



Easier printing with gelatin

## X ABOUT XPECT INX®

XPECT INX® develops and commercializes industry-leading biomaterials for 3D-bioprinting applications. With more than 20 years of experience in bio-ink development, XPECT INX® develops and offers a wide range of ready to use bioinks for different 3D-printing technologies, including 2PP, DLP and deposition-based 3D-printing.

By developing and supplying exceptional quality bioinks and biomaterials, we support our customers in bringing their tissue engineering and regenerative medicine applications to clinical reality. Our bioink products can be used in a broad range of biofabrication applications, including tissue, bone and organ regeneration, personalized drug screening, and organ-on-a-chip technologies.

For more information on the company and our products, see [xpect-inx.com](http://xpect-inx.com).

## X EASYGEL INX®

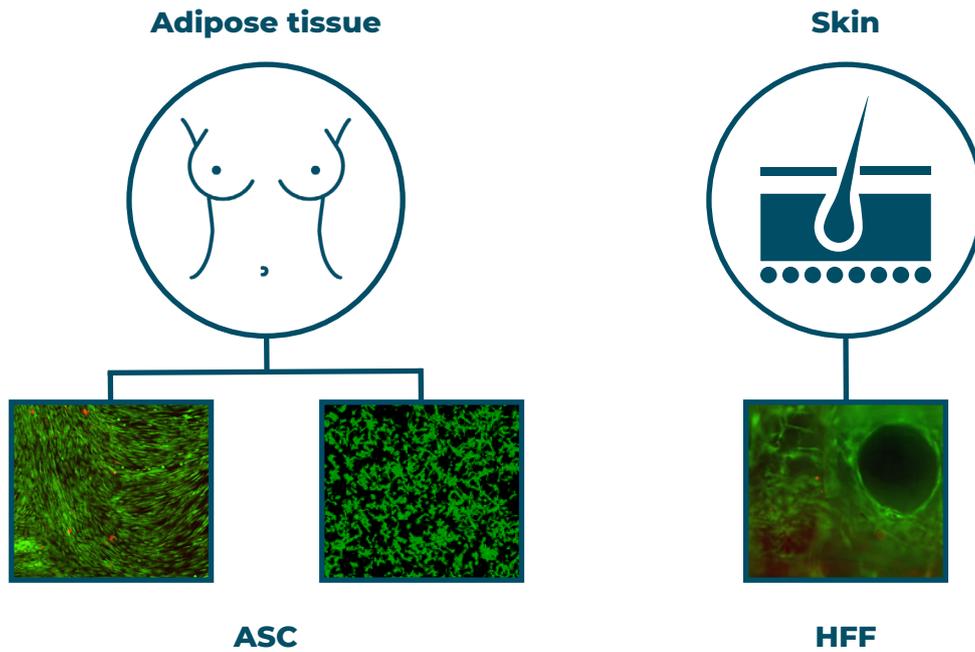


X EASYGEL INX® is a gelatin-based, shear thinning, cell-interactive ECM-mimicking ink. It provides all the benefits of gelatin with the addition of shear thinning behaviour, thereby allowing easy printing at 37 °C.

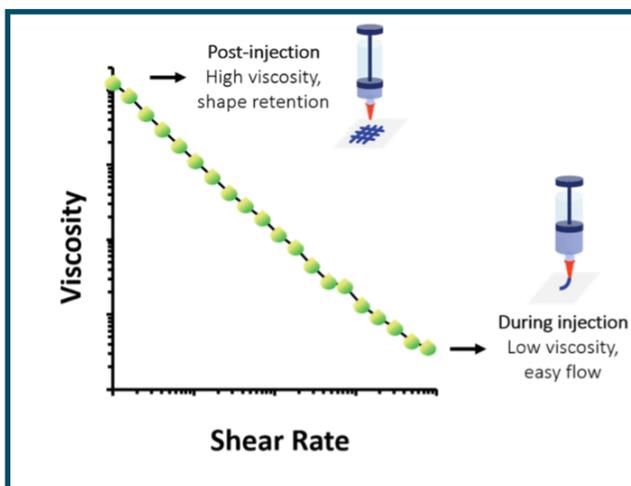
Based on gelatin derived from natural collagen, X EASYGEL INX® has been modified with photo-crosslinkable functional groups meaning that it can be printed with unprecedented efficiency. It resembles the natural ECM and has exceptionally high cell viabilities.

## X BIOLOGICAL APPLICATIONS

X EASYGEL INX<sup>®</sup> has been used to generate and sustain 3D cellular structures of a variety of human tissues, including adipose stem cells (ASC), and human foreskin fibroblasts (HFF). For more information on the biological applications of X EASYGEL INX<sup>®</sup> and the parameters used to generate these 3D cellular structures, contact us on [info@xpect-inx.com](mailto:info@xpect-inx.com).

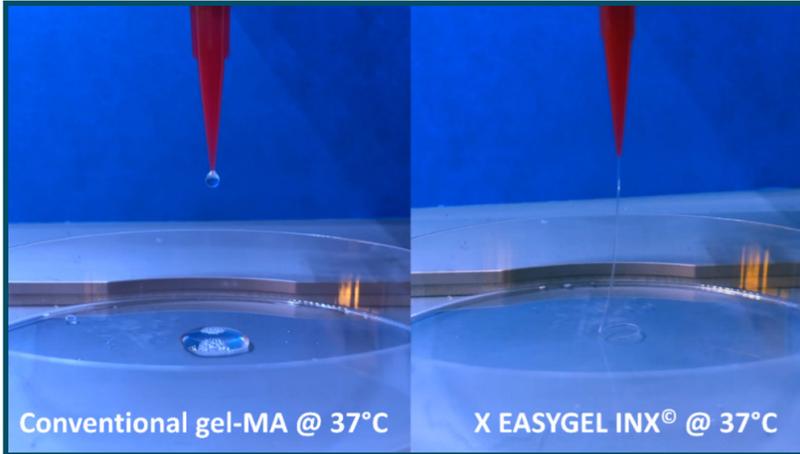


X EASYGEL INX<sup>®</sup> combines all the benefits of conventional gelatin/Gel-MA based inks in combination with a highly improved printing process thanks to its shear thinning behavior, as shown in Figure 1. At high shear rates, it exhibits a low viscosity which allows easy injection from the printing nozzle. However, at low shear rates it has a high viscosity, which is required for shape retention after deposition. As a result, it can be printed in a straightforward and reproducible way at 37°C both in the presence or absence of cells (Figure 2). In this respect, it overcomes the narrow processing range limitations associated with printing a conventional Gel-MA based ink.



**Figure 1:** Typical flow curve for a shear thinning fluid: A decreasing viscosity profile as a function of shear rate indicates a shear-thinning behavior.

Since X EASYGEL INX<sup>®</sup> is gelatin-based it is characterized by all the favourable gelatin properties including cell interactivity, biodegradability and the potential for cell encapsulation with high viability. Therefore, it acts as an ideal mimic of the natural extracellular environment, making it suitable for a range of tissues in combination with unprecedented processing ease. After printing, the material can be photo-crosslinked, resulting in a physiologically stable hydrogel.



**Figure 2:** Comparison of flow behavior of X EASYGEL INX<sup>®</sup> vs conventional Gel-MA based inks at 37°C.

## X EASYGEL INX<sup>®</sup> PROPERTIES & PROCESSING

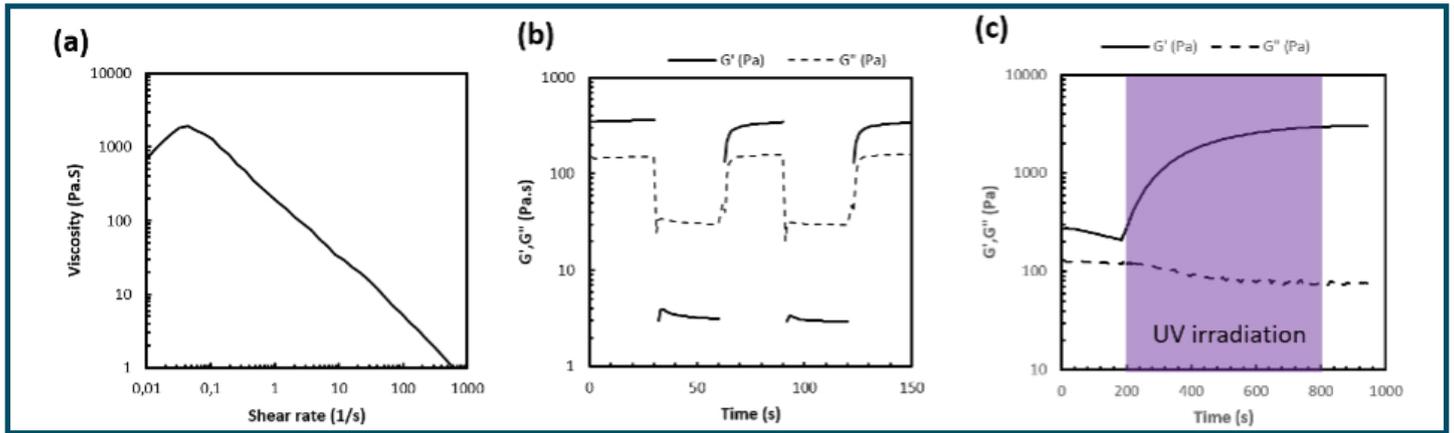
X EASYGEL INX<sup>®</sup> is a transparent gel at room temperature. The physical characteristics of the product are listed in Table 1.

X EASYGEL INX<sup>®</sup> reveals a shear-thinning behavior as shown in Figure 3 (a). This is favorable for extrusion-based 3D printers as the printing ink should easily be injected through the printing nozzle and the post-injection flow should be minimized in order to prevent structural deformation. These properties are very rarely seen in conventional gelatin-based inks, making their processing rather complicated.

Physical Properties	Unit	Result
pH	-	7.0 – 8.0
Viscosity ( $\dot{\gamma} = 0.01 \text{ s}^{-1}$ )	Pa.s	500 – 900
Viscosity ( $\dot{\gamma} = 554 \text{ s}^{-1}$ )	Pa.s	1 – 2
Storage modulus	kPa	2.5 – 3.5

**Table 1:** Physical properties of X STABLE INX<sup>®</sup>.

To enable an optimal printing process ensuring shape fidelity, an ink should not only exhibit shear-dependent viscosity, but also its viscosity must exhibit a rapid decrease and rapid recovery upon an instant change in the shear conditions. After ejecting from the printing needle, an ink solution should regain its viscosity quickly upon deposition on the printing surface. The rate of viscosity recovery was studied via rotational step shear tests at shear rates of 0.1 s<sup>-1</sup>, 100s<sup>-1</sup> and 0.1 s<sup>-1</sup> in the sequential order. As seen in figure 3 (b), X EASYGEL INX<sup>®</sup> exhibits a rapid mechanical recovery when the external forces are removed.



**Figure 2:** (a) Flow curve of X EASYGEL INX<sup>®</sup> as a function of shear rate, (b) Storage and loss modulus of X EASYGEL INX<sup>®</sup> tested in transient shear rate conditions and (c) storage and loss moduli of X EASYGEL INX<sup>®</sup> recorded via a rheometer during UV irradiation.

X EASYGEL INX<sup>®</sup> is photo-curable, and therefore the structures can be illuminated with UV irradiation during or after the printing process. After switching on the UV light source, the ink exhibits a fast-crosslinking reaction as indicated by the steep increase of storage modulus (Figure 3 (c)). At the end of the irradiation process, the ink reached a storage modulus of approximately 3 kPa. This allows for sufficient mechanical integrity while being ideal for soft tissue culture.

## BENEFITS OF X EASYGEL INX<sup>®</sup>

- Easy Printing:** Shear thinning behavior enables easy deposition at 37°C.
- Biodegradability:** Enables cellular remodeling of the printed matrix.
- Easy Handling:** Delivered in a ready-to-use cartridge.
- UV-Curable:** Efficient UV-based crosslinking.
- Reproducibility:** Production under strict quality control.

	Conventional Alginate-based Bioink	Conventional gel-MA based Bioink	XEASYGEL INX <sup>®</sup>
Printing at 37°C	✘	✘	✔
Cell-interactive	✘	✔	✔
Biodegradability	✘	✔	✔
Biocompatibility	✔	✔	✔
Shear-thinning	✔	✘	✔
Hydrogel	✔	✔	✔

**Table 2:** Typical benefits of X EASYGEL INX<sup>®</sup> over conventional bioinks.

## X PRINTER COMPATIBILITY

Our bioinks have been used repeatedly and successfully with the following printers:

-  Regemat 3D
-  FelixBio
-  Cellink BIO X



The R100 range is optimized for the Regemat 3D printer, the F100 range is optimized for the FelixBio printer and the X100 is the generic range which works on many printers, including the Cellink BIO X. If you would like to discuss your printer's compatibility with our bioinks, please contact us at [info@xpect-inx.com](mailto:info@xpect-inx.com).

## X PRODUCT SUPPORT & PRICING

To discuss your product needs and pricing, email us at [info@xpect-inx.com](mailto:info@xpect-inx.com) or use the contact form at [xpect-inx.com/contact-2](https://xpect-inx.com/contact-2)