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Application Note

CELLINK PCL

Description

Polycaprolactone (PCL) is a biodegradable polyester that has wide applications in the medical field. PCL is hydrophobic and semi-crystalline in nature, with decreasing crystallinity as the molecular weight of the polymer increases. Furthermore, the material exhibits a low melting point of around 60 degrees Celsius. Additionally, the polymer can be mixed with other thermoplastics to generate blended materials. During the synthesis of PCL, different groups can be incorporated during co polymerization. For example, this allows for modulation and acceleration of the degradation kinetics from 2-4 years (molecular weight dependent) in the pure PCL polymer to a more rapid degradation through the incorporation of lactones, or lactic or glycolic acids groups. Regardless, this thermoplastic has great flexibility in both drug delivery and as a scaffolding material for bioprinted constructs.

Application

CELLINK® PCL can support the growth of many cell types on its surface. Additionally, it can be utilized as a scaffolding material that can be impregnated with cells or a hydrogel network to fabricate composite materials. This approach has applications in bone, cartilage, liver, pancreas, and the engineering of other tissues. It can also be used in drug delivery applications and for the generation of model tissues *in vitro*.

CELLINK® PCL can be extruded through both heating and mixing with a solvent. Ensure that the solvent is compatible with the stainless-steel cartridge, plunger, and the tips. It is recommended that PCL powder is loaded into the cartridge as detailed in the *Thermoplastic Printhead Instruction* document.

Storage

CELLINK® PCL should be stored at -20 degrees Celsius. The shelf life of CELLINK® PCL is 1 year unless proper storage conditions are not followed. Ensure the package is sealed and the lid is tight to minimize moisture infiltration.

Solidification

CELLINK® PCL will cool down after printing and solidify. The temperature-controlled bed on the BIO X can be utilized to accelerate or slow down this cooling process. Sintering of PCL filaments is possible if no cells are used in the printing process. If a PCL/solvent mixture

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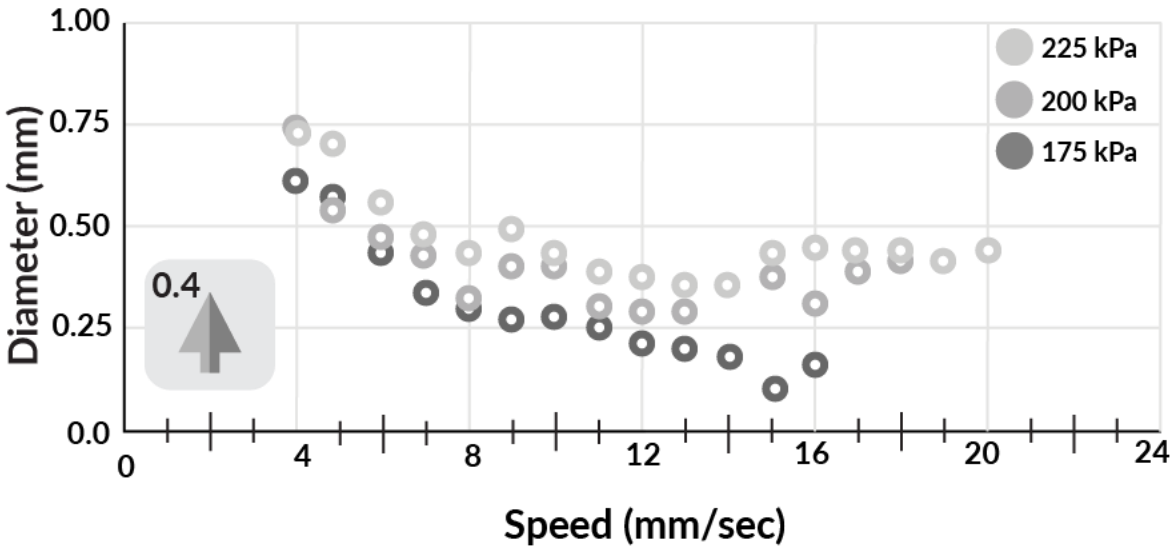
is bioprinted, make sure that the resulting construct is placed in a well-ventilated area to dry and that the solvent is removed prior to seeding with cells.

Printing Parameters

We recommend you use the following parameters during printing of CELLINK® PCL. Layer height should be set at 80% of the nozzle diameter. It is recommended to start with a printing temperature of 180 degrees Celsius. Use the recommended pressures in the chart below.



Printability Observations

CELLINK® PCL can be considered a good nozzle fidelic ink. The resulting filament characteristics is dependent on the layer height, nozzle diameter, pressure, and print speed. Due to the need to fuse filaments of successive layers together, it is recommended to use a layer height that is smaller than the nozzle diameter. This is to allow the filaments to fuse and to account for shrinkage of the layers during the cooling process.

If the PCL is extruding from the nozzle inconsistently, the tip may be dirty. Please wipe the tip with steel wool to remove the excess polymer. If the PCL is turning brown, the temperature is too hot. Lower the temperature or replace the PCL in the cartridge. Flush the nozzle with new PCL from the printer overview page or the utilities menu. It is recommended that the Thermoplastic printhead is preheated for a minimum of 15 minutes prior to bioprinting to ensure the polymer is melted within the cartridge. If necessary, run a calibration script to reoptimize the printing characteristics.

Do not touch the PCL construct until it is completely cooled. Touching too early can deform the structure. If the structure contracts inwards during the printing process, there may be a need for additional cooling between successive layers. Modify the G-code to pause the print for 1 minute between layers to allow solidification of what has been deposited.

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Additional Information

Use CELLINK® PCL in conjugation with our other standardized bioinks such as GelMA and CELLINK® bioink. This biomaterial is an excellent base material for the creation of scaffolds that can resist mechanical loading for the fabrication of a wide range of tissue types.

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