11º CONGRESSO NACIONAL DE BIOMECÂNICA
A. P. G. Castro, C. Pina, P. R. Fernandes, C. Santos, J. Folgado & A. Amaro (Eds)
Sesimbra, Portugal, 21-22 de Fevereiro, 2025

PVA BASED HYDROGELS FOR ARTICULAR CARTILAGE REPLACEMENT

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KEYWORDS: Hydrogel, PVA, Chitosan, Sodium-Alginate, Cartilage.

1 INTRODUCTION

The global ageing population is leading to an increase in joint problems, affecting both public health and athletes. Joint degeneration, caused by aging or diseases like osteoarthritis, is a growing concern worldwide. Athletes, due to the strain on their joints, are particularly vulnerable in the fact that this can impact both performance and long-term quality of life. Preventing joint diseases by addressing their causes is essential.
This study focused on the use of hydrogels to replace severed damage articular cartilage. Several hydrogels, based on 15% PVA, were develop and the swelling and compressive modulus were assessed.

2 MATERIALS AND METHODS

Three different types of hydrogels were produced: PVA, PVA-chitosan and PVA-chitosan-sodium alginate [1], using two different production methods, freeze-thaw and cast-drying. The composition of each hydrogel is present in Table 1.

Table 1- Hydrogels composition

	Cast-Drying			Freeze-Thaw		
	0C	1C	2C	0F	1F	2F
PVA (g)	6	6	6	6	6	6
Chitosan (g)	-	0,25	0,25	-	0,25	0,25
Water (g)	34	33,75	33,75	34	33,75	33,75
Sodium Alginate Solution (2%)	no	no	yes	no	no	yes

The hydrogels were submitted to swelling tests. For that, the different hydrogels were dried and weighed to a constant mass to ensure that they had no water content. The samples were then

submerged in distilled water until they reached a constant mass when weighed. The swelling was calculated thought equation 1. Five samples of each hydrogel were used per assay.

$$\frac{Ms-Md}{Ms} \times 100\ (\%) \qquad (1)$$

Where Ms represents the weight of the samples when soaked and Md the weight of the samples when dried.

In order to obtain the compressive elastic modules, the hydrogels were subjected to compression tests using a textometer (The TA.XT Express Texture Analyser, Stable Micro Systems) with a maximum load cell of 49.033 kN with a compressive speed of 0.5 mm/s. Seven samples of each hydrogel were used per assay.

3 RESULTS AND DISCUSSION

The swelling and the compressive elastic modulus results are given in Table 2. The swelling results showed that the freeze-thaw gels had higher values (□75%), showing no difference between the addiction of sodium alginate in the structure. The cast-drying hydrogels showed the highest compressive modulus values. The addiction of chitosan decreases (□63%) the compressive modulus. In contrast, the addiction of sodium alginate increases the modulus again. The swelling values and compressive modulus for all produced hydrogels are within the values for articular cartilage.

Table 2- Swelling Test and Compression Test Results

Hydrogel	*Average Swelling (%)*	*Average Compressive Modulus (MPa)*
0C	55.77±0.47	2.89±1.37
1C	62.38±1.41	1.84±1.27
2C	64.16±1.33	2.96±1.60
0F	66.40±0.35	1.23±0.10
1F	74.82±0.46	0.40±0.08
2F	74.46±0.23	0.49±0-04

4 CONCLUSIONS

The PVA based hydrogels produced in this work showed swelling and compressive modulus within the values found in the literature for human articular cartilage.

REFERENCES

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