EASYGEL INX© X100

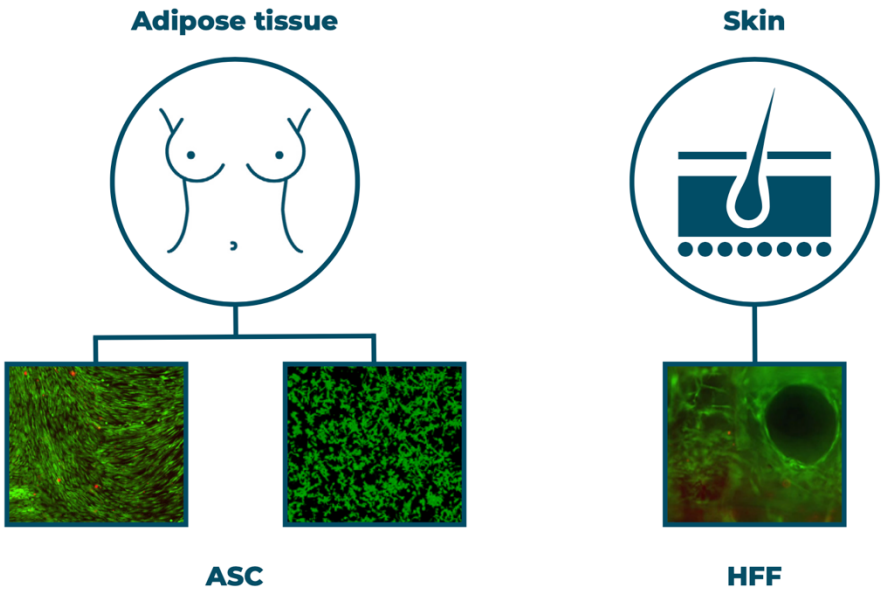
Easier printing with gelatin

EASYGEL INX© X100 is a gelatin-based, shear thinning, cell-interactive, extracellular matrix (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 EASYGEL INX© X100 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.

BIOLOGICAL APPLICATIONS

EASYGEL INX© X100 has been used to generate and sustain 3D cellular structures of a variety of human tissues, including adipose derived stem cells (ASC), and human foreskin fibroblasts (HFF). For more information on the biological applications of EASYGEL INX© X100 and the parameters used to generate these 3D cellular structures, contact us on info@xpect-inx.com



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EASYGEL INX© X100 combines all the benefits of conventional gelatin/Gel-MA based inks with a highly improved printing process thanks to its shear thinning behavior. 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 1). In this respect, it overcomes the narrow processing range limitations associated with printing a conventional Gel-MA based ink.

Conventional Gel-MA at 37°C vs. EASYGEL INX© at 37°C

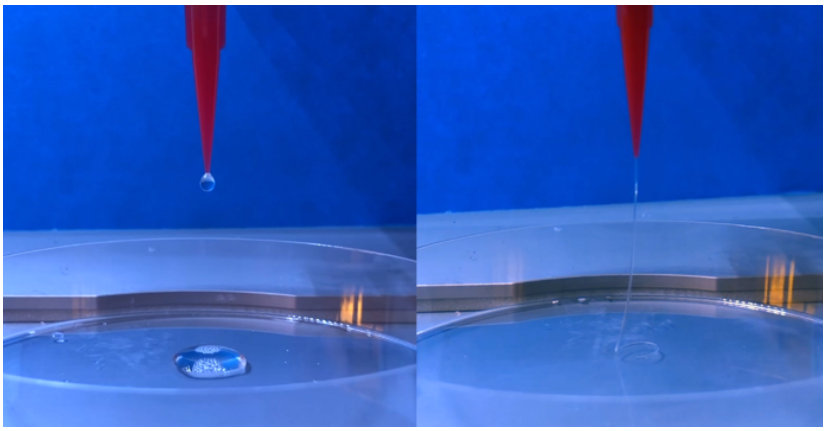

Figure 1: Comparison of flow behavior of EASYGEL INX© X100 vs conventional Gel-MA based inks at 37°C.

Since EASYGEL INX© X100 is gelatin-based, it is characterized by all the favourable gelatin properties including cell interactivity, biodegradability and the potential for cell encapsulation with high cell 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.

BENEFITS OF EASYGEL INX© X100

✓	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.

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Table 1: Typical benefits of EASYGEL INX© over conventional bioinks

	Conventional Alginate-based Bioink	Conventional gel-MA based Bioink	EASYGEL INX©
Printing at 37°C	✗	✗	✓
Cell-interactive	✗	✓	✓
Biodegradability	✗	✓	✓
Biocompatibility	✓	✓	✓
Shear-thinning	✓	✗	✓
Hydrogel	✓	✓	✓

PROPERTIES & PROCESSING

EASYGEL INX© X100 is a transparent gel at room temperature. The physical characteristics of the product are listed in Table 2.

EASYGEL INX© X100 reveals a shear-thinning behavior as shown in Figure 2 (a). 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. This is favorable for extrusion-based 3D printers as the 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.

Table 2: Physical properties of EASYGEL INX© X100

Physical Properties	EASYGEL INX© X100
pH	6.5 – 8.5
Viscosity (low shear) (Pa.s)	200 – 2500
Viscosity (high shear) (Pa.s)	0.1 – 1
Storage modulus after UV crosslinking (kPa)	2 – 6

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^{-1}, 100s^{-1} and 0.1 s^{-1} in the sequential order. As seen in Figure 2 (b), EASYGEL INX© X100 exhibits a rapid mechanical recovery when the external forces are removed.

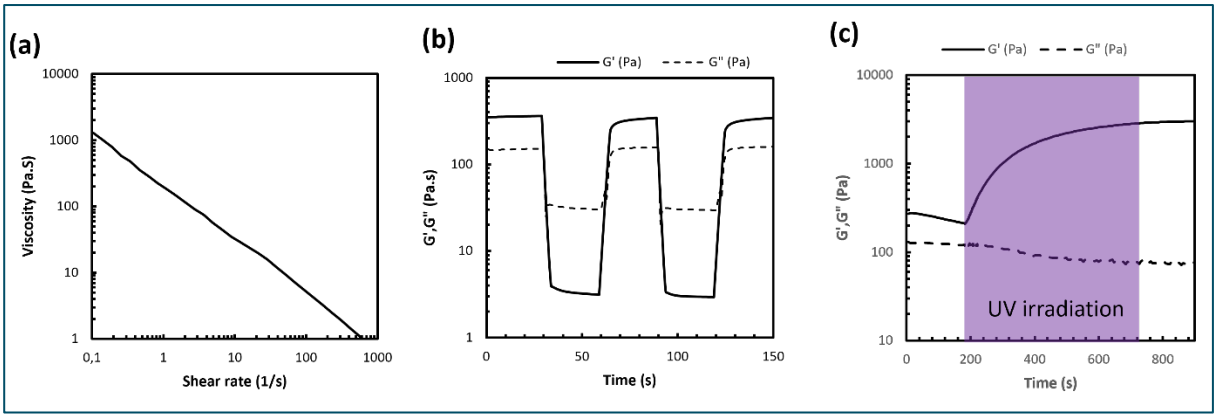

Figure 2: (a) Flow curve of EASYGEL INX© X100 as a function of shear rate, (b) Storage and loss modulus of EASYGEL INX© X100 tested in transient shear rate conditions and (c) storage and loss moduli of EASYGEL INX© X100 recorded via a rheometer during UV irradiation.

EASYGEL INX© X100 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 2 (c)). At the end of the irradiation process, the ink reached a sufficient storage modulus for mechanical integrity while being ideal for soft tissue engineering.

3D PRINTER COMPATIBILITY

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

- ✓ Regemat3D
- ✓ FelixBio
- ✓ Cellink BIOX

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