

Using the Advanced Microlab 600 Diluter as a Versatile Tool for Handling Viscous Hyaluronic Acid Solutions

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Introduction

Hyaluronic acids (HA) are anionic, non-sulfated glycosaminoglycans distributed widely throughout connective, epithelial and neural tissues. Due to its biocompatibility, HA are frequently used in many medical applications and the cosmetic industry. HA may consist of very large molecules with molecular weight ranging several million grams per mol (g/mol), which makes solutions very viscous and difficult to handle. Traditional air-displacement technologies, such as pipettes, often fail or deliver inaccurate values due to the error in the measured volume caused by the sample's density and viscosity. Positive displacement of viscous solutions is commonly used with manual syringes which offer excellent accuracy but less reproducibility due to manual handling. For this reason, the Microlab 600 was used for handling of HA solutions since the instrument combines the unique accuracy and precision of Hamilton syringes with the outstanding reproducibility and user-independent liquid handling capabilities of a semi-automated workstation.

In this application the Advanced Microlab 600 Dual Syringe Diluter (ML625-DIL) was used for preparation of HA hydrogels for tissue engineering. Tissue engineering is a technology for artificial production of biological tissues by the directed culturing of cells on a biocompatible support material in order to replace or regenerate diseased tissue in a patient.

Material & Methods

Hyaluronic acid was dissolved in distilled water by simply mixing the HA with the water to reach a 2% concentration. The Microlab 600 was then used for homogenization and precise dosage of the HA solution with crosslinking agents (peroxide and horse-radish peroxidase solution), which leads to hydrogel formation. After dispensing the HA solution mixed with the cross-linking agent, the HA forms a solid support which exhibits the negative shape of the tissue forms.

Results and Discussion

The Advanced Microlab 600 Diluter was used for preparation of HA hydrogels applied for tissue engineering and the determination of the tissue's final mechanical properties. The concentrations of HA solution and cross-linking agents were varied and the influence on the mechanical properties of the tissue was studied.

For this application many different dilutions had to be prepared using the Microlab 600 until the optimal composition of HA and cross-linking agent was identified for the different tissue types. Due to the excellent reproducibility, simplified handling as well as high accuracy and precision, the sample preparation process in the laboratory was speeded up compared to the former manual procedure. Moreover the software of the Microlab 600 enables users to track and store all steps of the preparation process without the need of additional paperwork. It can be concluded that the process safety and overall performance was improved by implementation of the Microlab 600 technology.

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