PhD Open Days

Casein Hydrogel with Apple Peel Extract incorporated for chronic wound treatment

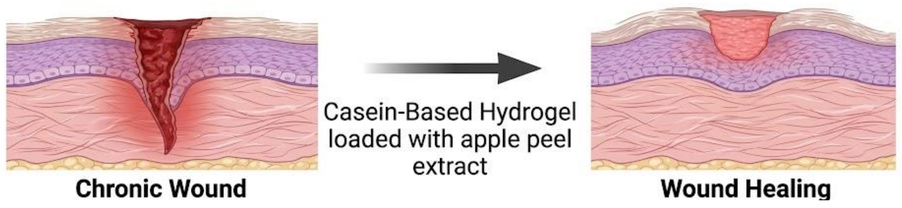
Bioengineering and Biosciences

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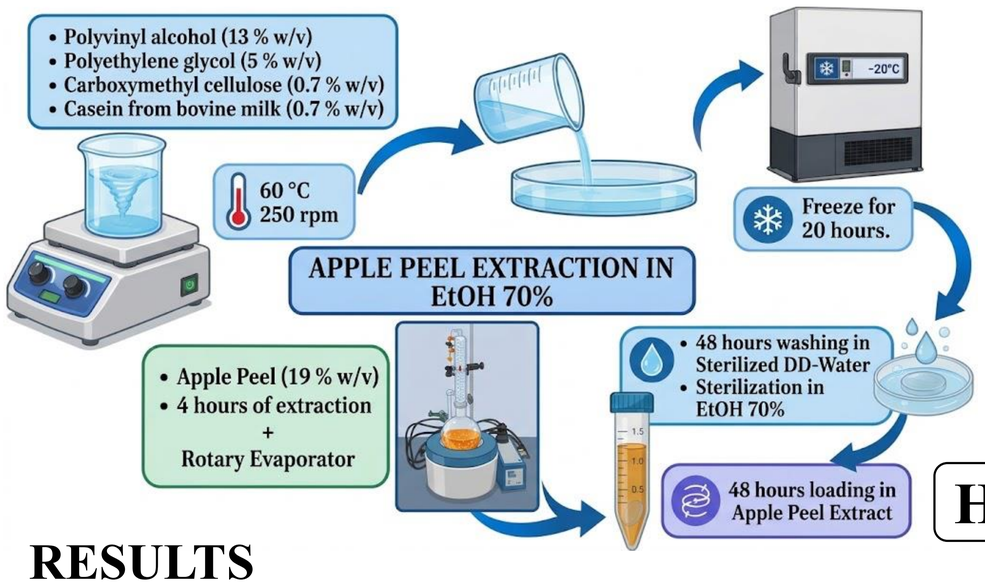
INTRODUCTION

Chronic wounds pose a major clinical challenge due to delayed healing and high infection risk, significantly affecting patient outcomes and healthcare resources. Innovative strategies are essential to support tissue regeneration. Natural materials offer a promising, biocompatible approach for developing advanced wound dressings.

This work aims to develop a dressing with casein and apple peel extract for the management of chronic wounds.



EXPERIMENTAL



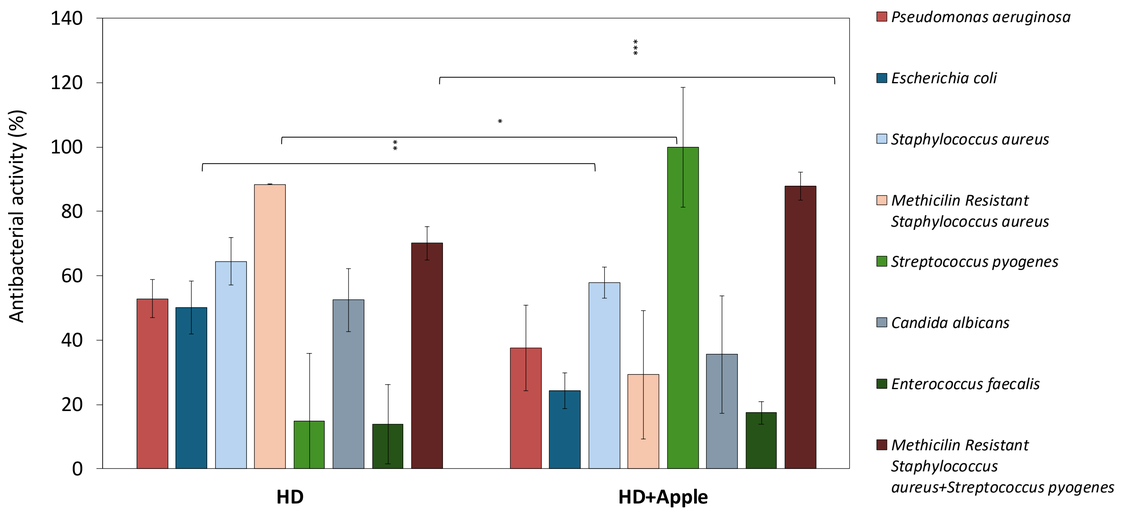
RESULTS

Physical Properties

Property	HD
Contact Angle (°)	46.2 ± 1.6
Swelling Ratio (%)	298.0 ± 8.5
Water Content (%)	83.0 ± 3.1
Young Modulus (Mpa)	0.07 ± 0.01
Maximum Force of adhesion (mN)	2.98 ± 0.04

- The samples showed suitable properties for the intended application.

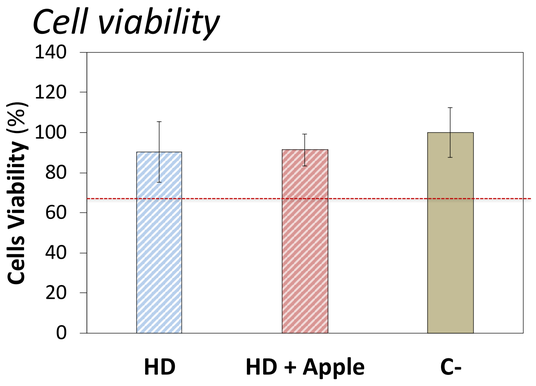
Antimicrobial Properties



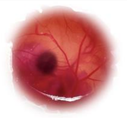
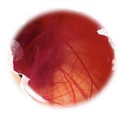
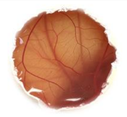
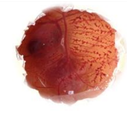
- Antimicrobial tests revealed that HD+Apple has a higher activity against MRSA+Str.Pyogenes due to the presence of casein and polyphenolics compounds.

Biocompatibility

Cell viability

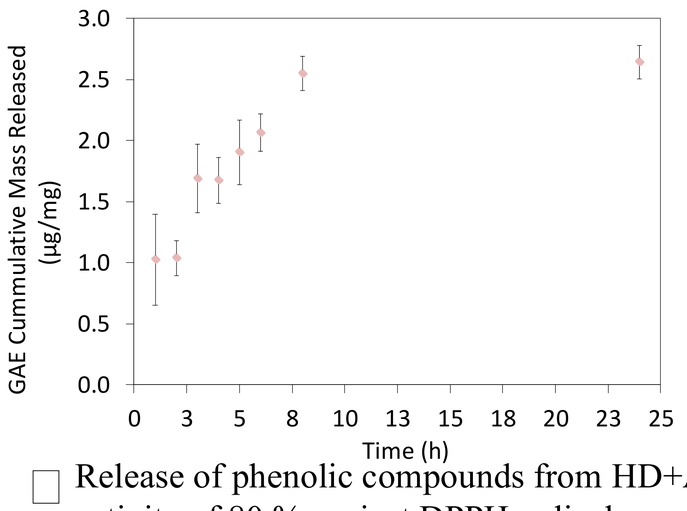


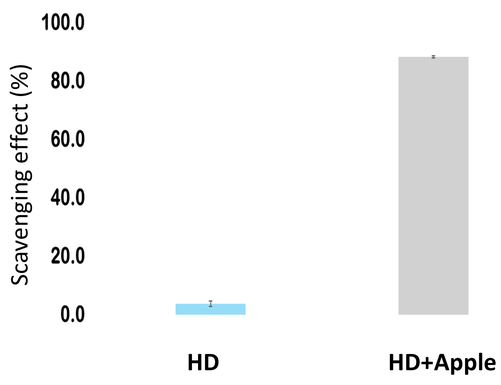
Irritation score

HD	HD + Apple	C-	C+
			
IS= 0	IS=0	IS=0	IS=17.28

- MTT assays shown no cytotoxic activity for both hydrogels, with cells viability > 70 %.
- No irritability observed.

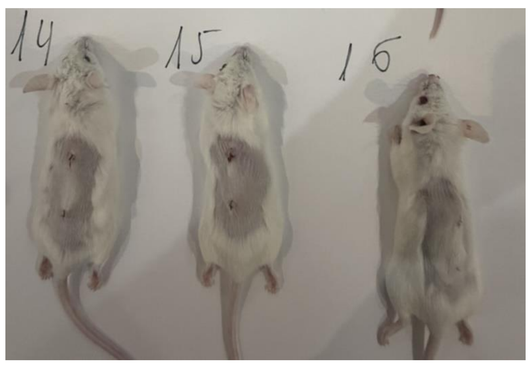
Total Phenolic content released





- Release of phenolic compounds from HD+Apple, lead to an antioxidant activity of 80 % against DPPH radical.

In vivo Assay



Murin model. Macroscopic appearance of the wound on day 10

Histological outcomes for the HD+Apple

Parameter	HD+Apple VS Non-aseptic dressing (mean ± SD)		HD+Apple VS Iodine dressing (mean ± SD)	
Fibrosis	**1.36 ± 0.81**	**2.18 ± 1.17**	1.58 ± 0.79	1.83 ± 1.03
	p-value (0.047)		p-value (0.047)	
Polymorphonuclear cells	3.58 ± 1.00	3.08 ± 1.00	**3.50 ± 1.24**	**2.17 ± 1.27**
	p-value (0.148)		**p-value (0.021)**	

- HD+Apple shown higher healing characteristic against Iodine dressing with significant results (p-value = 0.021).

CONCLUSION

The hydrogels produced showed suitable properties to be used in wound dressings. The loading with apple peel extract confers them a significant therapeutic potential, namely antioxidant activity and antimicrobial activity. They revealed to be non-cytotoxic and non-irritant. *In vivo* test shown that HD+Apple has promising characteristics for chronic wound healing.

Acknowledgment

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