VORNIA BIOMATERIALS

Certificate of Analysis for Methacrylated Hyaluronic Acid

PRODUCT CODE: HA-MA010 **LOT NUMBER: HAMA-01/16**

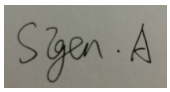
EXPIRY DATE: 09/2017

Quality Control Analysis

Characteristic	Specification	Result
Degree of substitution for methacrylated HA [%]	>40%	51%
methacrylate content [mmol/g]	0.7-1.2 mmol/g	0.96 mmol/g
Purity [%]	>95%	98%
pH after rehydration in PBS	Neutral (6.5-7.5)	6.8
Appearance	White foam / powder	White foam
Water solubilisation time [min]	Should dissolve within 30 minutes	20 min under vortex

NOTE: This product is packaged in 2 mL clear glass vials under argon. Do not expose to air until use as crosslinking will begin spontaneously.

Name: Sigen A

Signature: 

Date: 16.08.2016

Vornia Bio-inks:

Note:

Vornia Bio. Ltd. supplies two kinds of hyperbranched PEG-based multi acrylate polymers (HB-PEG-MAP): ***HB-PEG-MAP-A*** **(10K HB-PEG-MAP-A with more than 10 arms and 20K HB-PEG-MAP-A with more than 20 arms) for fabricating chemical crosslinked hydrogels (in combination with Vornia's thiolated nature-derived biopolymers)** and ***HB-PEG-MAP-B*** **(10K HB-PEG-MAP-B with more than 10 arms and 20K HB-PEG-MAP-B with more than 20 arms)** for UV fast curing hydrogels. Both of the two gelation systems possess good biocompatibility, excellent mechanical properties as well as fast and tunable gelation time (seconds to minutes) which make our polymers very promising materials for 3D-bioprinting.

Moreover, the molecular weight, branching degree and acrylate content of the polymers can be easily adjusted to meet the diversified demands of customers and co-operators.

Vornia Bio. Ltd. also supplies different types of nature-derived biopolymers:

High Mw thiolated hyaluronic acid (***HA-SH-High Mw***)

Low Mw thiolated hyaluronic acid (***HA-SH-Low Mw***)

Thiolated Gelatin type B (***Gel-SH***)

Methacrylated hyaluronic acid (***HA-MA***)

The substitution degree of functional group can be adjusted which can regulate the crosslinking degree, gelation time and stiffness of the hydrogel.

Soft Type Materials:

Gelation systems:

1. Chemical Cross linking Hydrogel System:

Gelation system	Component	Final Concentration	Properties
A	HB-PMAP-A	5-15%	Fast gelling, good cell compatibility
	HA-SH (high and low Mw)	0.5-1%	
B	HB-PMAP-A	5-15%	Fast gelling, good cell compatibility and cell adhesion
	Gelatin-SH (type B)	5-10%	

2. UV Curable Hydrogel System:

Gelation system	Component	Final Concentration	Properties
C	HB-PMAP-B	10-15%	Fast gelling, excellent mechanical performance
	Initiator (2959)	0.1%-1% (w/w)	
D	HA-methacrylate	5-10%	Fast gelling, excellent mechanical performance
	Initiator (2959)	0.1%-1% (w/w)	

<u>Nature-derived biopolymers:</u>

1. **Thiolated HA**

Materials	Degree of substitution (%)	Free thiol fraction (%)	Free thiol content
HA-SH-High Mw	50-60%	50-60%	1.0-1.2 mmol/g
HA-SH-Low Mw	60-80%	60-80%	1.2-1.6 mmol/g

2. **Thiolated Gelatin**

Materials	Degree of substitution (%)	Free thiol content
Gelatin-SH (type B)	50-57%	0.57 mmol/g

3. **Thiolated Gelatin**

Materials	Degree of substitution (%)	Free MA content
HA-MA	40%	0.92 mmol/g