GROWDEX® - AN INNOVATIVE WOOD CELLULOSE-BASED MATRIX FOR 3D CELL CULTURING

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Global businesses – local presence

UPM's sales by market 2016
EUR 9,812 million

- 13% North America
- 63% Europe
- 18% Asia
- 6% Rest of the world

54 production plants in 12 countries
19,300 employees in 45 countries
85,000 shareholders in 40 countries
55,000 suppliers in 70 countries
12,000 customers in 120 countries
External proof of our responsibility

The wood we use and our products are verified by third party certificates and ecolabels.

Our consistent efforts in responsibility have received recognition from several third parties and made us one of the industry leaders in several indices.
Biofuels and biochemicals are natural evolutionary steps in wood based value creation.
Nanocellulose originates from trees
Nanocellulose is a material innovation

- Due to the high specific surface area (small size) and hydrophilicity, the cellulose elementary fibrils, *i.e.* Biofibrils, form a strong hydrogel with water

- Biofibrils have typically very high aspect ratio: the length might be several micrometers while the diameter is in nanometer scale
Key material properties of GrowDex®

- Plant based *i.e.* non-animal based
- Highly viscous *i.e.* high gel force and tunable
- High water retention
- Pseudoplastic - pipettable and injectable in gel format
- Tolerates salts, temperatures and pH (hydrogel pH 6-7)
- Storage and handling in room temperature
- Not autofluorescent
- Semitransparent

- Very low batch to batch variation
- Scalable production at UPM
- Possibility to use in clinical applications
Enabling development of new medical treatments

GrowDex®
cellulose based hydrogel for life science applications

3D Cell Culturing Matrix for e.g. Cancer Research

Membranes for e.g. Wound Care Applications
UPM nanocellulose journey

- **< 2006**
  - UPM makes the first nanocellulose tests

- **2008**
  - UPM establishes Finnish Nanocellulose Centre together with scientific partners

- **2008**
  - First cell culture tests with Helsinki University. UPM starts to build its IPR portfolio

- **2012**
  - First scientific articles related to GrowDex™, research continues

- **2014**
  - Marketing of GrowDex® starts, first fairs and customer tests

- **2015**
  - Several organizations are using and testing GrowDex®. Business is expanding to new applications
UPM Biomedicals - a new life science platform opportunity for future

UPM BIOMEDICALS

CELL CULTURING PLATFORM

WOUND HEALING PLATFORM

OTHER NEW PLATFORMS
RIGHT PEOPLE

RIGHT PLACE

RIGHT TIME

INTRODUCTION  GROWTH  MATURE  DECLINE

RIGHT LEADERSHIP
3D cell culture

- **GrowDex®** supports 3D cell culturing, *e.g.* liver cell, liver cancer cell, ESC, iPSC, etc.

- Published results (by Helsinki University)
  - WA07, human embryonic stem cell line
  - iPS(IMR90)-4, iPS-DF19-9-7T, human induced pluripotent stem cell lines
  - HepG2, human liver carcinoma cell line
  - HepaRG, hepatic progenitor cell line
  - ARPE-19, human retinal pigmented epithelial cell line

- Several other cell types have been tested/are being tested (unpublished)
GrowDex®

1. GrowDex® can simply be mixed with culture media and cells due to its fluid characteristics
2. GrowDex®’s concentration and stiffness can easily be modified to provide optimal environments for different cell types
3. GrowDex® is a continuous gel matrix allowing diffusion of small molecules such as nutrients and oxygen
4. GrowDex® nanofibril network physically resembles human ECM
5. GrowDex® is biocompatible and supports growth of various cell types and e.g. formation of 3D spheroids
6. GrowDex®’s cellulose nanofibril matrix can easily be degraded with cellulase enzyme while retaining the grown cell structure
7. GrowDex® enables hPSC culturing without feeder cells, no genotoxicity found
8. GrowDex® can be used in multidispensers and automatic pipetting systems