HYDROTECH INX© X200

HYDROTECH INX© X200 is the first biocompatible hydrogel resin enabling two-photon polymerization induced printing from the micro- to the meso- scale.

It is a ready-to-use liquid synthetic resin for the fabrication of bioinert hydrogel structures with ISO 10993-5 certified biocompatibility.

The highly reactive strong and flexible material enables printing of macrostructures with micrometer precision, which makes it suitable for a whole range of biologicial applications.

APPLICATIONS

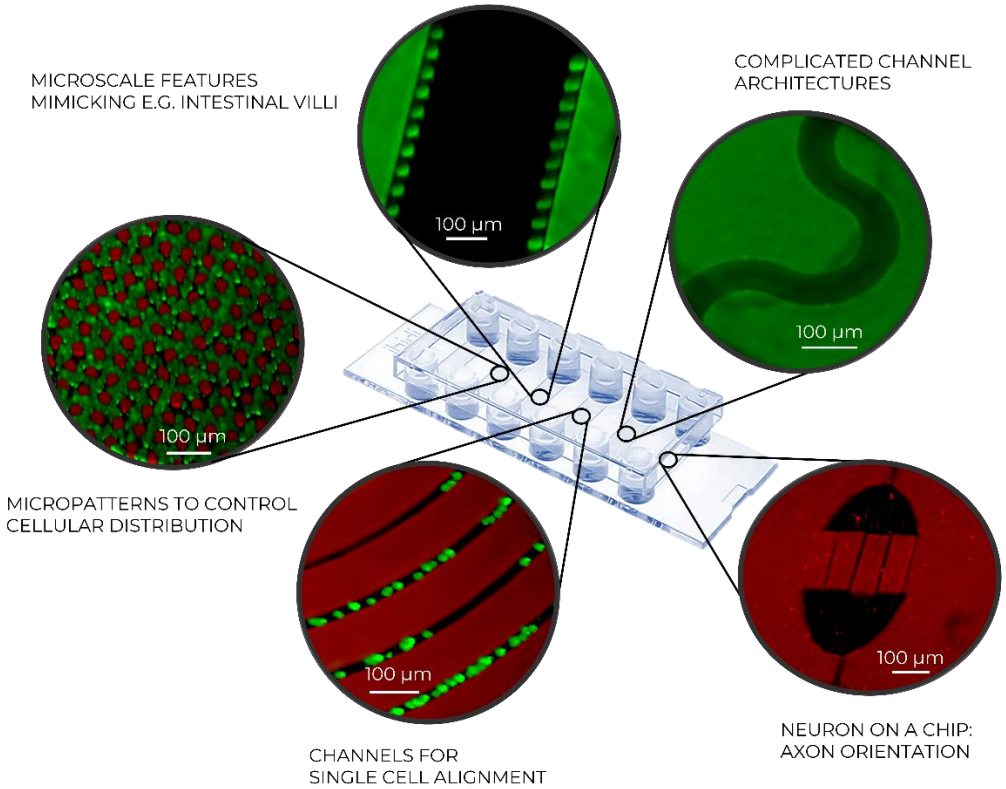

Figure 1: Printed structures inside a microfluidic chip for organ-on-chip applications: (clockwise from top): 'Microchannel containing microvilli; complicated microchannel architectures; cell sieve allowing axon orientation for neuron-on-chip; micro-channels containing HT-1080 fibroscarcoma single cells allowing for cellular orientation; cell-inert micropatterns providing control over cell density and orientation (HT-1080 fibrosarcoma cells).

Thanks to the bio-inert nature, ISO certified (10993-5) biocompatibility and mechanical robustness, the hydrogel is ideal for organ-on-chip applications, where cell interactivity is undesired (e.g. inside the channels) (Figure 1). Additionally, the liquid state of the resin enables straightforward injection of the material in microfluidic chips prior to printing in combination with efficient dissolution of uncrosslinked material after printing.

The high reactivity and easy processing allow for versatility in chip design (Figure 1). This includes the development of complicated channel architectures and the generation of cell 'entrapment' areas to position cells exactly at the site of the readout sensor of the chip. Additionally, when this cell positioning is combined with channels with subcellular dimensions, cell sprouting can be controlled. This can for example be applied for axon orientation in neural tissue engineering. Additionally, the high architectural control also allows for the generation of channels with (sub-)cellular dimensions, enabling specific cell alignment and/or control over cellular distribution (e.g. for HT 1080 fibrosarcoma cells as demonstrated in Figure 1). Additionally, by printing channels with single cell dimensions, seperation of single cells from spheroid cultures can be performed.

What's more, the viscous resin enables the generation of complicated chip designs with microfeatures at subcellular resolutions to mimic natural architectures such as liver lobules or intestinal villi on chip inside a microfluidic channel (Figure 1).

Finally, additional complexity can be added by combining the material with cell-encapsulating resins such as HYDROBIO INX© X400 in a two-stage printing process, for the generation of complicated 3 dimensional cell cultures containing areas with high and low cell densities. Thanks to the robust but flexible nature of HYDROTECH INX© X200, it can form the ideal support to scaffolds (Figure 2).

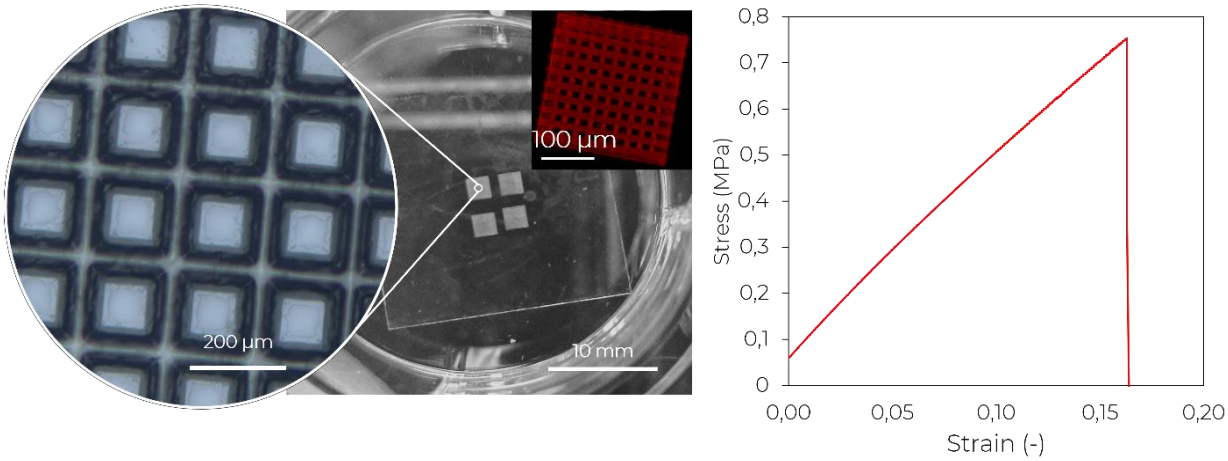

Figure 2: HYDROTECH INX© X200 macro-scaffolds providing structural support to tissue engineering constructs, thanks to its robust, but flexible mechanical properties.

HYDROTECH INX© X200

PROPERTIES & PROCESSING

HYDROTECH INX© X200 is a viscous liquid at room temperature which provides easy and fast processing. Stable structures can be printed using scanning speeds up to 600 mm/s using different objectives (i.e. 10X, 25X, ...). Additionally, thanks to its liquid nature, in combination with the absence of volatile components, it allows for long hanging droplet printing processes thereby expanding the maximum dimensions of structures up to 20 mm in height with micrometer resolutions.

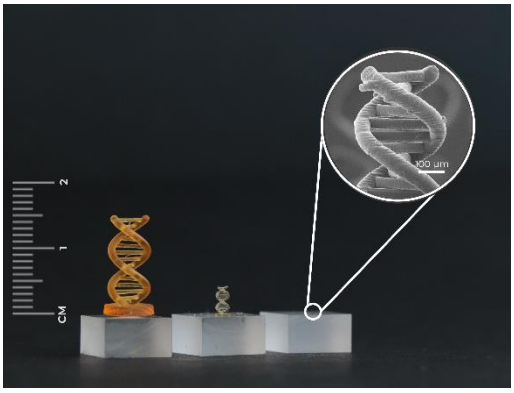

Figure 3: First hydrogel resin enabling multiscale printing from micro- to meso-scale

Complex and open geometries can easily be printed thanks to its mechanical robustness. The resulting flexible structures can recover their original shape as seen from the compress-release cycles, illustrated in Figure 4.

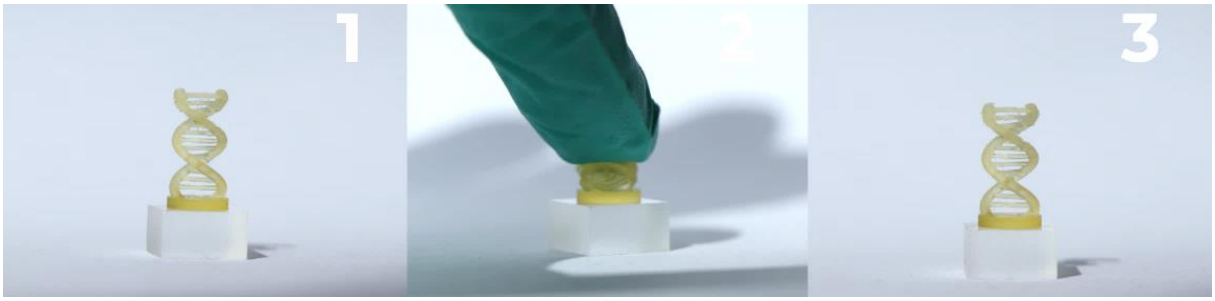

Figure 4: The 3D printed DNA structure (1) compressed (2) and recovered after stress release (3)

Thanks to the low water absorption capacity (60 to 80 % over its dry weight), the printed structures do not undergo large structural deformations after hydration in aqueous media.

Physical Properties	HYDROTECH INX© X200
Appearance	Orange-red viscous liquid
Viscosity	1 - 10 Pa.s
Refractive index	1.46 – 1.48
Degree of swelling (%)	60 - 80
Young's modulus*	3 - 4 MPa
Storage modulus after crosslinking	200 - 1200 kPa

* In equilibrium swollen state

HYDROTECH INX© X200

BENEFITS

✓	Biocompatibility	No toxic effect after printing (ISO 10993-5 CERTIFIED)
✓	Bio-inert	Non-cell-interactive material
✓	Throughput	High throughput thanks to high reactivity
✓	Processability	Micro- and macro-scale structures with good shape fidelity
✓	Mechanical integrity	Soft and flexible hydrogel
✓	Stability	Non-degradable hydrogel suitable for long term applications
✓	Easy to handle	Provided as ready-to-print formulation in amber vials
✓	Reproducibility	Production under strict quality control

PRODUCT FAMILY

	Organic - Inorganic Hybrids	HYDROTECH INX© X100	HYDROTECH INX© X200
Strength	✓✓	✓✓	✓
Flexibility	✗	✓	✓✓
Hydrogel	✗	✓	✓
Biocompatibility	✗	✓	✓
High Resolution	✓	✓	✓
High Reactivity	✓	✓	✓
Dip in Laser Lithography	✓	✗	✓

3D PRINTER COMPATIBILITY

Our MPL bioinks can be used with a range of MPL systems. HYDROTECH INX© X200 has already been validated on:

- ✓ Nanoscribe Photonic Professional GT2
- ✓ Nanoscribe Quantum X Bio
- ✓ Upnano NanoOne
- ✓ Upnano NanoOne Bio

If you would like to discuss your printer's compatibility with our bioinks, please contact us at info@bioinx.com