A Novel Biological Dermal Matrix for Skin Reconstruction

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1. Introduction

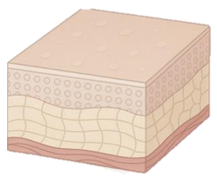
Skin and soft tissue defects from trauma, burns, or surgical resection remain a major clinical challenge. Biological dermal substrates support reconstructive surgery by providing a scaffold for neovascularization and wound healing, but accessible alternatives with comparable performance are still needed.

We developed a novel dermal substrate from rabbit skin, a sustainable agri-food by-product, preserving a collagen-elastin network and ECM organization similar to human dermis. Its performance was benchmarked against two commercial substitutes, Matriderm® (MedSkin) and NovoSorb® (PolyNovo).

2. Materials and Methods

Production of rabbit skin-derived dermal substrate (RDS)

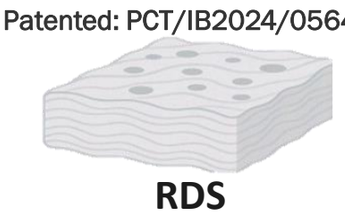
Patented: PCT/IB2024/056438



RABBIT SKIN

DECELLULARIZATION

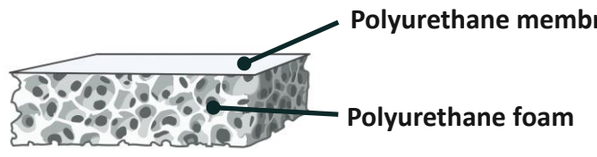
(Alkaline, detergents and enzymatic solution application – Cell removal)



RDS

Benchmarked against commercial matrices:

Matriderm®



NovoSorb®

3. Results and Discussion

Product Characterization

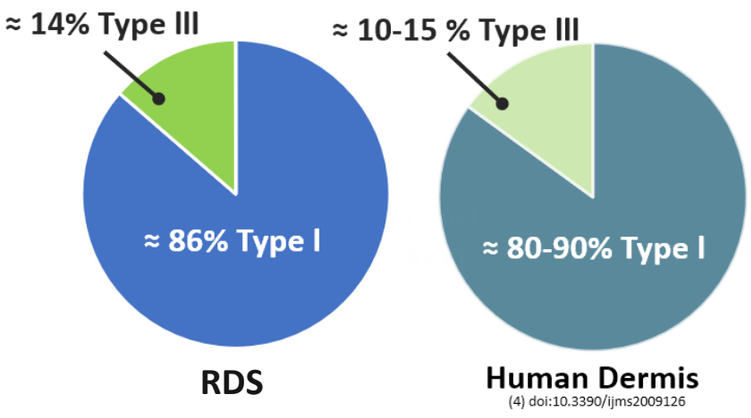
RDS Composition

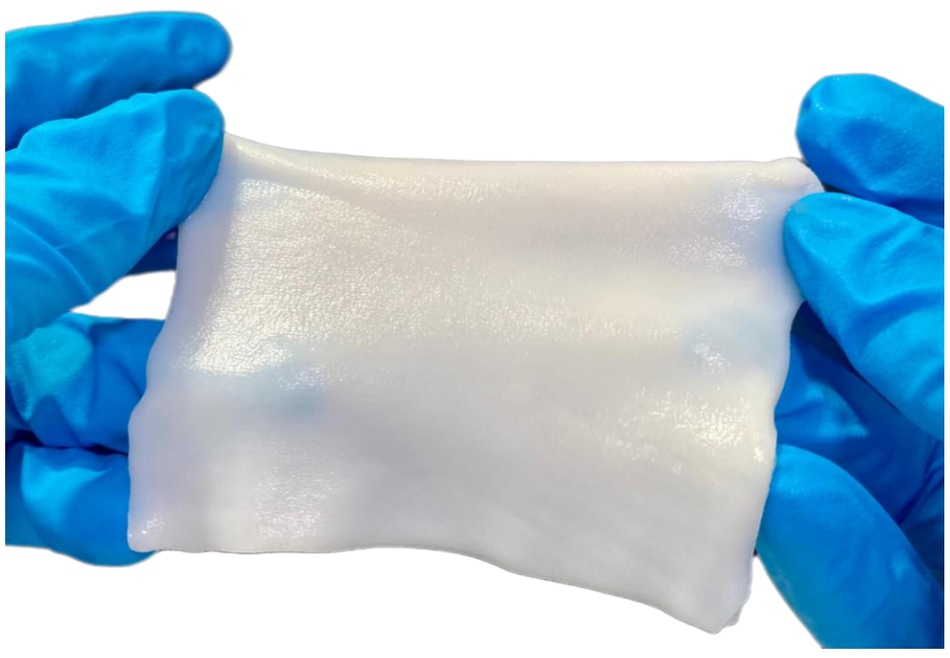
ECM Component	Concentration (µg/ mg of dry tissue)
Collagen	
Soluble	59,6 ± 5,47
Unsoluble	188,2 ± 72,3
Total Collagen	248,9 ± 77,8
Elastin	22,1 ± 7,45
GAGs	0,20 ± 0,13
DNA	66,8 ± 11,0 ng/ mg of dry tissue

Collagen Types Relative Abundance

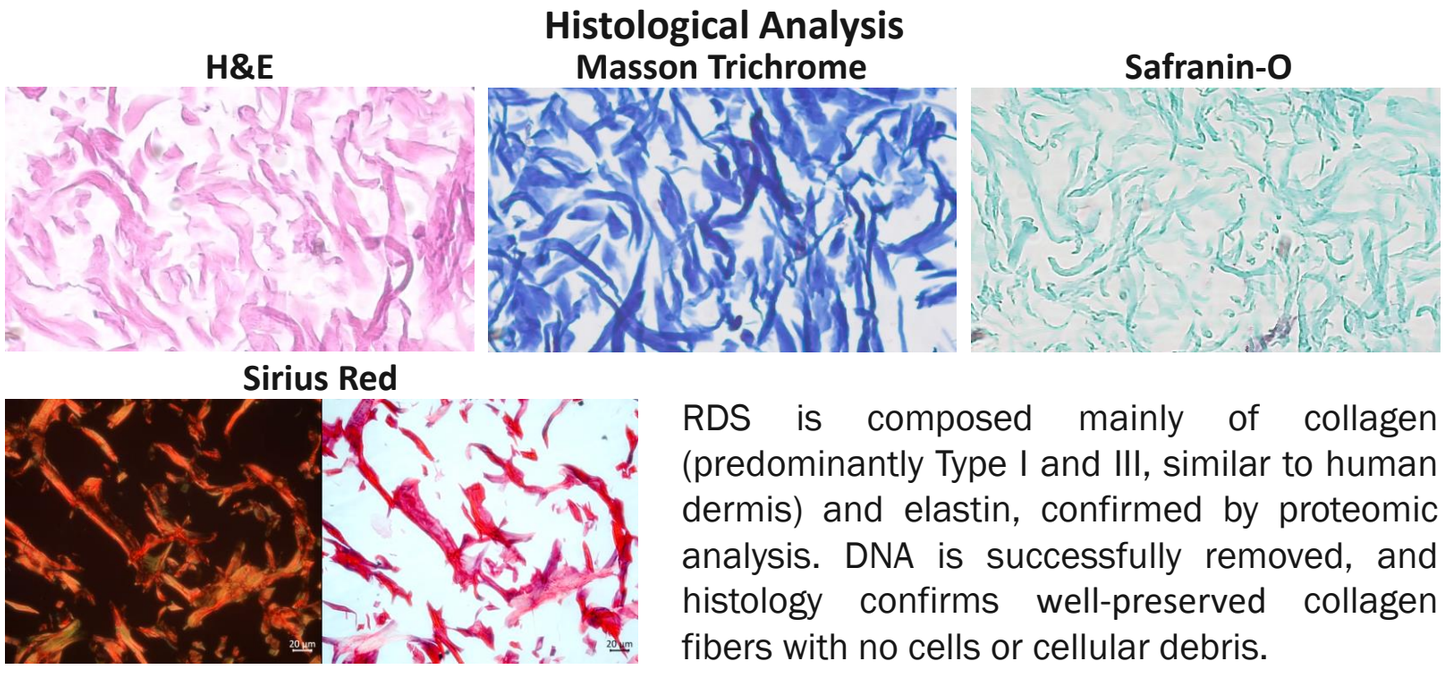
Proteomic Analysis

Collagen I	86,4%
Collagen III	13,6%
Collagen V	0,0163%
Collagen VIII	0,0002%





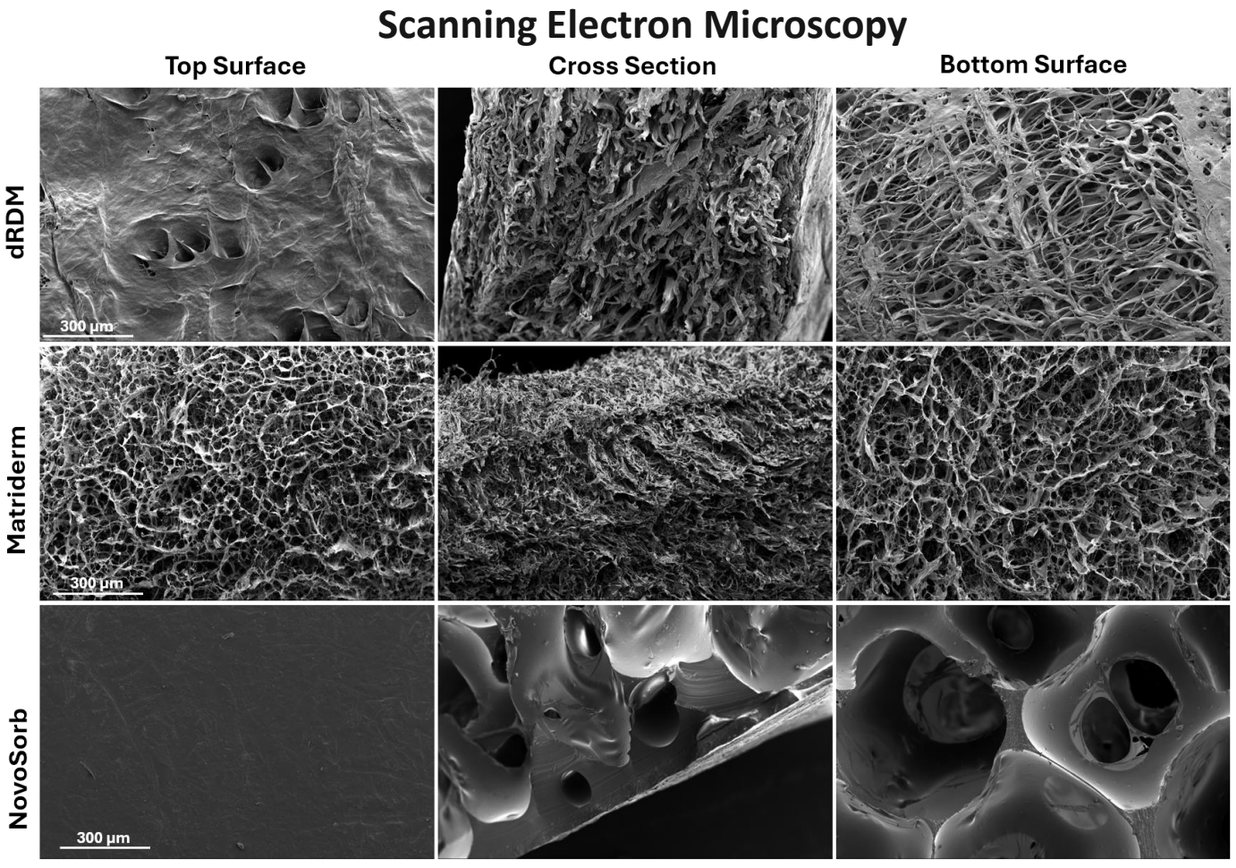
Histological Analysis

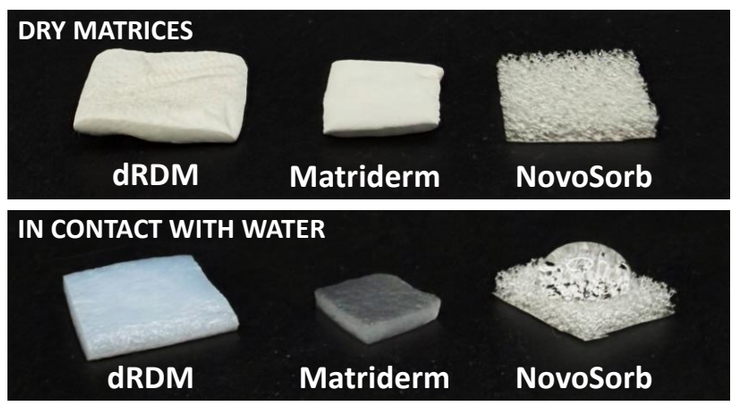


RDS is composed mainly of collagen (predominantly Type I and III, similar to human dermis) and elastin, confirmed by proteomic analysis. DNA is successfully removed, and histology confirms well-preserved collagen fibers with no cells or cellular debris.

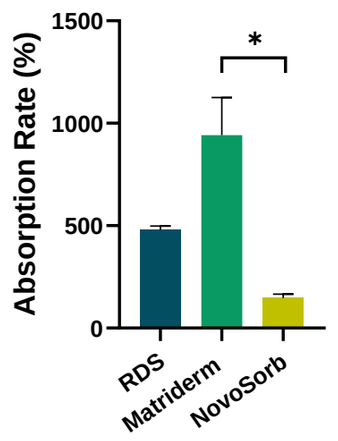
Benchmarking with Matriderm® and NovoSorb®

Scanning Electron Microscopy

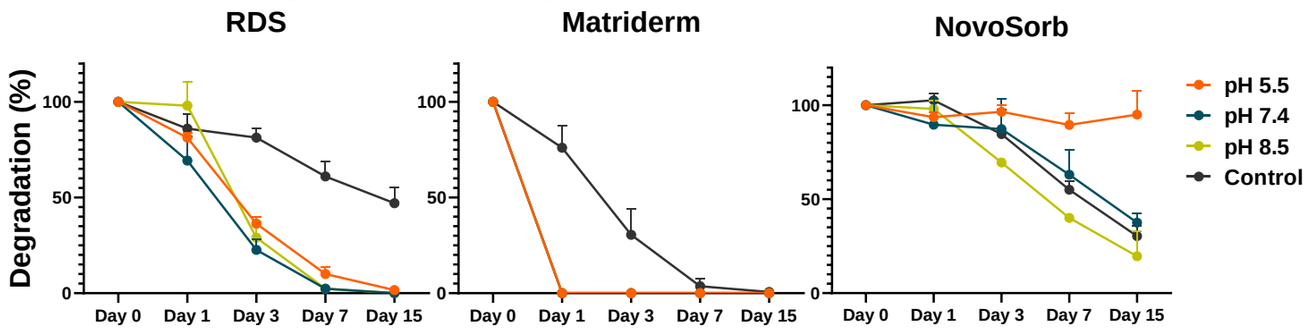




Swelling Properties



Degradation Assay with Simulated Wound Fluid



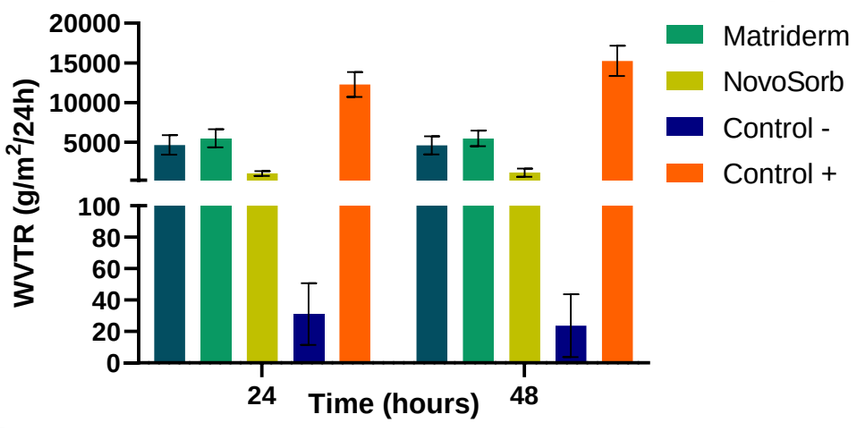
Morphology: **RDS** and **Matriderm** are both collagen-fiber structure, but RDS presents a more organized fiber structure while Matriderm presents more random fibers. RDS preserved basal membrane supports epidermis formation.

Permeability: **RDS** and **Matriderm's** porous network enables water/nutrient exchange while **NovoSorb's** more hydrophobic polyurethane film limits this, hindering regeneration.

Degradation: RDS degrades gradually, providing prolonged tissue support, whereas Matriderm degrades rapidly and NovoSorb degrades very slowly, potentially compromising regeneration.

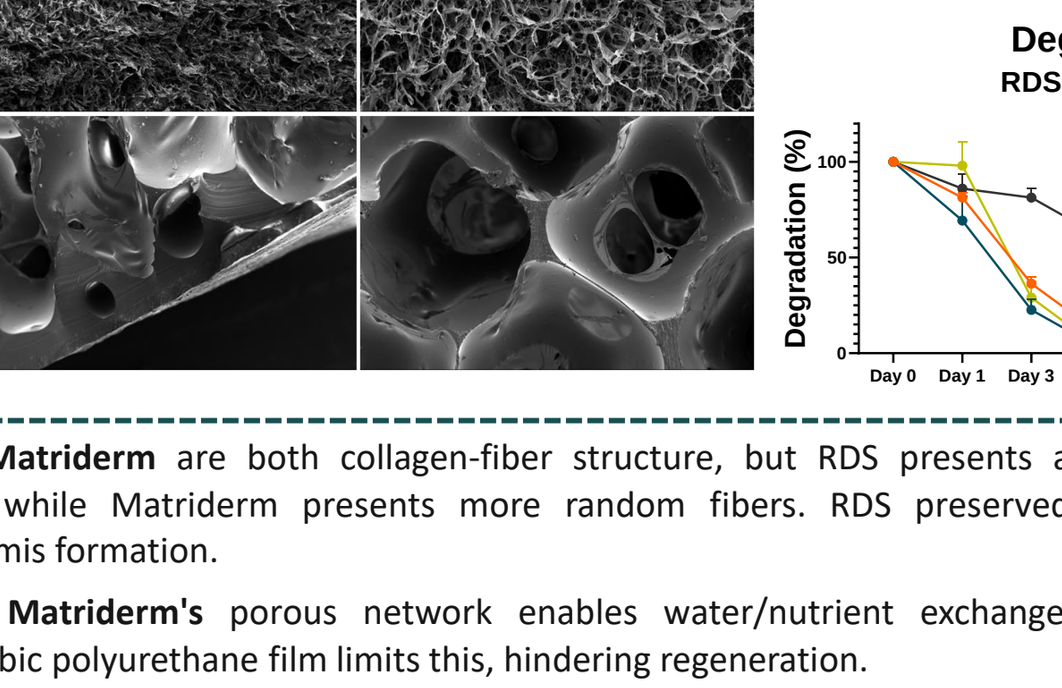
Cell support: **RDS** and **Matriderm** both sustain cell growth for 30+ days while **NovoSorb** revealed reduced cellular performance

Poster WVTR



Dermo-Epidermal Model

Dermo-Epidermal Support Capacity



4. Conclusion

The RDS shows a collagen-elastin architecture comparable to native dermis with efficient decellularization. It matches Matriderm's permeability and cell-support performance while offering a more controlled degradation, outperforming NovoSorb overall. These findings support dRDM as a sustainable, effective alternative for dermal reconstruction.

LV REUNIÃO ANUAL DA SPCRE

Acknowledgments

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1º CONGRESSO LUSO-BELGA