect the product.

Shelf-life:

This material is supplied with a minimum remaining shelf-life of 6 months.

Packaging:

Glass vial. 1 gram.

Price:

EUR 260/1 g

References:

1. Šmejkalová, D., Hermannová, M., Šulaková, R., Průšová, A., Kučerik, J., & Velebný, V. Carbohydrate Polymers, 2012, 87(2), 1460-1466.
2. Gong J, Chen M, Zheng Y, Wang S, Wang Y. Journal of Controlled Release, 2012, 159(3): 312-323.
3. Kedar U, Phutane P, Shidhaye S, Kadam V. Nanomedicine: Nanotechnology, Biology and Medicine, 2010, 6(6): 714-729.
4. Šedová P., Buffa R., at all , Carbohydrate Research,.371, 2013, 8-15.

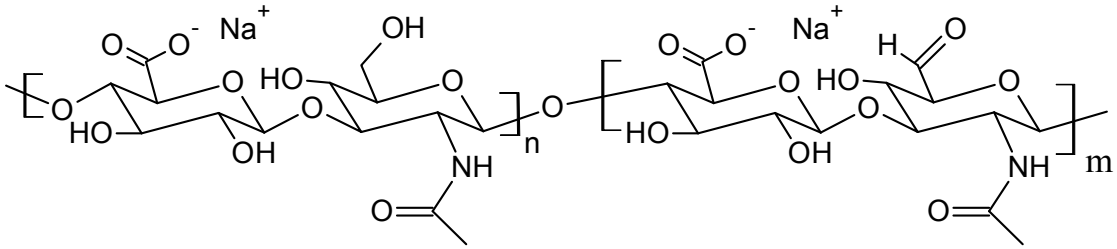
Notice:

Sodium formyl hyaluronate

Synonyms:

Sodium oxo-hyaluronate
Sodium 6(GlcNAc)-oxo hyaluronate
Formyl hyaluronate

Structural formula:



Source:

Sodium formyl hyaluronate is chemically modified sodium hyaluronate (SH). Modification was achieved by oxidation process.

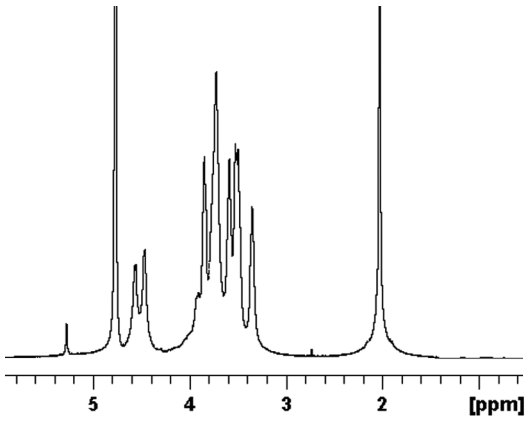
Identification:

Product characterized by NMR and by carbazole analysis of sodium hyaluronate.

Solubility:

Soluble in water, forms a clear solution (up to 5.0 g/100 ml water for lower molecular weight (MW) material; a lower concentration for higher MW material). Soluble in alcohol-water mixture up to a concentration of 50% (v/v). Insoluble in aprotic solvents.

^{1}H NMR spectrum:



Benefits and possible use:

- Suitable for:
  - cross-linking [1-2]
  - the attachment of primary amino groups
  - the preparation of carriers for biologically active substances [3-5]

Specification:

This material can be supplied with tailor-made MW according to the customer´s requirements, within a range of 50 to 1050 kDa. Below are the most common ranges used.

Sodium formyl hyaluronate (50–100 kDa)		
Appearance	White to slightly yellow powder or granules	
pH	5.0–8.0	0.5% aqueous solution
Dry matter	> 85%	
Degree of substitution	4–12%	NMR
Molecular weight (kDa)	50–100	SEC-MALLS

Sodium formyl hyaluronate (300-500 kDa)		
Appearance	White to slightly yellow powder or granules	
pH	5.0–8.0	0.5% aqueous solution
Dry matter	> 85%	
Degree of substitution	4–12%	NMR
Molecular weight (kDa)	300–500	SEC-MALLS

Sodium formyl hyaluronate (420-630 kDa)		
Appearance	White to slightly yellow powder or granules	
pH	5.0–8.0	0.5% aqueous solution
Dry matter	> 85%	
Degree of substitution	4–12%	NMR
Molecular weight (kDa)	420–630	SEC-MALLS

Sodium formyl hyaluronate (750-1050 kDa)		
Appearance	White to slightly yellow powder or granules	
pH	5.0–8.0	0.5% aqueous solution
Dry matter	> 85%	
Degree of substitution	3–8%	NMR
Molecular weight (kDa)	750–1050	SEC-MALLS

Storage:

Store in originally sealed packaging in a dry place, at the recommended temperature of 2–8 °C, protected from direct sunlight. If not used immediately after opening, avoid high humidity and UV light exposure. Store refrigerated (2–8 °C). Temperatures up to 40 °C during transport (short term only) do not affect the product.

Shelf-life:

This material is supplied with a minimum remaining shelf-life of 1 year.

Packaging: Glass vial. 1 gram.

Price:

50-100 kDa - EUR 200/1 g
300-500 kDa - EUR 230/1 g
420-630 kDa - EUR 230/1 g
750-1050 kDa - EUR 230/1 g

Patents:

World Patent WO 2011/069475A2

References:

1. Su W.Y.,Chen Y. C., Lin F.H., Acta Biomaterialia, 2010, 6(8): 3044-3055.
2. Nair S., Remya N.S., Remya S., Nair P. D., Carbohydrate Polymers, 2011, 85(4): 838-844. Šedova P., Buffa R., Kettou S., Huerta-Angeles G., Hermannova M., Leierova V., Šmejkalová D., Moravcova M. & Velebný V. (2013). Preparation of hyaluronan polyaldehyde - a precursor of biopolymer conjugates. Carbohydrate Research, 371, 8–15.
3. Ekici S., Ilgin P., Butun S., Sahine N. Carbohydrate Polymers, 2011, 84(4): 1306-1313
4. Bhakta, G., Rai, B., Lim, Z.X.H., Hui, J.H., Stein, G.S., van Wijnen, A.J., Nurcombe, V., (...), Cool, S.M, Biomaterials 33 (26), 2012, 6113-6122
5. Martínez-Sanz E.,Ossipov D.A., Hilborn J., Larsson S., Jonsson K.B., Varghese O. P. Journal of Controlled Release, 2011, 152 (2): 232–240
6. Šedova P., Buffa R., at all, Carbohydrate Research, 371, 2013, 8-15
7. Buffa, R., Kettou, S., Pospišilova L., Huerta-Angeles, G., Chladkova D., & Velebny, V. (2011). A method of preparation of an oxidized derivative of hyaluronic acid and a method of modification thereof (WO/2011/069475).

Notice:

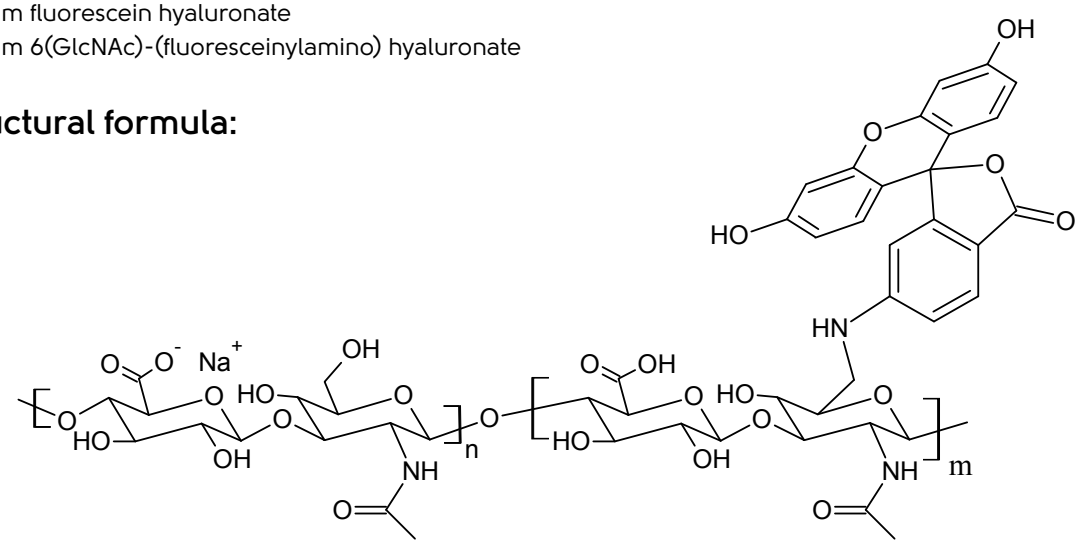
This product is intended primarily for R&D purposes and is not to be used for any other purposes, including but not limited to in vitro diagnostic purposes, foods, drugs, medical devices or cosmetics for humans or animals, or for commercial purposes.

Sodium fluoresceinylamino hyaluronate

Synonyms:

Fluorescein hyaluronic acid
Sodium fluorescein hyaluronate
Sodium 6(GlcNAc)-(fluoresceinylamino) hyaluronate

Structural formula:



Source:

Sodium fluoresceinylamino hyaluronate is chemically modified sodium hyaluronate (SH). Modification was achieved by reductive amination using Sodium formyl hyaluronate.

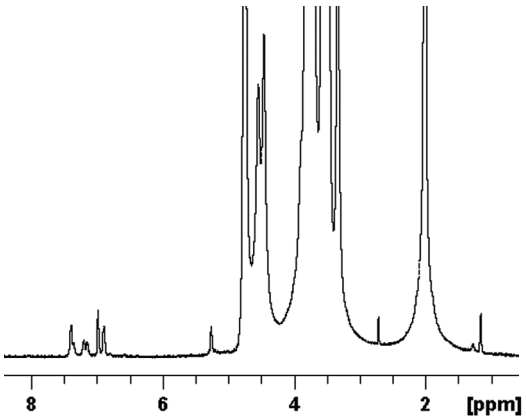
Identification:

Product characterized by NMR and by carbazole analysis of SH.

Solubility:

Soluble in water, forms a clear solution (up to 4.0 g/100 ml water for lower molecular weight (MW) material; a lower concentration for higher MW material). Soluble in alcohol-water mixture up to a concentration of 50% (v/v). Insoluble in aprotic solvents.

^{1}H NMR spectrum:



Benefits and possible use:

- Suitable for:
  - lifetime-sensing of hyaluronidase activity [1-2]
  - imaging and mapping of hyaluronan interaction with CD-44 receptor [3]
  - studying hyaluronan and its derivatives interactions with cancer cells [4]
  - identification of hyaluronic acid binding proteins [5]

Specification:

This material can be supplied with tailor-made MW according to the customer´s requirements, within a range of 30 to 200 kDa. Below is the most common range used.

Sodium fluoresceinylamino hyaluronate (30–200 kDa)		
Appearance	purple powder or granules	
pH	6.0–7.5	1% (w/v) aqueous solution, 25 °C
Dry matter	> 85%	
Degree of substitution	1–5%	NMR
Molecular weight (kDa)	30–200	SEC-MALLS

Storage:

Store in originally sealed packaging. If not used immediately after opening, avoid high humidity and light exposure. Store refrigerated (2-8 °C). Temperatures up to 40 °C during transport (short term only) do not affect the product.

Shelf-life:

This material is supplied with a minimum remaining shelf-life of 6 months.

Packaging:

Glass vial. 100 milligrams.

Price:

EUR 235/100 mg

References:

1. Fudala R, Mummert ME, Gryczynski Z, Rich R, Borejdo J, Gryczynski I., J Photochem Photobiol B. 2012 ;106:69-73.
2. Zhang LS, Mummert ME. Anal Biochem. 2008;379(1):80-5.
3. Harada H, Nakata T, Hirota-takahata Y, Tanaka I., Nakajima M., Takahashi M., The Journal of Antibiotics (2006) 59, 770–776
4. Dickinson, L. E., Gerecht, S., J. Vis. Exp. (46), e2413
5. Yokoo M., Miyahayashi Y., Naganuma T., Kimura N, Sasada H, Sato E., Biol Reprod. 2002 67 (4) 1165-1171.

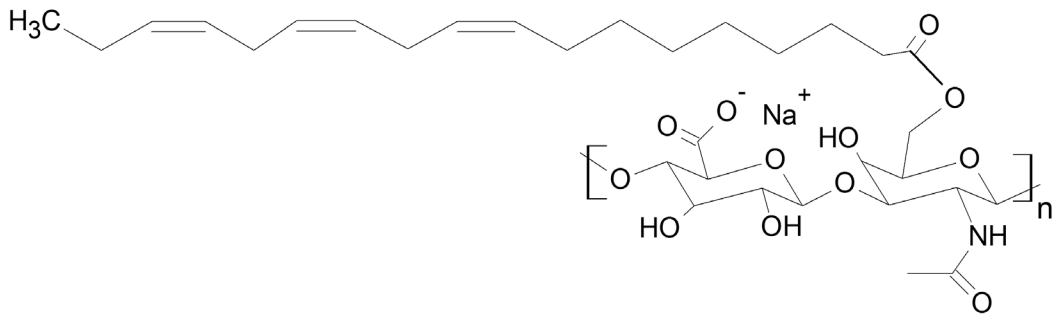
Notice:

Sodium linolenoyl hyaluronate

Synonyms:

HA-linolenic acid

Structural formula:



Source:

Product is classified as a semi-synthetic polymer wherein linolenic acid is chemically attached to sodium hyaluronate by a patented esterification methodology. [1]

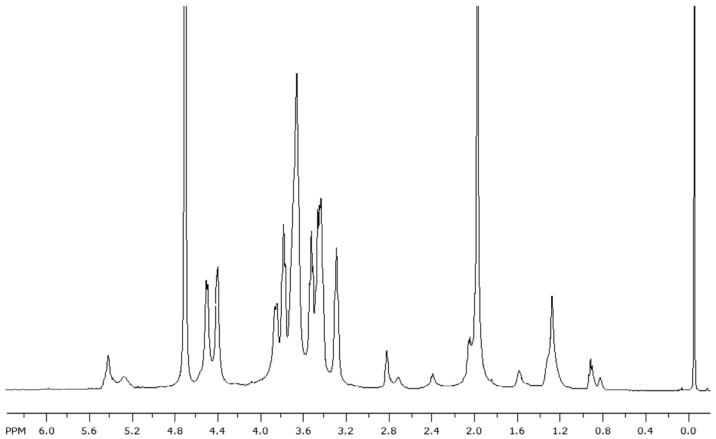
Identification:

Product purity is determined by gas chromatography to ensure it is free of residual solvents and chemicals after reaction. The structure is confirmed by Nuclear Magnetic Resonance. [2]

Solubility:

Product is fully soluble in water.

^{1}H NMR spectrum of sodium linolenoyl hyaluronate in 1% D_2O



Benefits and possible use:

- Modulation of the balance of lipid inflammatory mediators and, therefore, is valuable in the treatment of inflammatory skin disorders [3]
- Intended for drug delivery applications [4]

Specification:

Appearance	White to slightly yellow powder	
Dry matter	> 85%	
Degree of substitution	7–13%	NMR
Starting molecular weight (kDa)	10–20	SEC-MALLS

Storage:

Store preferably in originally sealed packaging. If not used immediately after opening, avoid high humidity and UV light exposure. Store refrigerated (2-8 °C). Temperatures up to 40 °C during transport (short term only) do not affect the product.

Shelf-life:

Material is supplied with minimum remaining shelf-life of 6 months.

Packaging:

Glass vial. 1 gram.

Price:

EUR 320/1 g

Patents:

WO2014/082609 (A1)

References:

1. Šmejkalová D, Huerta-Angeles G, Bobek M, Hermannová M, Vištejnová L, Novotny J, et al. C6-C18-acylated derivative of hyaluronic acid, method of preparation thereof, nanomicellar composition on its basis, method of preparation thereof and method of preparation stabilized nanomicellar composition, and use thereof. WO2014082609 A1
2. Huerta-Angeles G, Bobek M, Přikopová E, Šmejkalová D, Velebný V. Novel synthetic method for the preparation of amphiphilic hyaluronan by means of aliphatic aromatic anhydrides. Carbohydrate Polymers. 2014;111: 883-91.
3. Boelsma E, Hendriks HF, Roza L. Nutritional skin care: health effects of micronutrients and fatty acids. Am J Clin Nutr. 2001 May; 73(5):853-64.
4. Šmejkalová D, Nešporová K, Hermannová M, Huerta-Angeles G, Čožíková D, Vištejnová L, et al. Paclitaxel isomerisation in polymeric micelles based on hydrophobized hyaluronic acid. Int J Pharm. 2014; 466(1-2):147-55.

Notice:

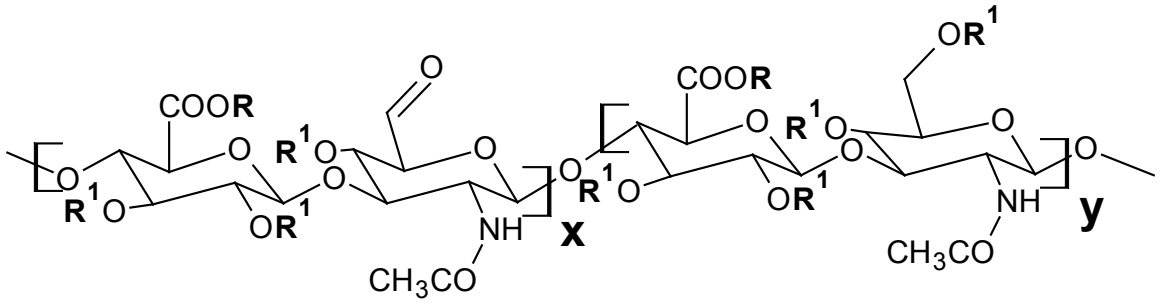
This product is intended primarily for R&D purposes and is not to be used for any other purposes, including but not limited to in vitro diagnostic purposes, foods, drugs, medical devices or cosmetics for humans or animals, or for commercial purposes.

Sodium octanoyl formyl hyaluronate

Synonyms:

Sodium octanoyl-6-oxo hyaluronate
Sodium O-octanoyl-6(GlcNAc)-oxo hyaluronate

Structural formula:



R = Na, H
R^1 = H, CO-$(CH_2)_6$-CH_3

Source:

Sodium octanoyl formyl hyaluronate is produced by chemical modification of native sodium hyaluronate (SH).

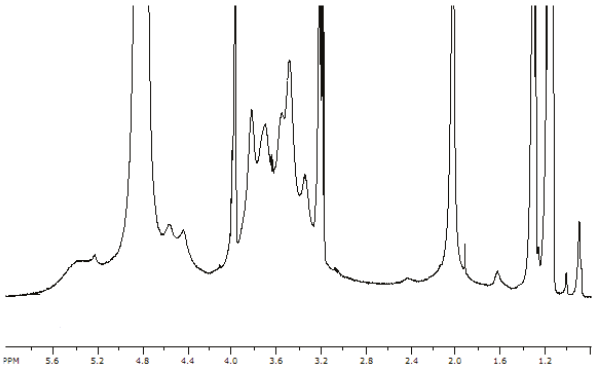
Identification:

Product characterized by NMR.

Solubility:

Solubility depends on the degree of substitution of octanoyl (DS) and molecular weight (MW) of the material.

^{1}H NMR spectrum:



Benefits and possible use:

- The unique structure of the product is able to self-assemble and form cavities that can dissolve hydrophobic components in water [1]
- Suitable for:
  - the fabrication of biocompatible drug delivery systems [2-4]
  - membranes for post-surgical adhesion prevention (minimal adhesion of cells to the derivative)
  - nanofiber- or microfiber-based membranes or scaffolds
- Cross-linking and encapsulation of various less polar active ingredients

Specification:

Appearance	White powder or granules	
pH	5.0–8.0	1% (w/v) aqueous solution, 25 °C
Dry matter	> 85%	
Degree of substitution	10–50%	NMR (octanoyl)
Degree of substitution	4–12%	NMR (formyl)
Molecular weight (kDa)	20–200	SEC-MALLS

Storage:

Store in originally sealed packaging. If not used immediately after opening, avoid high humidity and UV light exposure. Store refrigerated (2-8 °C). Temperatures up to 40 °C during transport (short term only) do not affect the product.

Shelf-life:

This material is supplied with a minimum remaining shelf-life of 6 months.

Packaging:

Glass vial. 1 gram.

Price:

EUR 540/1 g

Patents:

World Patents WO 2010/105582, WO 2011/069475

References:

1. Šmejkalová, D., Hermannová, M., Šulaková, R., Průšová, A., Kučerik, J., & Velebný, V. Carbohydrate Polymers, 2012, 87(2), 1460-1466.
2. Gong J, Chen M, Zheng Y, Wang S, Wang Y. Journal of Controlled Release, 2012, 159(3): 312-323.
3. Kedar U, Phutane P, Shidhaye S, Kadam V. Nanomedicine: Nanotechnology, Biology and Medicine, 2010, 6(6): 714-729.
4. Šedová P., Buffa R., at all, Carbohydrate Research, 371, 2013, 8-15.

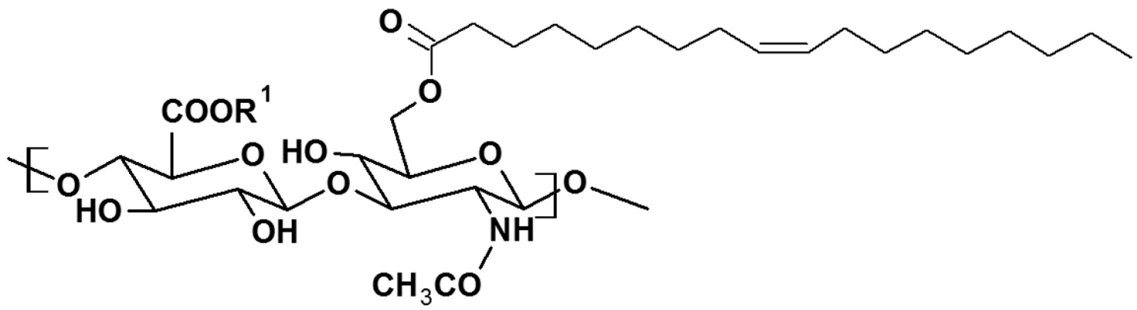
Notice:

Sodium oleyl hyaluronate

Synonyms:

HA-oleyl
Sodium O-octadec-9-enoyl hyaluronate

Structural formula:



R = H^+ or Na^+

Source:

Oleic acid is chemically attached to sodium hyaluronate by a new esterification methodology.

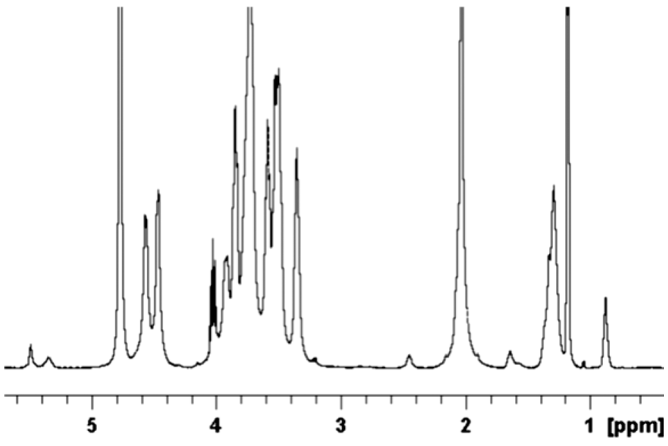
Identification:

The product is characterized by Nuclear Magnetic Resonance and SEC-MALLS.

Solubility:

Product is fully soluble in water.

^{1}H NMR spectrum of HA-oleyl acid in 2% D_2O



Benefits and possible use:

- Favors the penetration of hydrophobic active ingredients
- Combats skin aging
- Intended for drug delivery applications [1-2]
- Prevents decreasing age-related oiliness

Specification:

Appearance	White to slightly yellow powder	
Dry matter	> 85%	
Degree of substitution	5–15%	NMR
Starting molecular weight (kDa)	5–20	SEC-MALLS

Storage:

Store preferably in originally sealed packaging. If not used immediately after opening, avoid high humidity and UV light exposure. We recommend storing refrigerated (2-8 °C). Temperature up to 40 °C during transport (short term only) does not affect the final quality of the product.

Shelf-life:

Material is supplied with a minimum remaining shelf-life of 6 months.

Packaging:

3-layer aluminium foil. 1 gram.

Price:

EUR 105/1 g

Patents:

PV 2012-842

References:

1. N. Zhang, P. Wardwell and R. Bader, Pharmaceutics 5:329-352 (2013).
2. Šmejkalova D, Nešporova K, Hermannova M, Huerta-Angeles G, Čožikova D, Vištejnova L, et al. Paclitaxel isomerisation in polymeric micelles based on hydrophobized hyaluronic acid. Int J Pharm. 2014; 466(1-2):147-55

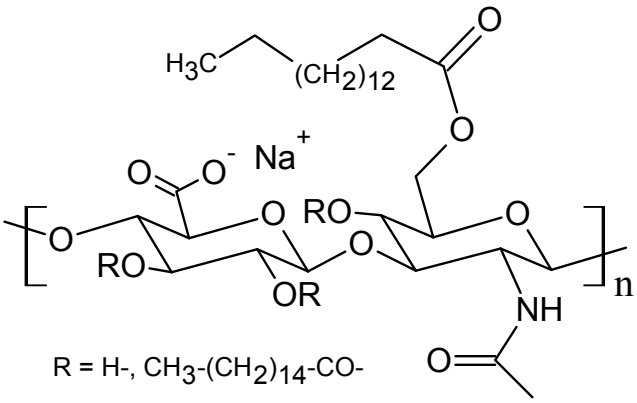
Notice:

Sodium palmitoyl hyaluronate

Synonyms:

Sodium hexadecanoyl hyaluronate
Sodium O-hexadecanoyl hyaluronate

Structural formula:



Source:

Sodium palmitoyl hyaluronate is chemically modified sodium hyaluronate (SH). Modification was achieved by an acylation process.

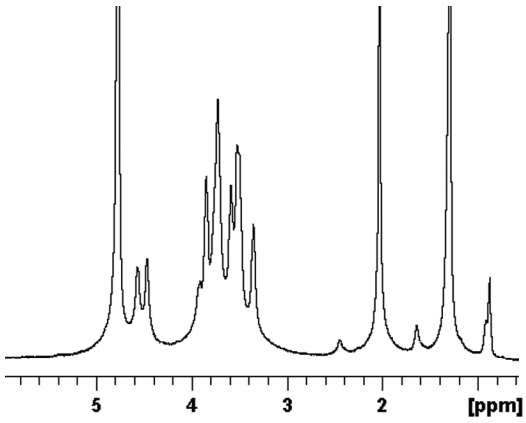
Identification:

Product characterized by NMR.

Solubility:

Solubility properties are influenced by molecular weight (MW) and the degree of substitution (DS) of the derivative; the higher these parameters, the slower the dissolution in water. Solubility of the derivatives may be increased by adding alcohols to aqueous solutions.

^{1}H NMR spectrum:



Benefits and possible use:

- Suitable for:
  - biomedical applications such as drug delivery [1-2]
  - anti-adhesion of membranes for internal surgery
    (presumed minimal adhesion of cells)
  - microfiber based membranes or scaffolds

Specification:

Sodium palmitoyl hyaluronate (10–200 kDa)		
Appearance	White powder or granules	
Dry matter	> 85%	
Degree of substitution	40–70%	NMR
Starting molecular weight (kDa)	10–200	SEC-MALLS

Sodium palmitoyl hyaluronate (300–350 kDa)		
Appearance	White powder or granules	
Dry matter	> 85%	
Degree of substitution	50–70%	NMR
Starting molecular weight (kDa)	300-350	SEC-MALLS

Sodium palmitoyl hyaluronate (950–1150 kDa)		
Appearance	White powder or granules	
Dry matter	> 85%	
Degree of substitution	35–55%	NMR
Starting molecular weight (kDa)	950–1150	SEC-MALLS

Storage:

Store in originally sealed packaging. If not used immediately after opening, avoid high humidity and UV light exposure. Store refrigerated (2-8 °C). Temperatures up to 40 °C during transport (short term only) do not affect the product.

Shelf-life:

This material is supplied with a minimum remaining shelf-life of 6 months.

Packaging:

Glass vial. 1 gram.

Price:

EUR 370/1 g

Patents:

Patent application PV 2012-842

References:

1. Schanté CE, Zuber G, Herlin C, and Vandamme TF. Carbohydrate Polymers; 85(3), 2011, 469-489.
2. Liu Y., Sun J., Cao W., Yang J., Lian He, Li X., Sun Y., Wang Y., Siling Wang, Zhonggui He, International Journal of Pharmaceutics, 2011, 421 (1): Pages 160-169.

Notice:

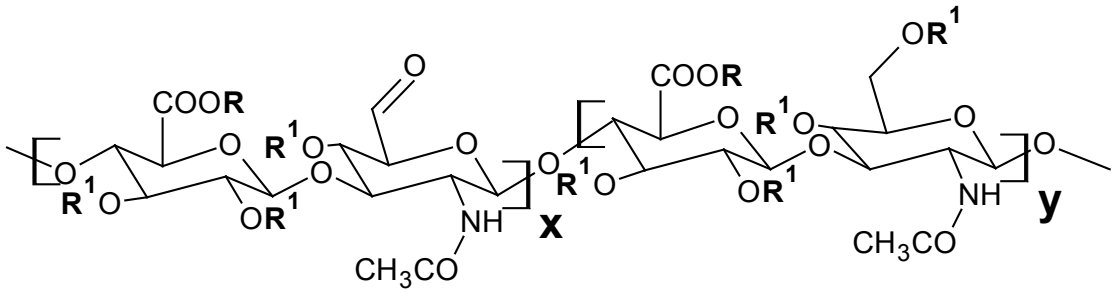
This product is intended primarily for R&D purposes and is not to be used for any other purposes, including but not limited to in vitro diagnostic purposes, foods, drugs, medical devices or cosmetics for humans or animals, or for commercial purposes.

Sodium palmitoyl formyl hyaluronate

Synonyms:

Sodium palmitoyl-6-oxo hyaluronate
Sodium O-palmitoyl-6(GlcNAc)-oxo hyaluronate

Structural formula:



R = Na, H
R^1 = H, CO-$(CH_2)_{14}$-CH_3

Source:

Sodium palmitoyl formyl hyaluronate is produced by chemical modification of native sodium hyaluronate (SH).

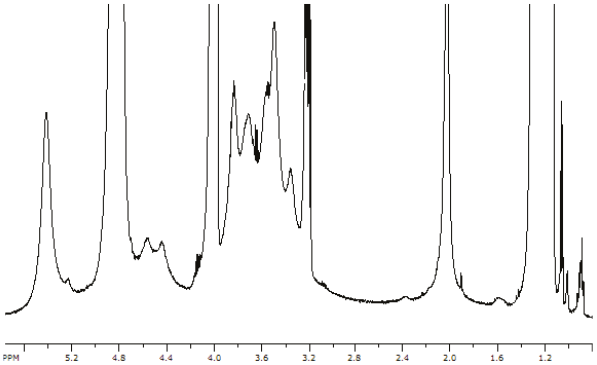
Identification:

Product characterized by NMR.

Solubility:

Solubility depends on the degree of substitution of palmitoyl (DS) and molecular weight (MW) of the material.

^{1}H NMR spectrum:



Benefits and possible use:

- The unique structure of the product is able to self-assemble and form cavities that can dissolve hydrophobic components in water [1]
- Suitable for:
  - the fabrication of biocompatible drug delivery systems [2-4]
  - membranes for post-surgical adhesion prevention (minimal adhesion of cells to the derivative)
  - nanofiber- or microfiber-based membranes or scaffolds
- Cross-linking and encapsulation of various nonpolar active ingredients

Specification:

Appearance	White powder or granules	
pH	5.0–8.0	1% (w/v) aqueous solution, 25 °C
Dry matter	> 85%	
Degree of substitution	10–50%	NMR (palmitoyl)
Degree of substitution	4–12%	NMR (formyl)
Molecular weight (kDa)	20–200	SEC-MALLS

Storage:

Store in originally sealed packaging. If not used immediately after opening, avoid high humidity and UV light exposure. Store refrigerated (2-8 °C). Temperatures up to 40 °C during transport (short term only) do not affect the product.

Shelf-life:

This material is supplied with a minimum remaining shelf-life of 6 months.

Packaging:

Glass vial. 1 gram.

Price:

EUR 545/1 g

Patents:

World Patents WO 2010/105582, WO 2011/069475

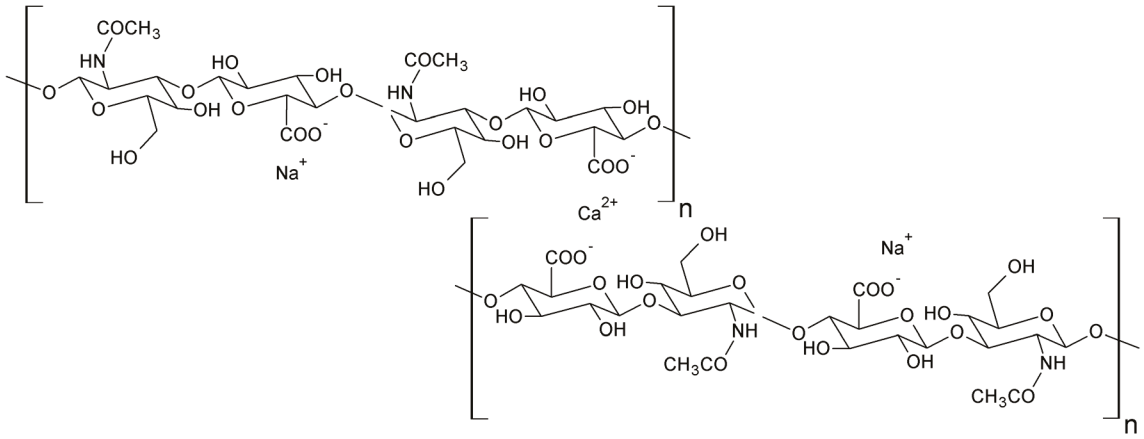
References:

1. Šmejkalová, D., Hermannová, M., Šulaková, R., Průšová, A., Kučerik, J., & Velebný, V. Carbohydrate Polymers, 2012, 87(2), 1460-1466.
2. Gong J, Chen M, Zheng Y, Wang S, Wang Y. Journal of Controlled Release, 2012, 159(3): 312-323.
3. Kedar U, Phutane P, Shidhaye S, Kadam V. Nanomedicine: Nanotechnology, Biology and Medicine, 2010, 6(6): 714-729.
4. Šedová P., Buffa R., at all, Carbohydrate Research, 371, 2013, 8-15.

Notice:

Sodium-calcium hyaluronate

Structural formula:



Source:

Produced biotechnologically (fermentation of bacterial strain *Streptococcus equi susp. Zooepidemicus*). Non-animal. Non GMO.

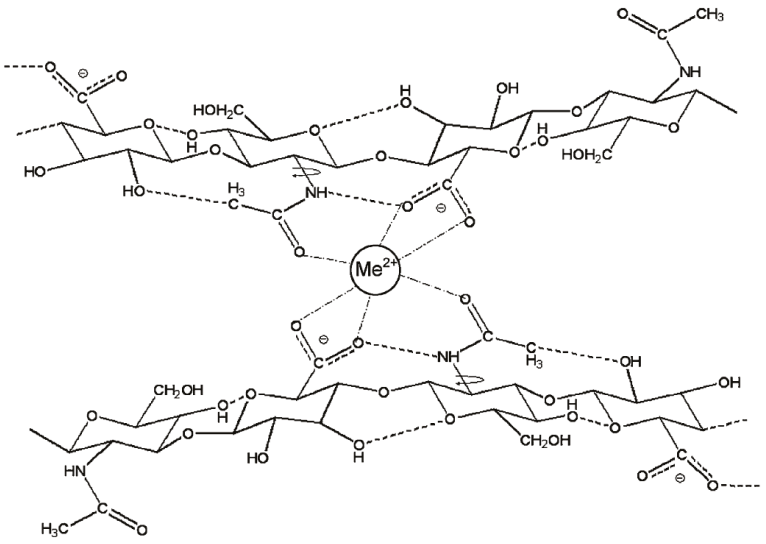
Solubility:

- Completely water soluble.
- Soluble in alcohol-water mixture up to a concentration of approximately 40% alcohol.

Benefits of the product:

- Calcium source
- Prevention and treatment of bone diseases [1]
- Building blocks for delivery systems [2]

Proposed structure of complex formed between a divalent cation ($Me2^{+}$) and hyaluronan: [3]



Specification:

Appearance	White powder or lyophilisate	
Sodium-calcium hyaluronate	≥ 90%	
Molecular weight	90–120 kDa	SEC-MALLS
Calcium content*	30–60%	ICP-OES
Dry matter	≥ 85%	
Sterility	Non sterile	

*Percentage of calcium in a total amount of calcium and sodium

Storage:

Store in originally sealed packaging. If not used immediately after opening, avoid high humidity and UV light exposure. Store refrigerated (2-8 °C). Temperature up to 40 °C during transport (short term only) do not affect the product.

Shelf-life:

This material is supplied with a minimum remaining shelf-life of 12 months.

Packaging:

Glass vial. 1 gram.

Price:

EUR 420/1 g

References:

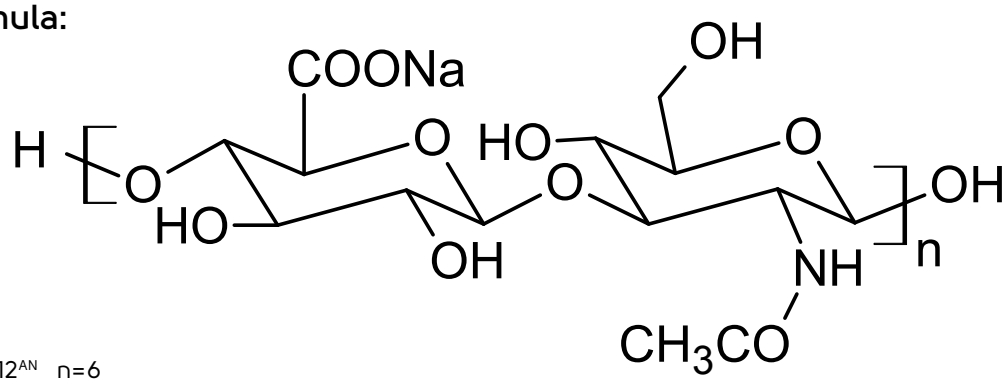
1. Bol´shakova AE, Mel´nikova NB, Nistratova LN, P´yanzina IP, Salikova TV, Gavrilova SA, Krasil´nikova EV. Suspension based on calcium carbonate and sodium hyaluronate for the prevention and treatment of bone diseases. Pharmaceutical Chemistry Journal. 2012 October; 46 (7): 449-455. Doi: 10.1007/s11094-012-0819-82.
2. Feng M, Ibrahim BM, Wilson EM, Doh KO, Bergman BK, Park C, Yeo Y. Stabilization of hyaluronate-associated gene delivery system using calcium ions. Biomaterials Sciense. 2014 February; 2: 936-942. Doi: 10.1039/C4BM00012A
3. Furth G, Knierim R, Buss V, Mayer C. Binding of bivalent cations by hyaluronate in aqueous solution. International Journal of Biological Macromolecules. 2008; 42 (1): 33-40. Doi: 10.1016/j.ijbiomac.2007.09.001
4. Berts I, Fragneto G, Hilborn J, Rennie AR. Tuning the density profile of surface-grafted hyaluronan and the effect of counter-ions. The European Physical Journal E. 2013 July; 36 (70): 449-455. Doi: 10.1140/epje/i2013-13070-7
5. Zellermann AM, Bergmann D, Mayer, C. Cation induced conformation changes in hyaluronate solution. European Polymer Journal. 2013; 49 (1): 70-79. Doi: 10.1016/j.eurpolymj.2012.09.025

Notice:

This product is intended primarily for R&D purposes and is not to be used for any other purposes, including but not limited to in vitro diagnostic purposes, foods, drugs, medical devices or cosmetics for humans or animals, or for commercial purposes.

Hyaluronan oligosaccharides^{AN} EVEN-numbered (sodium salt)

Structural formula:



HA4^{AN}	n=2	HA12^{AN}	n=6
HA6^{AN}	n=3	HA14^{AN}	n=7
HA8^{AN}	n=4	HA16^{AN}	n=8
HA10^{AN}	n=5	HA18^{AN}	n=9

Source:

Hyaluronan oligosaccharides are produced by partial digestion of high-molar mass hyaluronan (of biotechnological origin) with bovine testicular hyaluronidase and chromatographic fractionation into size-uniform HA oligosaccharides by anion-exchange chromatography after the enzyme removal.

Identification:

The purity and size of each HA oligomer is confirmed by HPLC analyses and mass spectrometry.

Solubility:

Easily soluble in aqueous media.

Molecular weight:

	Oligomer in acidic form
HA4^{AN}	776.2 g/mol
HA6^{AN}	1155.3 g/mol
HA8^{AN}	1534.5 g/mol
HA10^{AN}	1913.6 g/mol
HA12^{AN}	2292.7 g/mol
HA14^{AN}	2671.8 g/mol
HA16^{AN}	3050.9 g/mol
HA18^{AN}	3430.0 g/mol

Benefits and possible use:

- Biologically active
- Attractive building blocks for organic synthesis

Specification:

HA4^{AN}, HA6^{AN}, HA8^{AN}, HA10^{AN}		
Appearance	White to slightly yellow lyophilisate	
Mass spectrum	to pass the test	Mass spectrometer
Identification Sodium	to pass the test	
pH	5.0–8.0	pH meter
	Purity	
HA4^{AN}, HA6^{AN}, HA8^{AN}	≥ 95.0%	HPLC/IEC-UV
HA10^{AN}	≥ 90.0%	HPLC/IEC-UV
HA12^{AN}, HA14^{AN}, HA16^{AN}, HA18^{AN}		
Appearance	White to slightly yellow lyophilisate	
Mass spectrum	to pass the test	Mass spectrometer
Chlorides	to pass the test	HPLC/ELSD
Purity	> 80.0%	HPLC/IEC-UV

Storage:

Store in originally sealed packaging. If not used immediately after opening, avoid high humidity and UV light exposure. Store refrigerated (2-8 °C). Temperatures up to 25 °C during transport (short term only) do not affect the product.

Shelf-life:

This material is supplied with a minimum remaining shelf-life of 6 months.

Packaging:

Glass vial. 10 milligrams.

Price:

HA4^{AN} - EUR 390/10 mg
HA6^{AN} - EUR 450/10 mg
HA8^{AN} - EUR 530/10 mg
HA10^{AN} - EUR 590/10 mg
HA12^{AN} - EUR 620/10 mg
HA14^{AN} - EUR 630/10 mg
HA16^{AN} - EUR 660/10 mg
HA18^{AN} - EUR 710/10 mg

References:

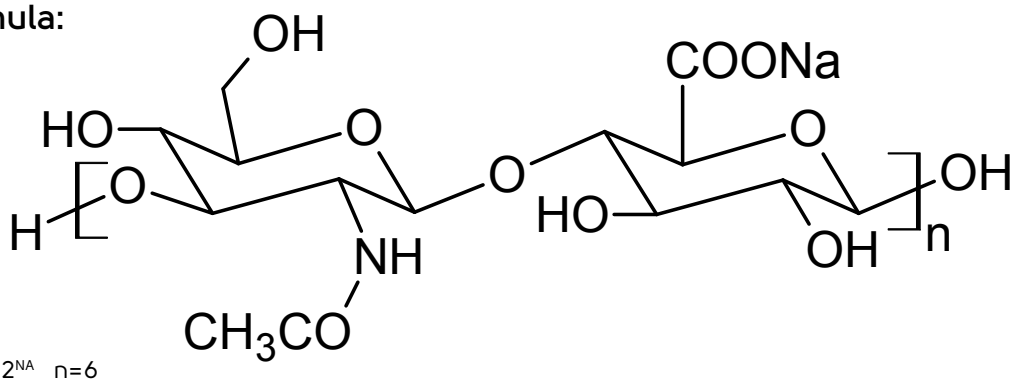
1. **HA4^{AN}, HA6^{AN}**
   Lucie Borovcova, Martina Hermannova, Volodymyr Pauk, Matej Simek, Vladimír Havlícek, Karel Lemr. Simple area determination of strongly overlapping ion mobility peaks. Analytica Chimica Acta 2017, 981, 71-79.
2. **HA4^{AN}**
   Wakao N, Imagama S, Zhang H, Tauchi R, Muramoto A, Natori T, et al. Hyaluronan oligosaccharides promote functional recovery after spinal cord injury in rats. Neurosci Lett. 2011 Jan 25;488(3):299-304.
   Torigoe K, Tanaka HF, Ohkochi H, Miyasaka M, Yamanokuchi H, Yoshidad K, et al. Hyaluronan tetrasaccharide promotes regeneration of peripheral nerve: in vivo analysis by film model method. Brain Res. 2011 Apr 18;1385:87-92.
3. **HA4^{AN}, HA6^{AN}**
   Voelcker V, Gebhardt C, Averbeck M, Saalbach A, Wolf V, Weih F, et al. Hyaluronan fragments induce cytokine and metalloprotease upregulation in human melanoma cells in part by signalling via TLR4. Exp Dermatol. 2008 Feb;17(2):100-7.
4. **HA4^{AN}, HA6^{AN}, HA8^{AN}, HA10^{AN}**
   Termeer CC, Hennies J, Voith U, Ahrens T, Weiss JM, Prehm P, et al. Oligosaccharides of hyaluronan are potent activators of dendritic cells. J Immunol. 2000 Aug 15;165(4):1863-70.
   Matou-Nasri S, Gaffney J, Kumar S, Slevin M. Oligosaccharides of hyaluronan induce angiogenesis through distinct CD44 and RHAMMmediated signalling pathways involving Cdc2 and gamma-adducin. Int J Oncol. 2009 Oct;35(4):761-73.
5. **HA4^{AN}, HA6^{AN}, HA8^{AN}, HA10^{AN}, HA12^{AN}, HA14^{AN}, HA16^{AN}, HA18^{AN}**
   Toole BP. Hyaluronan Oligosaccharides as a Potential Anticancer Therapeutic. Current Pharmaceutical Biotechnology. [doi:10.2174/1389201 08785161569]. 2008;9:249-52.
6. **HA6^{AN}, HA8^{AN}, HA10^{AN}, HA12^{AN}, HA14^{AN}, HA16^{AN}, HA18^{AN}**
   Misra S, Ghatak S, Toole BP. Regulation of MDR1 expression and drug resistance by a positive feedback loop involving hyaluronan, phosphoinositide 3-kinase, and ErbB2. J Biol Chem. 2005 May 27;280(21):20310-5.
7. **HA12^{AN}, HA14^{AN}, HA16^{AN}, HA18^{AN}**
   Ghatak S, Misra S, Toole BP. Hyaluronan constitutively regulates ErbB2 phosphorylation and signaling complex formation in carcinoma cells. J Biol Chem. [Article]. 2005 Mar;280(10):8875-83.
   Slomiany MG, Dai L, Tolliver LB, Grass GD, Zeng Y, Toole BP. Inhibition of Functional Hyaluronan-CD44 Interactions in CD133-positive Primary Human Ovarian Carcinoma Cells by Small Hyaluronan Oligosaccharides. Clin Cancer Res. 2009 Dec 15;15(24):7593-601.
   Kenshi Yamasaki et al., "NLRP3/cryopyrin Is Necessary for IL-1 Release in Response to Hyaluronan, an Endogenous Trigger of Inflammation in Response to Injury," Journal of Biological Chemistry (March 3, 2009), doi:10.1074/jbc.M806084200.

Notice:

This product is intended primarily for R&D purposes and is not to be used for any other purposes, including but not limited to in vitro diagnostic purposes, foods, drugs, medical devices or cosmetics for humans or animals, or for commercial purposes.

Hyaluronan oligosaccharides^{NA} EVEN-numbered (sodium salt)

Structural formula:



HA4^{NA}	n=2	HA12^{NA}	n=6
HA6^{NA}	n=3	HA14^{NA}	n=7
HA8^{NA}	n=4	HA16^{NA}	n=8
HA10^{NA}	n=5	HA18^{NA}	n=9

Source:

Hyaluronan oligosaccharides are produced by partial digestion of high-molar mass hyaluronan (of biotechnological origin) with leech hyaluronidase and chromatographic fractionation into size-uniform HA oligosaccharides by anion-exchange chromatography after the enzyme removal.

Identification:

The purity and size of each HA oligomer is confirmed by HPLC analyses and mass spectrometry.

Solubility:

Easily soluble in aqueous media.

Molecular weight:

	Oligomer in an acidic form
HA4^{NA}	776.2 g/mol
HA6^{NA}	1155.3 g/mol
HA8^{NA}	1534.5 g/mol
HA10^{NA}	1913.6 g/mol
HA12^{NA}	2292.7 g/mol
HA14^{NA}	2671.8 g/mol
HA16^{NA}	3050.9 g/mol
HA18^{NA}	3430.0 g/mol

Benefits and possible use:

- Biologically active
- Attractive building blocks for organic synthesis

Specification:

HA4^{NA}, HA6^{NA}, HA8^{NA}, HA10^{NA}		
Appearance	White to slightly yellow lyophilisate	
Mass spectrum	to pass the test	Mass spectrometer
Identification Sodium	to pass the test	
pH	5.0–8.0	pH meter
	Purity	
HA4^{NA}, HA6^{NA}, HA8^{NA}	≥ 95.0%	HPLC/IEC-UV
HA10^{NA}	≥ 90.0%	HPLC/IEC-UV
HA12^{NA}, HA14^{NA}, HA16^{NA}, HA18^{NA}		
Appearance	White to slightly yellow lyophilisate	
Mass spectrum	to pass the test	Mass spectrometer
Chlorides	to pass the test	HPLC/ELSD
Purity	> 80.0%	HPLC/IEC-UV

Storage:

Store in originally sealed packaging. If not used immediately after opening, avoid high humidity and UV light exposure. Store refrigerated (2-8 °C). Temperatures up to 25 °C during transport (short term only) do not affect the product.

Shelf-life:

This material is supplied with a minimum remaining shelf-life of 6 months.

Packaging:

Glass vial. 10 milligrams.

Price:

HA4^{NA} - EUR 390/10 mg
HA6^{NA} - EUR 450/10 mg
HA8^{NA} - EUR 530/10 mg
HA10^{NA} - EUR 590/10 mg
HA12^{NA} - EUR 620/10 mg
HA14^{NA} - EUR 630/10 mg
HA16^{NA} - EUR 660/10 mg
HA18^{NA} - EUR 710/10 mg

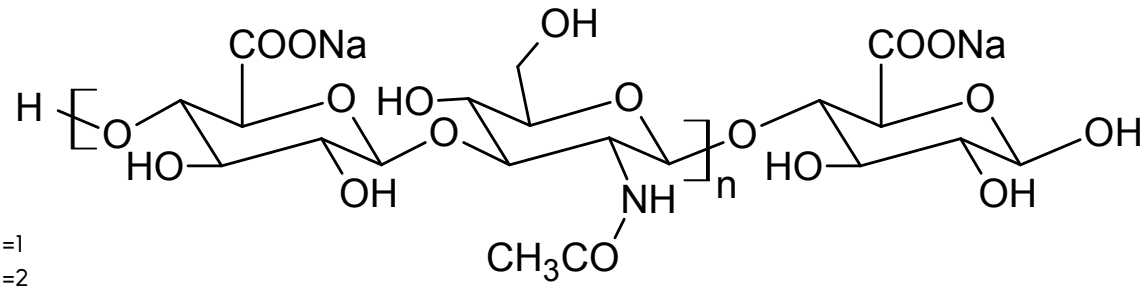
References:

1. **HA4^{AN}, HA6^{AN}**
   Lucie Borovcova, Martina Hermannova, Volodymyr Pauk, Matej Simek, Vladimír Havlícek, Karel Lemr. Simple area determination of strongly overlapping ion mobility peaks. Analytica Chimica Acta 2017, 981, 71-79.
2. **OHA^{NA}**
   Zhao X., Yang B., Li L., Zhang F., Linhardt RJ. On-line separation and characterization of hyaluronan oligosaccharides derived from radical depolymerisation. Carbohydrate Polymers 96 (2013) 503-509.
3. **HA4^{AN}**
   Wakao N, Imagama S, Zhang H, Tauchi R, Muramoto A, Natori T, et al. Hyaluronan oligosaccharides promote functional recovery after spinal cord injury in rats. Neurosci Lett. 2011 Jan 25;488(3):299-304.
   Torigoe K, Tanaka HF, Ohkochi H, Miyasaka M, Yamanokuchi H, Yoshidad K, et al. Hyaluronan tetrasaccharide promotes regeneration of peripheral nerve: in vivo analysis by film model method. Brain Res. 2011 Apr 18;1385:87-92.
4. **HA4^{AN}, HA6^{AN}**
   Voelcker V, Gebhardt C, Averbeck M, Saalbach A, Wolf V, Weih F, et al. Hyaluronan fragments induce cytokine and metalloprotease upregulation in human melanoma cells in part by signalling via TLR4. Exp Dermatol. 2008 Feb;17(2):100-7.
5. **HA4^{AN}, HA6^{AN}, HA8^{AN}, HA10^{AN}**
   Termeer CC, Hennies J, Voith U, Ahrens T, Weiss JM, Prehm P, et al. Oligosaccharides of hyaluronan are potent activators of dendritic cells. J Immunol. 2000 Aug 15;165(4):1863-70.
   Matou-Nasri S, Gaffney J, Kumar S, Slevin M. Oligosaccharides of hyaluronan induce angiogenesis through distinct CD44 and RHAMM-mediated signalling pathways involving Cdc2 and gamma-adducin. Int J Oncol. 2009 Oct;35(4):761-73.
6. **HA4^{AN}, HA6^{AN}, HA8^{AN}, HA10^{AN}, HA12^{AN}, HA14^{AN}, HA16^{AN}, HA18^{AN}**
   Toole BP. Hyaluronan Oligosaccharides as a Potential Anticancer Therapeutic. Current Pharmaceutical Biotechnology. [doi:10.2174/1389201 08785161569]. 2008;9:249-52.
7. **HA6^{AN}, HA8^{AN}, HA10^{AN}, HA12^{AN}, HA14^{AN}, HA16^{AN}, HA18^{AN}**
   Misra S, Ghatak S, Toole BP. Regulation of MDR1 expression and drug resistance by a positive feedback loop involving hyaluronan, phosphoinositide 3-kinase, and ErbB2. J Biol Chem. 2005 May 27;280(21):20310-5.

Notice:

Hyaluronan oligosaccharides^{AA} **ODD-numbered** (sodium salt)

Structural formula:



HA3^{AA} n=1
HA5^{AA} n=2
HA7^{AA} n=3
HA9^{AA} n=4
HA11^{AA} n=5

Source:

Hyaluronan oligosaccharides are produced by partial digestion of high-molar mass hyaluronan (of biotechnological origin) with bovine testicular hyaluronidase and terminal N-acetylglucosamin is peeled off under alkali condition. Mixture of oligomers is chromatographically fractionated into size-uniform HA oligosaccharides by anion-exchange chromatography.

Identification:

The purity and size of each HA oligomer is confirmed by HPLC analyses and MS.

Solubility:

Soluble in aqueous media.

Molecular weight:

	Oligomer in an acidic form
HA3^{AA}	573.2
HA5^{AA}	952.3
HA7^{AA}	1331.4
HA9^{AA}	1710.5
HA11^{AA}	2089.6

Benefits and possible use:

- Attractive building blocks for organic synthesis
- Sterilization by 0.22 µm syringe filter

Specification:

Appearance	White to slightly yellow lyophilisate	
Mass spectrum	to pass the test	Mass spectrometer
Purity	> 80.0%	HPLC/IEC-UV
Chlorides	≤ 0.5% (w/w)	HPLC/ELSD

Storage:

Store in originally sealed packaging. If not used immediately after opening, avoid high-temperature, high-level of humidity and exposure to UV light. Store regrigerated (2–8 °C). Temperatures up to 25 °C during transport (short term only) do not affect the product.

Shelf-life:

This material is supplied with a minimum remaining shelf-life of 6 months.

Packaging:

Glass vial. 10 milligrams.

Price:

$HA3^{AA}$ - EUR 505/10 mg
$HA5^{AA}$ - EUR 505/10 mg
$HA7^{AA}$ - EUR 505/10 mg
$HA9^{AA}$ - EUR 505/10 mg
$HA11^{AA}$ - EUR 505/10 mg

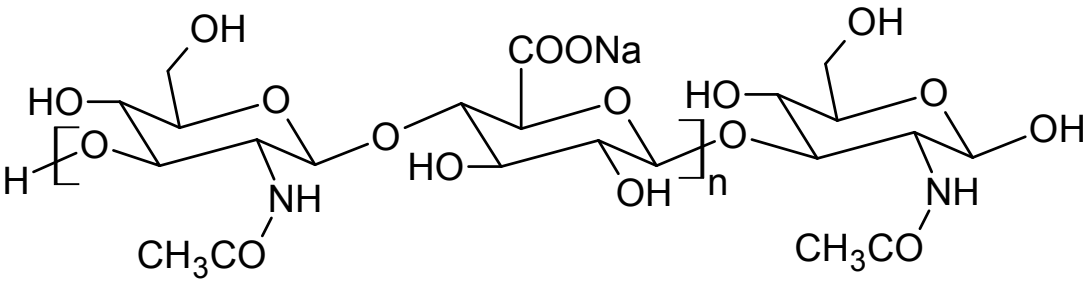
References:

1. Blundell CD, Almond A. Temperature dependencies of amide 1H- and 15N-chemical shifts in hyaluronan oligosaccharides. Magn. Reson. Chem. 2007; 45: 430–433.
2. Price KN, Al Tuinman, Baker DC, Chisena C, Cysyk RL. Isolation and characterization by electrospray-ionization mass spectrometry and high-performance anion-exchange chromatography of oligosaccharides derived from hyaluronic acid by hyaluronate lyase digestion: Observation of some heretofore unobserved oligosaccharides that contain an odd number of units. Carbohydr. Res. 1997; 303: 303-311.
3. Nicola Volpi. On-Line HPLC/ESI-MS Separation and Characterization of Hyaluronan Oligosaccharides from 2-mers to 40-mers. Anal. Chem. 2007; 79: 6390-6397.

Notice:

Hyaluronan oligosaccharides^{NN} **ODD-numbered** (sodium salt)

Structural formula:



HA3^{NN} n=1
HA5^{NN} n=2
HA7^{NN} n=3
HA9^{NN} n=4
HA11^{NN} n=5

Source:

Hyaluronan oligosaccharides are produced by partial digestion of high-molar mass hyaluronan (of biotechnological origin) with bovine testicular hyaluronidase and glucuronic acid from non-reducing terminus is splitted by β-glucuronidase from bovine liver. Mixture of oligomers is chromatographically fractionated into size-uniform HA oligosaccharides by anion-exchange chromatography.

Identification:

The purity and size of each HA oligomer is confirmed by HPLC analyses and MS.

Solubility:

Soluble in aqueous media.

Molecular weight:

	Oligomer in an acidic form
HA3^{NN}	600.2
HA5^{NN}	979.3
HA7^{NN}	1358.4
HA9^{NN}	1737.5
HA11^{NN}	2116.6

Benefits and possible use:

- Attractive building blocks for organic synthesis
- Sterilization by 0.22 µm syringe filter

Specification:

Appearance	White to slightly yellow lyophilisate	
Mass spectrum	to pass the test	Mass spectrometer
Purity	> 80.0%	HPLC/IEC-UV
Chlorides	≤ 0.5% (w/w)	HPLC/ELSD

Storage:

Store in originally sealed packaging. If not used immediately after opening, avoid high-temperature, high-level of humidity and exposure to UV light. Store regrigerated (2–8 °C). Temperatures up to 25 °C during transport (short term only) do not affect the product.

Shelf-life:

This material is supplied with a minimum remaining shelf-life of 6 months.

Packaging:

Glass vial. 10 milligrams.

Price:

$HA3^{NN}$ - EUR 780/10 mg
$HA5^{NN}$ - EUR 585/10 mg
$HA7^{NN}$ - EUR 585/10 mg
$HA9^{NN}$ - EUR 585/10 mg
$HA11^{NN}$ - EUR 585/10 mg

References:

1. Blundell CD, Almond A. Temperature dependencies of amide 1H- and 15N-chemical shifts in hyaluronan oligosaccharides. Magn. Reson. Chem. 2007; 45: 430–433.
2. Price KN, Al Tuinman, Baker DC, Chisena C, Cysyk RL. Isolation and characterization by electrospray-ionization mass spectrometry and high-performance anion-exchange chromatography of oligosaccharides derived from hyaluronic acid by hyaluronate lyase digestion: Observation of some heretofore unobserved oligosaccharides that contain an odd number of units. Carbohydr. Res. 1997; 303: 303-311.
3. Nicola Volpi. On-Line HPLC/ESI-MS Separation and Characterization of Hyaluronan Oligosaccharides from 2-mers to 40-mers. Anal. Chem. 2007; 79: 6390-6397.

SETS

Hyaluronan Oligosaccharides ODD and EVEN packaged sets

Hyaluronan Oligosaccharides EVEN Numbered SET ($HA4^{AN}$, $HA6^{AN}$, $HA8^{AN}$, $HA10^{AN}$)

AN -the hyaluronan chain starts with D-glucuronic acid, and the end of the chain is located N- acetyl glucosamine

For research purposes only.

Hyaluronan Oligosaccharide ($HA4^{AN}$), 5 mg
Hyaluronan Oligosaccharide ($HA6^{AN}$), 5 mg
Hyaluronan Oligosaccharide ($HA8^{AN}$), 5 mg
Hyaluronan Oligosaccharide ($HA10^{AN}$), 5 mg

Price € 1475

Hyaluronan Oligosaccharides EVEN Numbered SET ($HA12^{AN}$, $HA14^{AN}$, $HA16^{AN}$, $HA18^{AN}$)

AN - the hyaluronan chain starts with D-glucuronic acid, and the end of the chain is located N- acetyl glucosamine

For research purposes only.

Hyaluronan Oligosaccharide ($HA12^{AN}$), 5 mg
Hyaluronan Oligosaccharide ($HA14^{AN}$), 5 mg
Hyaluronan Oligosaccharide ($HA16^{AN}$), 5 mg
Hyaluronan Oligosaccharide ($HA18^{AN}$), 5 mg

Price € 1475

Hyaluronan Oligosaccharides EVEN Numbered SET ($HA4^{NA}$, $HA6^{NA}$, $HA8^{NA}$, $HA10^{NA}$)

NA -the hyaluronan chain starts with N- acetyl glucosamine and the end of the chain is located D-glucuronic acid

For research purposes only.

Hyaluronan Oligosaccharide ($HA4^{NA}$), 5 mg
Hyaluronan Oligosaccharide ($HA6^{NA}$), 5 mg
Hyaluronan Oligosaccharide ($HA8^{NA}$), 5 mg
Hyaluronan Oligosaccharide ($HA10^{NA}$), 5 mg

Price € 780

Hyaluronan Oligosaccharides EVEN Numbered SET ($HA12^{NA}$, $HA14^{NA}$, $HA16^{NA}$, $HA18^{NA}$)

NA -the hyaluronan chain starts with N- acetyl glucosamine and the end of the chain is located D-glucuronic acid
For research purposes only.

Hyaluronan Oligosaccharide ($HA12^{NA}$), 5 mg
Hyaluronan Oligosaccharide ($HA14^{NA}$), 5 mg
Hyaluronan Oligosaccharide ($HA16^{NA}$), 5 mg
Hyaluronan Oligosaccharide ($HA18^{NA}$), 5 mg

Price € 1475

Hyaluronan Oligosaccharides ODD Numbered SET ($HA3^{AA}$, $HA5^{AA}$, $HA7^{AA}$, $HA9^{AA}$ $HA11^{AA}$)

AA - D-glucuronic acid is located on both ends of the hyaluronan chain

For research purposes only.

Hyaluronan Oligosaccharide ($HA3^{AA}$), 5 mg
Hyaluronan Oligosaccharide ($HA5^{AA}$), 5 mg
Hyaluronan Oligosaccharide ($HA7^{AA}$), 5 mg
Hyaluronan Oligosaccharide ($HA9^{AA}$), 5 mg
Hyaluronan Oligosaccharide ($HA11^{AA}$), 5 mg

Price € 1135

Hyaluronan Oligosaccharides ODD Numbered SET ($HA3^{NN}$, $HA5^{NN}$, $HA7^{NN}$, $HA9^{NN}$ $HA11^{NN}$)

NN - on both ends of the hyaluronan chain is located the N- acetyl glucosamine

For research purposes only.

Hyaluronan Oligosaccharide ($HA3^{NN}$), 5 mg
Hyaluronan Oligosaccharide ($HA5^{NN}$), 5 mg
Hyaluronan Oligosaccharide ($HA7^{NN}$), 5 mg
Hyaluronan Oligosaccharide ($HA9^{NN}$), 5 mg
Hyaluronan Oligosaccharide ($HA11^{NN}$), 5 mg

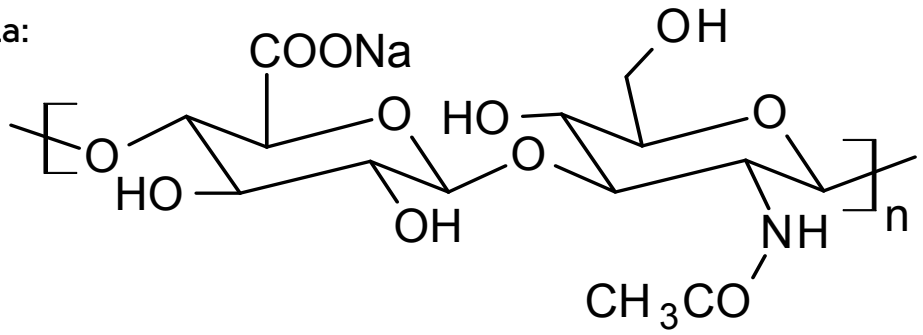
Price € 650

CUSTOMISED SETS - Hyaluronan Oligosaccharides Mix?

Customised sets of Hyaluronan Oligosaccharides made from of your choice of ODD and EVEN Oligosaccharides can be configured. Please contact specialities@contipro.com with your request and we will send a quotation.

Sodium hyaluronate with narrow molar mass distribution

Structural formula:



Source:

Produced biotechnologically (fermentation of bacterial strain *Streptococcus equi susp. Zooepidemics*), enzymatically digested (bovine testicular hyaluronidase) to certain molar mass and chromatographically fractionated. Non GMO.

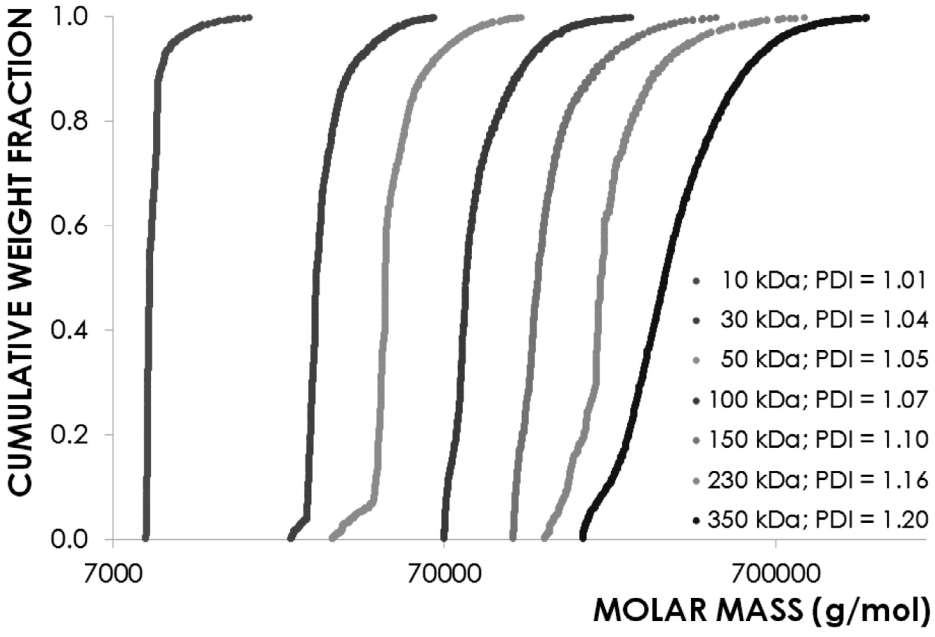
Solubility:

- Completely water soluble.
- Soluble in alcohol-water mixture up to a concentration of approximately 50% alcohol (depending on the alcohol type and the MW of the sodium hyaluronate).
- Insoluble in aprotic solvents.

Benefits of the product:

- Material for biological testing (may influence wound macrophages, blood phagocytes, expression of human β-defensin 2 etc., see references below)
- GPC and Gel electrophoresis standard quality.

Examples of Molar Mass distributions of hyaluronan with narrow molar mass distribution (SEC-MALS analysis):



Specification:

Sodium hyaluronate with narrow molar mass distribution (5–20 kDa)		
Sodium hyaluronate	≥ 90%	
Molecular weight (kDa)	According to request	SEC-MALLS
Polydispersity index (MW 5–20 kDa)	≤ 1.02	SEC-MALLS
Sterility	Non sterile	

Sodium hyaluronate with narrow molar mass distribution (20–100 kDa)		
Sodium hyaluronate	≥ 90%	
Molecular weight (kDa)	According to request	SEC-MALLS
Polydispersity index (MW < 100 kDa)	≤ 1.10	SEC-MALLS
Sterility	Non sterile	

Sodium hyaluronate with narrow molar mass distribution (100–350 kDa)		
Sodium hyaluronate	≥ 90%	
Molecular weight (kDa)	According to request	SEC-MALLS
Polydispersity index (MW > 100 kDa)	≤ 1.20	SEC-MALLS
Sterility	Non sterile	

SINGLE - available MW ranges (kDa) Packaging & Price		
5-20	100 mg	EUR 1520
20-30	100 mg	EUR 1520
30-40	100 mg	EUR 1520
40-60	100 mg	EUR 1750
60-80	100 mg	EUR 1750
80-100	100 mg	EUR 1750
100-120	50 mg	EUR 1520
120-140	50 mg	EUR 1520
140-160	50 mg	EUR 1750
160-350	50 mg	EUR 1750

SETS - available MW ranges (kDa) Packaging & Price			
Set MW 5 – 110kDa	5 – 10 kDa	50 mg	EUR 1950
	10 – 20 kDa	50 mg	
	25 – 35 kDa	50 mg	
	40 – 60 kDa	50 mg	
	90 – 110 kDa	20 mg	
Set MW 90 – 360 kDa	90 – 110 kDa	20 mg	EUR 1980
	140 – 160 kDa	15 mg	
	220 – 240 kDa	15 mg	
	330 – 360 kDa	15 mg	

Storage:

Store in originally sealed packaging. If not used immediately after opening, avoid high humidity and UV light exposure. Store refrigerated (2-8 °C). Temperatures up to 40 °C during transport (short term only) do not affect the product.

Shelf-life:

This material is supplied with a minimum remaining shelf-life of 12 months.

Packaging:

Glass vial.

Notice:

This product is intended primarily for R&D purposes and is not to be used for any other purposes, including but not limited to in vitro diagnostic purposes, foods, drugs, medical devices or cosmetics for humans or animals, or for commercial purposes.

References:

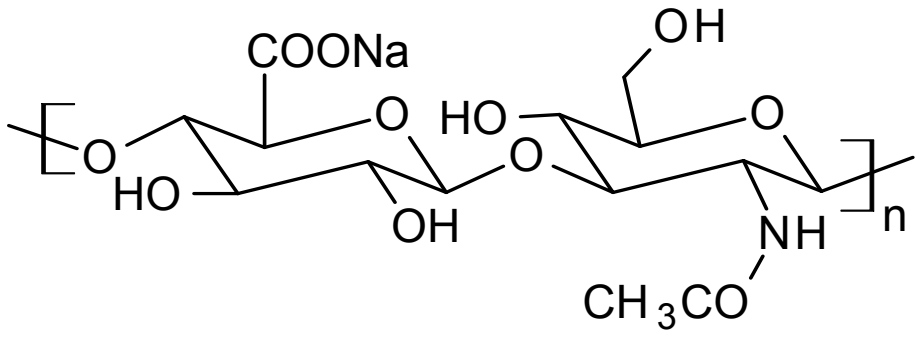
1. Cozikova D, Silova T, Moravcova V, Smejkalova D, Pepeliaev S, Hermannova M, and Velebny V. Preparation and extensive characterization of hyaluronan with narrow molecular weight distribution. Carbohydrate Polymers 2017, 160, 134–142.
2. Tolg C, Telmer P, Turley E. Specific Sizes of Hyaluronan Oligosaccharides Stimulate Fibroblast Migration and Excisional Wound Repair. PLoS ONE. 2014 February; 9(2): e88479. doi: 10.1371/journal.pone.0088479
3. Safrankova B, Gajdova S, Kubala L. The Potency of Hyaluronan of Different Molecular Weights in the Stimulation of Blood Phagocytes. Mediators of Inflammation. 2010 December; 2010: 380948. doi: 10.1155/2010/3809488
4. Liang J, Jiang D, Jung Y, Xie T, Ingram J, Church T, Degan S, Leonard M, Kraft M, Noble PW. The Role of Hyaluronan and Hyaluronan Binding Proteins in Human Asthma. J Allergy Clin Immunol. J Allergy Clin Immunol. 2011 August; 128(2): 403–411. doi: 10.1016/j.jaci.2011.04.006
5. Hill DR, Kessler SP, Rho HK, Cowman MK, de la Motte CA. Specific-sized Hyaluronan Fragments Promote Expression of Human β-Defensin 2 in Intestinal Epithelium. J Biol Chem. 2012 August;287(36): 30610–30624. doi: 10.1074/jbc.M112.356238

Sodium hyaluronate – laboratory

Synonyms:

Hyaluronan, hyaluronic acid

Structural formula:



Source:

Produced biotechnologically (fermentation of bacterial strain Streptococcus equi susp. zooepidemicus). Non-animal. Non GMO.

Solubility:

- Completely water soluble. The speed of dissolution depends on the molecular weight (MW). The lower the MW, the faster the dissolution.
- Soluble in alcohol-water mixture up to a concentration of approximately 50% alcohol (depending on the alcohol type and the MW of the sodium hyaluronate).
- Insoluble in aprotic solvents.

Compatibility and processing:

- Product is relatively stable. Changes in MW occur when heating or at extreme pH values (higher MW, lower stability).
- Very sensitive to free radicals.
- Forms non-soluble salts with amphiphilic cationic substances (e.g. cationic detergents) and high MW positively charged substances (chitosan, quaternized polymers, some proteins).
- Sterilization of solutions by autoclaving (all MWs, the higher the MW, the greater the drop in MW during sterilization) or by filtration (the possibility of sterilizing the filter depends on the solution concentration and MW).

Specification:

Sodium hyaluronate - laboratory		
Appearance	white powder	
pH	5.0–8.5	0.5% aqueous solution
Sodium hyaluronate	93.0-105.0%	spectrophotometry
Total microbial count	≤ 10 CFU/g	
Bacterial endotoxins	≤ 0.05 IU/mg	
Proteins	≤ 0.1%	
Sterility	non sterile	
Molecular weight (kDa)	according to request	SEC-MALLS

Available MW ranges (kDa)		
8-15	130–300	1250–1500
15-30	300–500	1500–1750
30-50	500–750	1750–2000
50-90	750–1000	2000–2200
90-130	1000–1250	2200–2400

Storage:

Store in originally sealed packaging. If not used immediately after opening, avoid high humidity and UV light exposure. Store refrigerated (2-8 °C). Temperatures up to 40 °C during transport (short term only) do not affect the product.

Shelf-life:

This material is supplied with a minimum remaining shelf-life of 12 months.

Packaging:

Glass vial. 1 gram.

Price:

EUR 145/1 g

Notice:

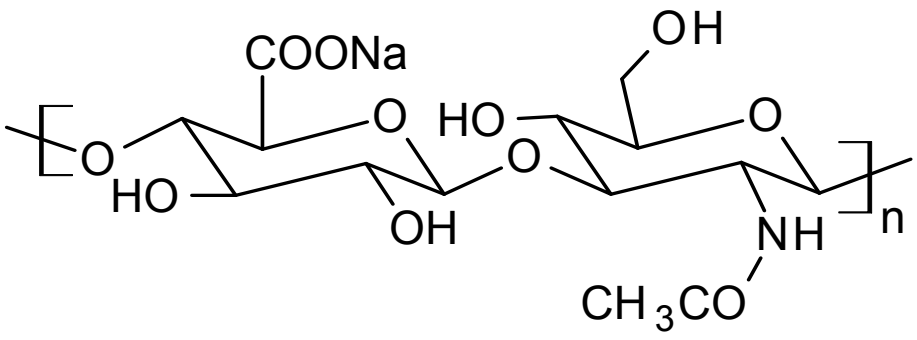
This product is intended primarily for R&D purposes and is not to be used for any other purposes, including but not limited to in vitro diagnostic purposes, foods, drugs, medical devices or cosmetics for humans or animals, or for commercial purposes.

Sodium hyaluronate – technical

Synonyms:

Hyaluronan, hyaluronic acid

Structural formula:



Source:

Produced biotechnologically (fermentation of bacterial strain Streptococcus equi susp. zooepidemicus). Non-animal. Non GMO.

Solubility:

- Completely soluble in water. The speed of dissolution depends on the molecular weight (MW). The lower the MW, the faster the dissolution.
- Soluble in alcohol-water mixture up to a concentration of approximately 50% alcohol (depending on the alcohol type and the MW of the sodium hyaluronate).
- Insoluble in aprotic solvents.

Compatibility and processing:

- Product is relatively stable. Changes in MW occur when heating or at extreme pH values (higher MW, lower stability).
- Very sensitive to free radicals.
- Forms non-soluble salts with amphiphilic cationic substances (e.g. cationic detergents) and high MW positively charged substances (chitosan, quaternized polymers, some proteins).
- Sterilization of solutions by autoclaving (all MWs, the higher the MW, the greater the drop in MW during sterilization) or by filtration (the possibility of sterilizing the filter depends on the solution concentration and MW).

Specification:

Sodium hyaluronate - technical		
Appearance	white powder	
pH	5.0–8.0	0.5% aqueous solution
Sodium hyaluronate	> 93%	spectrophotometry
Molecular weight (kDa)	according to request	SEC-MALLS

Available MW ranges (kDa)		
8-15	130–300	1250–1500
15-30	300–500	1500–1750
30-50	500–750	1750–2000
50-90	750–1000	2000–2200
90-130	1000–1250	2200–2400

Storage:

Store in originally sealed packaging. Avoid high humidity and UV light exposure, if not used immediately after opening. Store refrigerated (2-8 °C). Temperatures up to 40 °C during transport (short term only) do not affect the product.

Shelf-life:

This material is supplied with a minimum remaining shelf-life of 12 months.

Packaging:

Glass vial. 1 gram.

Price:

EUR 40/1 g

Notice:

This product is intended primarily for R&D purposes and is not to be used for any other purposes, including but not limited to in vitro diagnostic purposes, foods, drugs, medical devices or cosmetics for humans or animals, or for commercial purposes.

HYALURONAN TAILORED TO YOUR NEEDS

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