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A bioinspired material for bone tissue regeneration: use of Ganoderma sessile mycelium as microstructure director

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INTRODUCTION & AIM

The development of new strategies to repair large segmental bone defects is currently an ongoing challenge all around the world, and biomaterials suitable for dealing with this are in high demand. An important aim in this field is to achieve simultaneously both the mechanical and biological requirements of the implant site.

In this study, we propose obtaining a bioinspired bone tissue biomaterial using the stiff and modulable mycelium of Ganoderma sessile, a well-known medicinal mushroom. The mycelium was cultured on a substrate composed of Alginate crosslinked by Hydroxyapatite nanoparticles (ALG/HAn), with in vitro osteogenic properties previously verified by the authors.[1]

METHOD

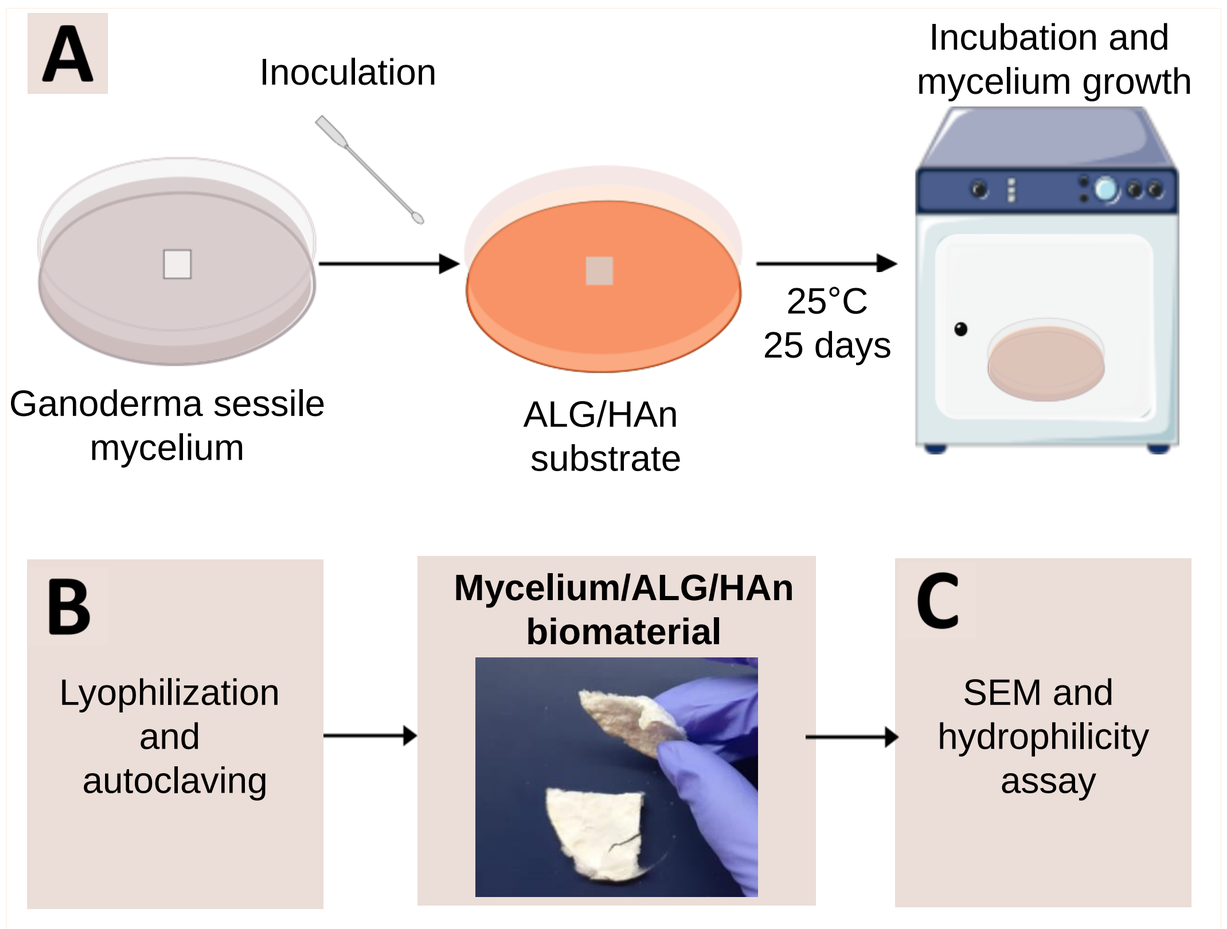

Figure 1: Mycelium/ALG/HAn biomaterial synthesis and surface characterization. A) Ganoderma sessile mycelium was cultured on ALG/HAn enriched substrate. **B)** The mycelium was inactivated and sterilized by autoclaving to obtain the final biomaterial. **C)** The surface was characterized by scanning electron microscopy (SEM) and hydrophilicity assay by water contact angle measurements.

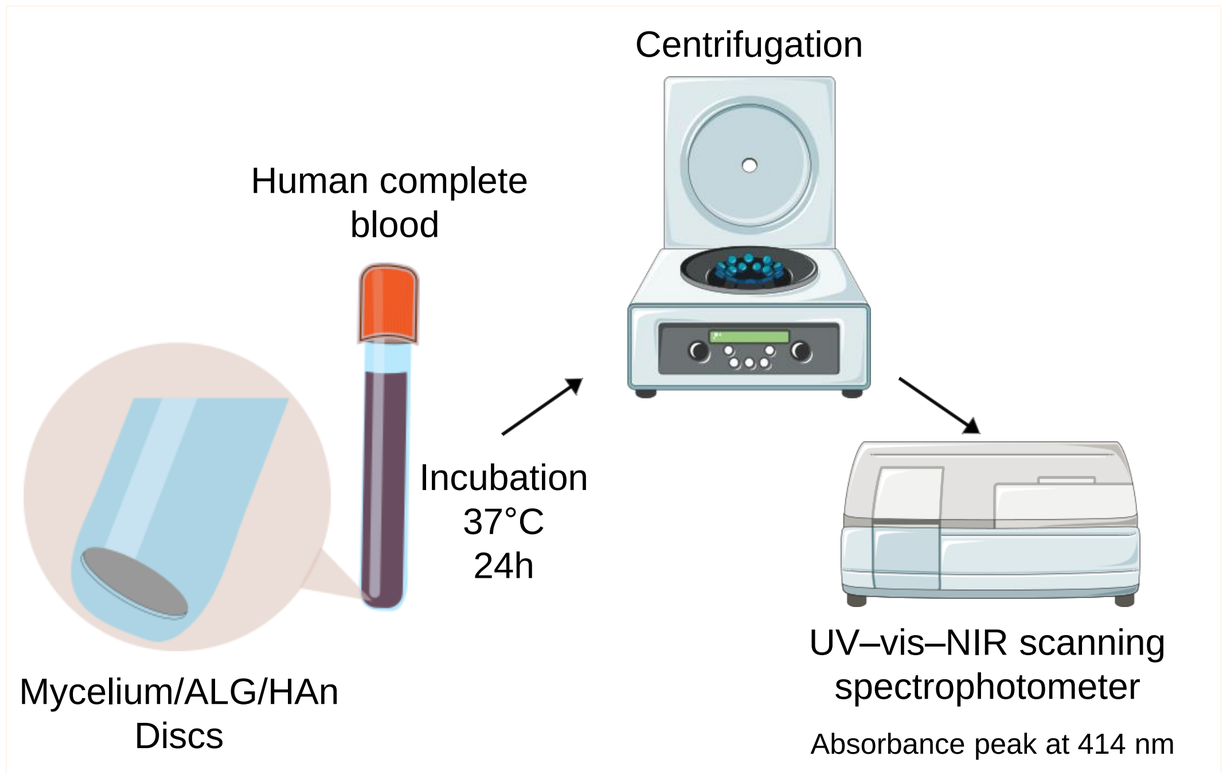

Figure 2: Hemocompatibility assay procedure.

RESULTS & DISCUSSION

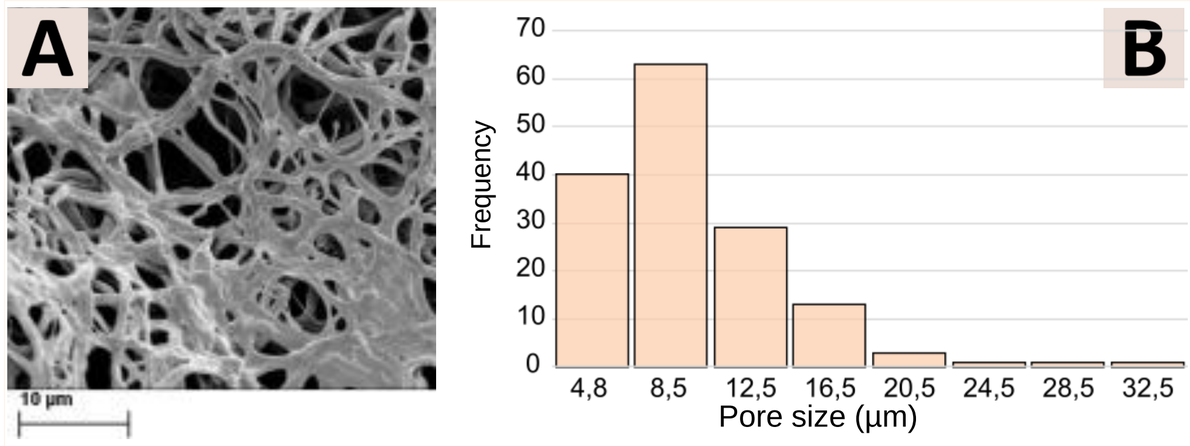

Figure 3. Surface characterization. A) SEM micrograph of the mycelium/ALG/Han biomaterial. **B)** Histogram of the pore size distribution. SEM image confirm that the mycelium acts as a directing agent of the biomaterial microstructure. The mycelium colonized the ALG/HAn substrate, leading to the formation of a trabecular bone-like network with a hierarchical structure.

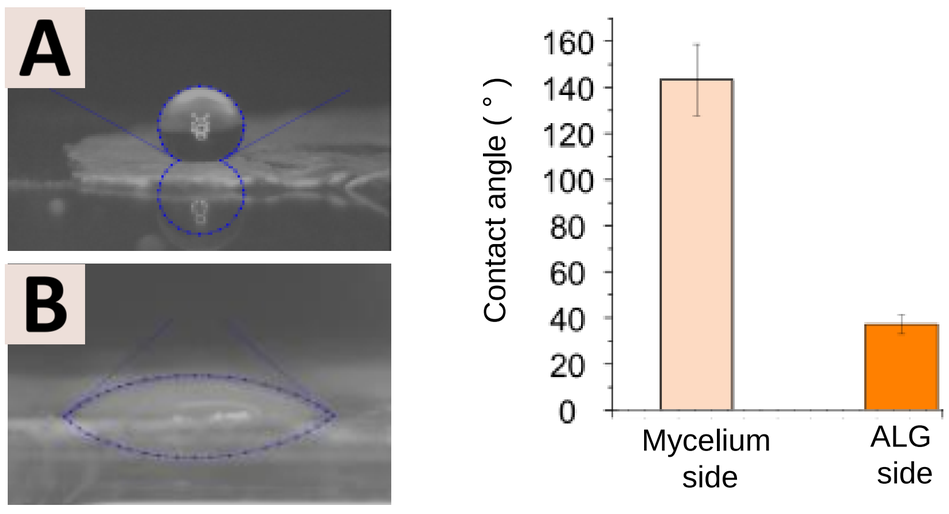

Figure 4. Surface characterization: Hydrophilicity assay. Surface hydrophilicity measured by water contact angle on: **A)** mycelium rich side and **B)** ALG rich side. Water contact angle assays demonstrated that the presence of ALG in the membranes significantly reduced the hydrophobicity of the biomaterials

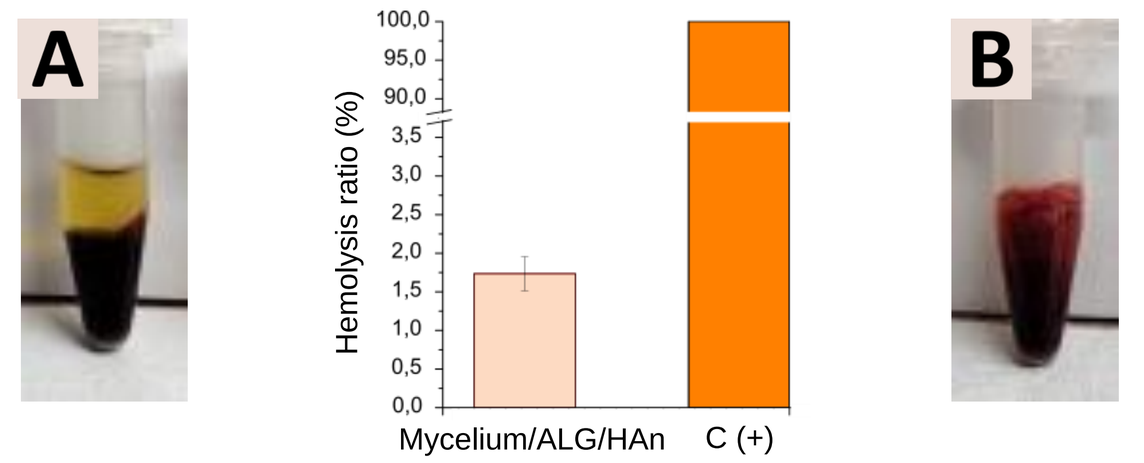

Figure 5. Hemocompatibility assay. The interaction between blood cells and biomaterial verifies the absence of hemolysis in human plasma samples when they are in contact with Mycelium/ALG/HAn discs **(A)** compared to the positive control (H_2O_2) **(B)**. The hemolysis rate, set at 5%, is considered the limit of acceptability.

CONCLUSION

The promising results of this work will provide a new perspective for the future development of mycelium-based biomaterials applied for bone tissue regeneration.

REFERENCES

1, N. L. D'Elía et al., J.Colloid Interface Sci., vol. 572, pp. 408-420, 2020