

1- Identification

**Product Identifier:** Crosslinker

**Product Description:** Crosslinker is a chitosan-based crosslinker which promotes crosslinking and stability for constructs. This product is a combination of three solutions: Calcium chloride solution, chitosan solution, and thrombin solution. Component A is made using Calcium chloride and Thrombin, and Component B is made from chitosan derived from shrimp and crab shells and  $\beta$ -glycerophosphate.

**Other Means of Identification:**

**Recommended Use:** Recommended for bioprinting in a laboratory setting. Recommended for research purposes. Manufactured under sterile conditions.

**To Prepare:** Let Component A and Component B thaw at 4°C. Once completely thawed, add Component B to Component A. Use within 7 days for best results.

**Restrictions on Use:** For research use only. Not recommended for *in vivo* use for humans or animals.

**Canadian Supplier Identifier:** c/o Axolotl Biosciences, Coast Capital Innovation Centre, University of Victoria, 3800 Finnerty Road, Victoria BC, V8W 2Y2

**Emergency Telephone Number (and any restrictions on the use of that number, if applicable):** \_\_\_\_\_

2- Hazard Identification


**GHS/WHMIS 2015 Classification**

Solution	Hazard Classification	Hazard Statements	Precautionary Statements
Component A	Skin Irritation (Category 2); Eye Irritation (Category 2)	H315; H319	P264; P280; P302+P352; P305+P351+P338; P332+P313; P337+P313; P362 + P364
Component B	Short-Term (Acute) Aquatic Hazard (Category 2)	H401	P273; P501

**COMPONENT B**

**Hazard Classification:**

**Label Elements**

**Symbol:** 

**Signal Word:** None

**Hazard Statements:** Toxic to aquatic life.

**Precautionary Statements:** Avoid release to the environment (P273).

**Response:** Dispose of contents/ container to an approved waste disposal plant (P501).

**Other Hazards:** No data available.

THROMBIN:

**Hazard Classification:**

**Label Elements**

**Symbol:**



**Signal Word:** None

**Hazard Statements:**

**Precautionary Statements:** Wash hands thoroughly after using (P264); Wear protective gloves/ eye protection/ face protection (P280); Take off contaminated clothing and wash it before reuse (P362 + P364).

**Response:**

IF ON SKIN: wash with plenty of soap and water (P302 + P352).

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing (P305+P351+P338).

IF SKIN IRRITATION OCCURS: Get medical advice/ attention (P332 + P313).

IF EYE IRRITATION PERSISTS: Get medical advice/ attention (P337 + P313).

**Other Hazards:** No data available.

### 3- Composition/Information of Ingredients

Common Name	Synonym	Formula	Molecular Weight	CAS Registry Number	Additives
β-glycerophosphate	Glycerophosphate disodium salt hydrate	$C_3H_7Na_2O_6P \cdot xH_2O$	216.04 g/mol	154804-51-0	Distilled Water
Calcium chloride	-	$CaCl_2$	110.98g/mol	10043-52-4	Tris Buffer Solution (TBS)

Chitosan	2-Amino-2-deoxy-(1→4)-β-D-glucopyranan Poly-(1,4-β-D-glucopyranosamine) Poly-(1→4)-β-D-glucosamine Deacetylated chitin	C <sub>6</sub> H <sub>11</sub> NO <sub>4</sub>	50,000-190,000 g/mol	9012-76-4	1% Acetic acid
Thrombin	Factor IIa	C <sub>12</sub> H <sub>10</sub> ClN <sub>3</sub> S	36,000 g/mol	9002-04-4	TBS

4- First Aid Measures

**First Aid Measures by Route of Exposure:**

**Inhalation:** If breathing difficulties occur, move person to fresh air and consult a physician.

**Skin Contact:** Flush exposed skin with water and consult a physician. Wash contaminated clothing before reuse.

**Eye Contact:** Flush eyes with water and consult a physician.

**Ingestion:** Rinse mouth with water. Do not give anything by mouth if person is unconscious. Consult a physician.

**Most important symptoms and effects (acute or delayed):** Data not available.

**Immediate medical attention and special treatment, if necessary:** If inhaled or ingested, or contact with skin or eyes occur, consult a physician.

5- Firefighting Measures

**Suitable extinguishing media:** Water, Class A Fire extinguisher, alcohol resistant foam, dry chemical or carbon dioxide.

**Unsuitable extinguishing media:** Data not available.

**Specific hazards arising from the hazardous product (e.g., hazardous combustion products):** Component A may produce Hydrogen chloride gas and Calcium oxides. Component B may produce Carbon oxides, Phosphorus oxides, Nitrogen oxides, and Sodium oxides.

**Special protective equipment and precautions for fire-fighters:** Wear self-contained breathing apparatus.

6- Accidental Release Measures

**Personal precautions, protective equipment and emergency procedures:** Avoid inhaling and contact to eyes and skin.

**Methods and materials for containment and cleaning up:** Wipe spilled crosslinker with paper towel and dispose in appropriate biohazardous waste container. Sanitize area with 70% ethanol after spill is cleared.

## 7- Handling and Storage

**Precautions for safe handling:** Use in ventilated area away from open flames.

**Conditions for safe storage (including incompatible materials):** Keep contents separate when stored frozen. After mixing, use bioink within one hour for best results.

## 8- Exposure Controls: Personal Protection

**Control parameters, including occupational exposure guidelines or biological exposure limits and the source of those values:** Data not available.

**Appropriate engineering controls:** Data not available.

**Individual protection measures (e.g. personal protective equipment):** Wear gloves and lab coat when using. When working with cells, wear a mask to avoid contamination to constructs and bioprint in sterile conditions.

## 9- Physical and Chemical Properties

**Appearance (physical state, colour, etc.):** Transparent liquid

**Odour:** Odourless

**Odour threshold:** Data not available.

**pH:** 7.4 – 7.6

**Melting point/Freezing point:** Data not available.

**Initial boiling point/boiling range:** Data not available.

**Flash point:** Data not available.

**Evaporation rate:** Data not available.

**Flammability (solid; gas):** Data not available.

**Lower flammable/explosive limit:** Data not available.

**Upper flammable/explosive limit:** Data not available.

**Vapour pressure:** Data not available.

**Vapour density:** Data not available.

**Relative density:** Data not available.

**Solubility:** Data not available.

**Partition coefficient - n-octanol/water:** Data not available.

**Auto-ignition temperature:** Data not available.

**Decomposition temperature:** Data not available.

**Viscosity:** Data not available.

## 10- Stability and Reactivity

**Reactivity:** Data not available.

**Chemical stability:** Stable under recommended storage conditions.

**Possibility of hazardous reactions:** Data not available.

**Conditions to avoid (e.g., static discharge, shock, or vibration):** Data not available.

**Incompatible materials:** Do not freeze crosslinker after mixing. Do not freeze bioink and crosslinker together. Frozen crosslinker will cause solutions to precipitate and become unusable.

**Hazardous decomposition products:** Data not available.

## 11- Toxicological Information

**Information on the likely routes of exposure (inhalation, ingestion, skin and eye contact):** Data not available.

**Symptoms related to the physical, chemical and toxicological characteristics:** Data not available.

**Delayed and immediate effects, and chronic effects from short-term and long-term exposure:** Data not available.

**Numerical measures of toxicity, including acute toxicity estimates (ATEs):**      Component A: 2  
   Component B: 2

## 12- Ecological Information

**Ecotoxicity:**

## COMPONENT B:

Common Name	LC50	EC50	Scientific Name	Length of Time (hours)	Notes
Rainbow Trout	1.73mg/L	-	Oncorhynchus mykiss	96	-
Water Flea	-	13.69mg/L	Daphnia pulex	48	Includes Toxicity to Other Aquatic Invertebrates

**Persistence and degradability:** Data not available.

**Bioaccumulative potential:** Data not available.

**Mobility in soil:** Data not available.

**Other adverse effects:** Data not available.

13- Disposal Considerations
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**Information on safe handling for disposal and methods of disposal, including any contaminated packaging:** Dispose according to biohazardous waste disposal protocols. If contaminated, dispose of product. Do not use if contaminated.

14- Transport Information
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**UN number:**

**UN proper shipping name:**

**Transport hazard class(es):** Not dangerous goods.

**Packing group:**

**Environmental hazards:** Data not available.

**Transport in bulk, if applicable:**

**Special precautions:** Ship on dry ice. Immediately store contents between -20°C and -30°C.

15- Regulatory Information
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**Safety, health and environmental regulations specific to the product:** Data not available.

**Date of Latest Revision of SDS:** 17-NOV-2020

