IOCM 2025 Conference

The 4th International Online Conference on Materials

3–6 November 2025 | Online

MDPI

Synthesis and characterization of alginic acid scaffolds with possible tissue regeneration applications

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INTRODUCTION

Organ and tissue transplant demand is a global challenge due to the limited availability of donors. Therefore, it is essential to develop new biomaterials that can reduce this demand and enhance patient recovery. Hydrogels, which are 3D networks of hydrophilic crosslinked biopolymers, possess high water-retention capacity, biodegradability, and biocompatibility. They are commonly used as scaffolds for tissue regeneration. Previous studies have shown that modified alginate hydrogels can aid in muscle tissue repair. In this work, alginic acid hydrogels chemically crosslinked with spermidine (Figure 1) which is an organic molecule found at high concentrations in proliferating animal tissues. The hydrogel were characterized by several techniques such as mass spectroscopy, FT-IR and SEM (Table 1). This alginic acid hydrogels were synthesized, as depicted in Figure 2, to promote skin fibroblast renewal.

METHOD

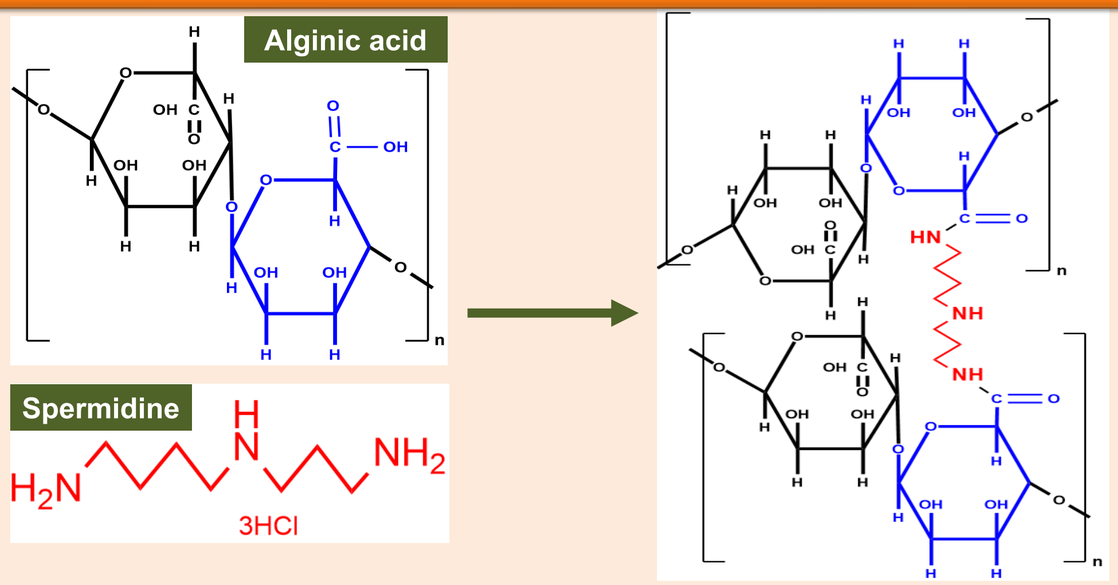

Figure 1: Alginic acid and spermidine chemical crosslinking reaction.

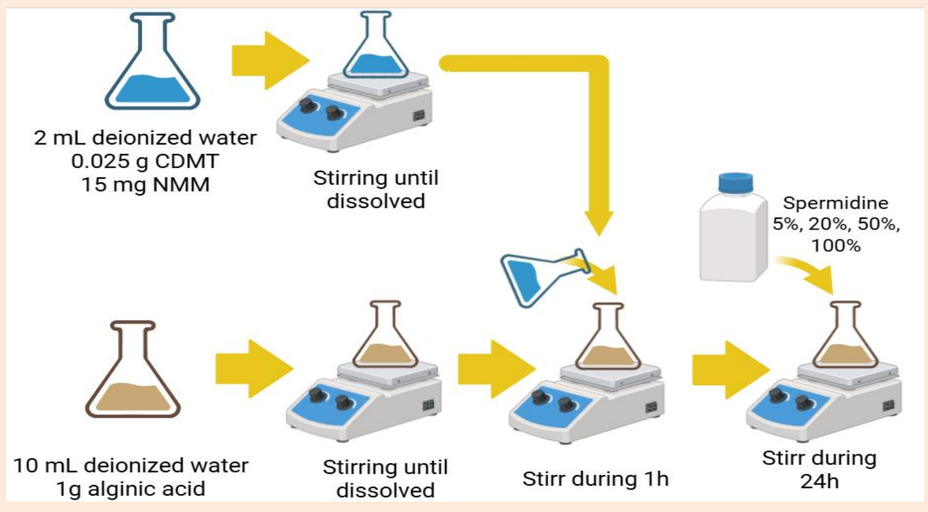

Figure 2: Protocol for alginic acid hydrogel synthesis

Table 1: Characterization techniques for alginic acid hydrogels

Characterization
Scanning electron microscopy (SEM)
Spectroscopic techniques (FT-IR, ESI-MASS)
Rheological properties (viscosity)

RESULTS & DISCUSSION

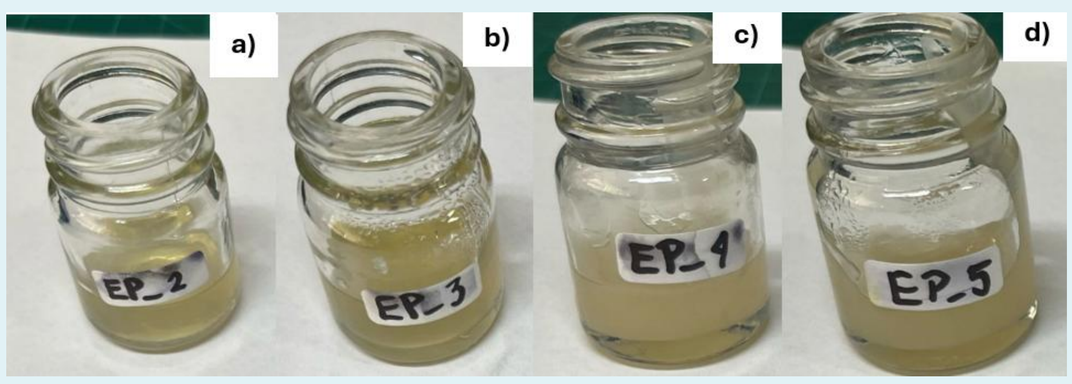

Figure 3. Alginic acid hydrogels at spermidine concentrations: a) 5% (w/w) b) 20% (w/w) c) 50% (w/w) d) 100% (w/w).

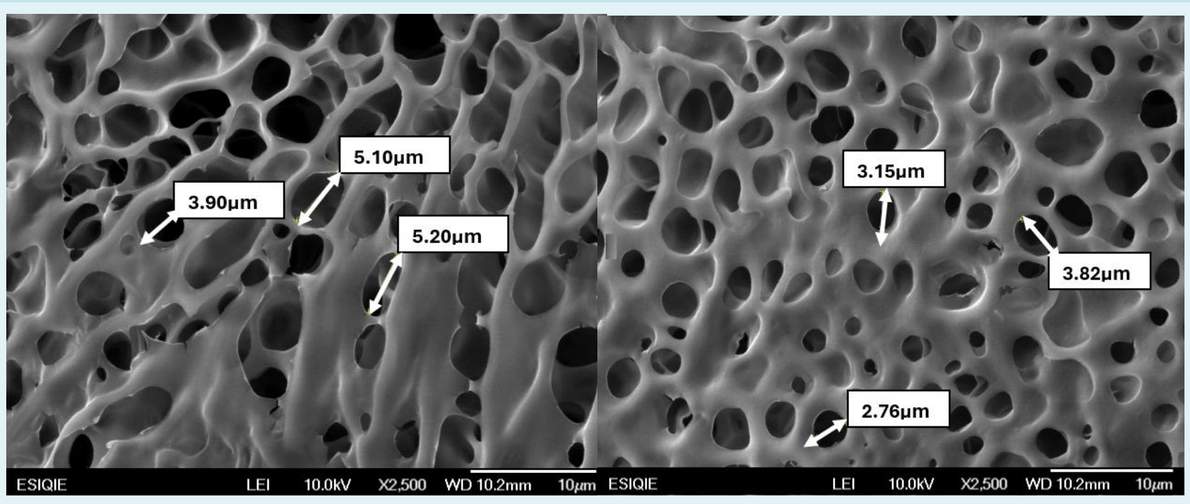

Figure 4. SEM images of alginic acid hydrogels with 5 % (w/w) of spermidine.

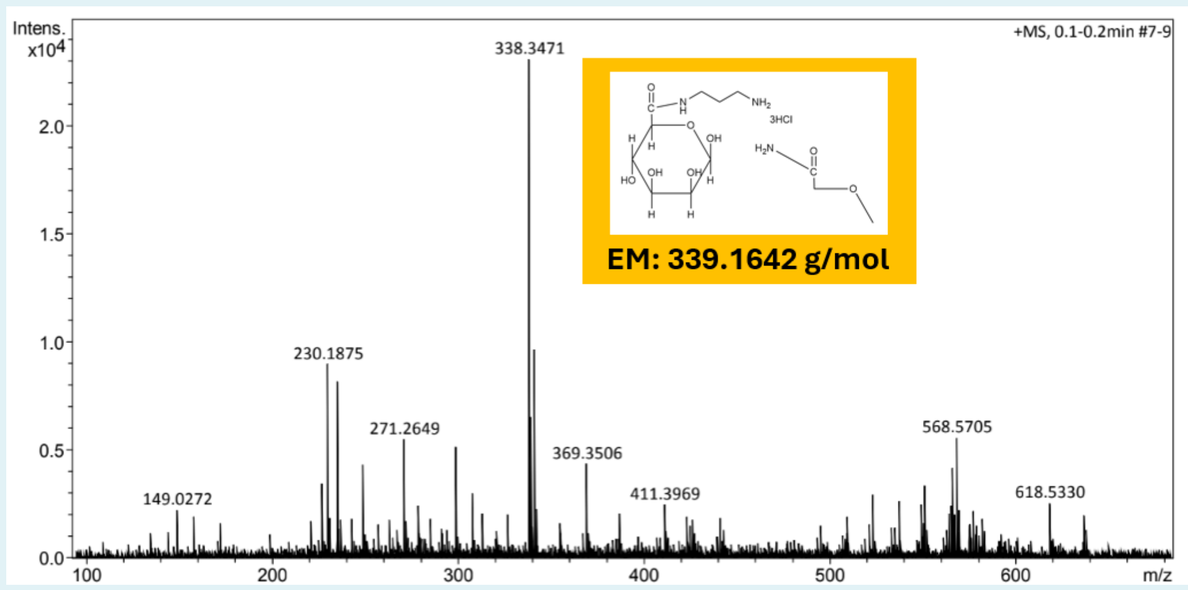

Figure 5. ESI-MASS of alginic acid hydrogels with 5 % (w/w) of spermidine.

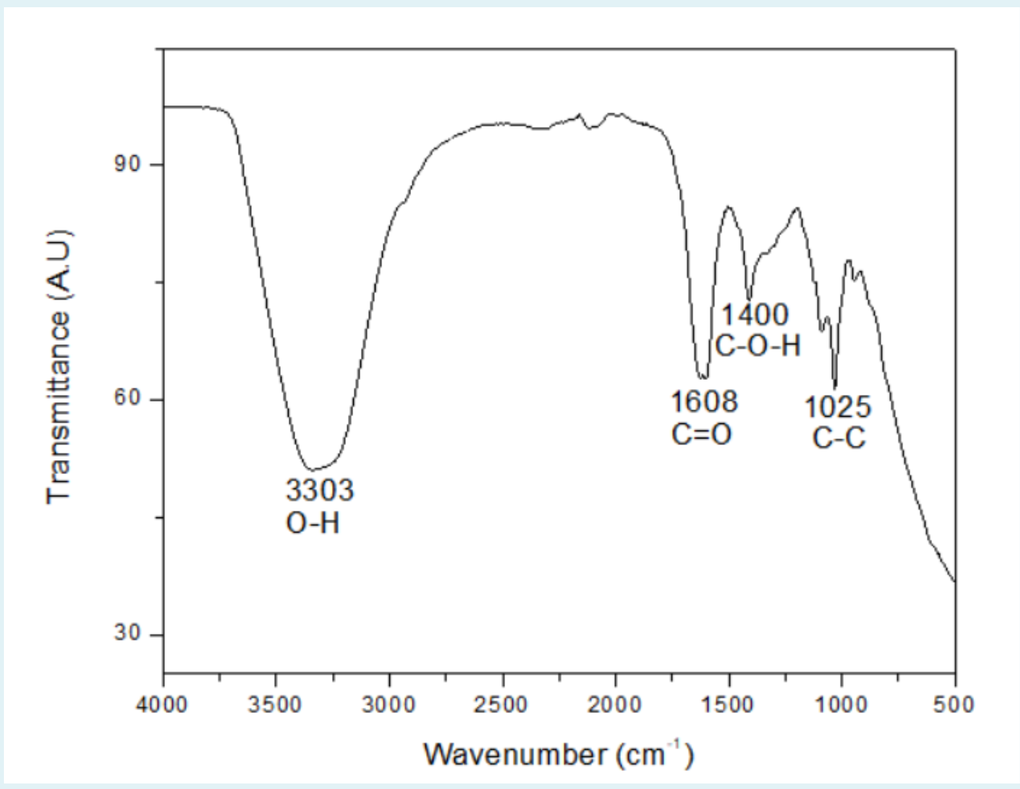

Figure 6: FT-IR spectra of alginic acid hydrogels with 5 % (w/w) of spermidine.

CONCLUSION

The preliminary results show that the novel alginic acid hydrogels were successfully synthesized through chemical crosslinking with spermidine. Characterization revealed an average pore size of 5.34 µm, and ESI–MASS analysis confirmed the expected bonding between alginic acid and spermidine. Additionally, FT–IR spectra identified characteristic functional groups of the hydrogel. According to this results, alginic acid hydrogels have a potential application as tissue scaffold.

REFERENCES

[1] *Prog Polym Sci*. **2012** Jan;37(1):106-1266
[2] *Biomaterials*. **1999** Jan;20(1):45-53.
[3] *Annu Rev Biochem*. **1976**;45:285-306.