I+Med S. Coop. an innovative company in the field of controlled delivery

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Abstract

I+Med, the Company

I+Med is an innovative and technologically company established in 2014 and structured as a cooperative, in the field of development and commercialization of biomedicine solutions based on nanohydrogels for the controlled release of drugs, vitamins, growth factors and other compounds of interest. Within its business objectives, it also intends to develop new production methods, adapted to new technologies. I+Med has an innovative character and can design, develop and manufacture new products in the field of biomedical engineering, thanks to the research expertise of the team and their experience not just in the development of the product and manufacture but also in the quality assurance and medical device certification.

In I+Med we develop our own products and also we develop drug products and medical devices for third parties in the field of encapsulation, vehiculization and controlled release based on our technologies. The company is the owner of two patents about nanogels for biomedical applications, and manufactures medical devices with CE Mark and following the European regulation 2017/745. We are certified and manufacturers by the Spanish Agency of Drugs and Medical Devices (AEMPS).

Competitive Advantages

Development of different types of polymeric matrices that can integrate many properties in one product:

- Time: less recovery time of the patient
- Usability: Easy to use
- Packaging: ergonomic, safe.
- Morphology/structure/formulation: adaptable polymers depending on final application
- Patient/final user: Better recovery, improvement in quality of life
- Ratio cost/profit: profitable.
- controlled release of drugs over conventional pharmacological treatments: greater control of the dose (quantity and frequency), prevents overdoses, increases the effectiveness of the treatment and minimizes the side effects, the periods of treatment and monitoring of the patient and the pharmaceutical expenditure.

Our R+D projects / research lines

Four selected projects are described herein:

1.- Biomimetic nanohydroxyapatite (nHAp): (Fig.1)
   nHAp is a natural mineral produced by the organism. I+Med has applied a synthesis method that mimics the physiologic biosynthesis conditions to get biomimetic nanoparticles avoiding toxic residues. The product will be used as active ingredient with remineralizing and antibacterial properties to be applied in Odontology. The main properties apart from the nanometric size that helps to get better into the inner layers of the enamel, is their spherical shape to increase the biocompatibility.

2.- Long-lasting eye drops: (Fig 2)
   I+Med has developed long-lasting eye drops to treat dry eye syndrome. They are made of a viscoelastic hydrogel formulation with highly mucoadhesive properties that extend the treatment up to 12 hours. These drops have humectant and lubricating properties and also release in a controlled way a natural antiinflammatory ingredient, the ectoin. The innovative packaging avoids the use of preservatives that can affect negatively the ocular surface in chronic treatments.

3.- Therapeutic coatings for advanced biomedical products: (Fig.3)
   Biodegradable polymeric coatings with controlled load and release properties of antibiotic ingredients in cardiac stimulating devices (CEDs or pacemakers). The risk of post-surgical infections and the need to remove the implanted device is the origin of this project. It is based in the combination of hydrogels technology combined with anchoring monolayers covalently bonded to the surface of the device, to get a protective physical barrier against bacteria and biofilm formation, with hydrophilic character and controlled release properties to prevent from potential post-surgical infections. The coatings are characterized by ATR-FTIR, NMR, XPS, electronic microscopy, contact angle, biocompatibility, etc.

4.- Ophthalmic Viscoelastic Device (OVD): (Table 1)
   Our own product developed for ophthalmic surgeries, such as cataracts to be used as replacement of aqueous humour. It is made of high molecular weight Hyaluronic acid solution at specific concentrations to get the required viscoelastic properties

Figures
Figure 1. XRD spectra of the obtained nHAp

Figure 2. In vitro release profile of the ectoin for 24h. In 6h 50% of the total amount is released, and a 75-80% in the first 12h.

Figure 3. Contact angle measurement of a flat sample coated (left) and uncoated (right): a decrease in contact angle after coating is observed, which means an increase in wettability.

Table 1. Properties of the different models of OpHLINE product.

| Model   | OpHLINE 1% | OpHLINE 2% | OpHLINE 3% | Method (%)
|---------|------------|------------|------------|--------
| VISCOSITY | 15,000-20,000 | 15,000-20,000 | 15,000-20,000 | Method 1
| pH       | 7.2-7.6    | 7.2-7.6    | 7.2-7.6    | Method 2
| CONSISTENCY | 20-50%     | 20-50%     | 20-50%     | Method 3
| VOLUME   | 1.2 mL     | 1.2 mL     | 1.2 mL     | Method 4
| ACCESIBILITY | 25% Laser head | 25% Laser head | 25% Laser head | Method 5
| STABILITY | Mild heat   | Mild heat   | Mild heat   | Method 6
| SENSITIVITY | Neutrogena | Neutrogena | Neutrogena | Method 7
| pH RANGE | 6.5-8.5     | 6.5-8.5     | 6.5-8.5     | Method 8
| BIODEGRADABLE | Biocompatible product | Biocompatible product | Biocompatible product | Method 9
| SHELF LIFE | 2 years    | 2 years    | 2 years    | Method 10
| STORAGE   | Protect from light and avoid freezing. Store between 5°C and 25°C. | Protect from light and avoid freezing. Store between 5°C and 25°C. | Protect from light and avoid freezing. Store between 5°C and 25°C. |