

Compatibility of a Smart Bacteria-Responsive Colorimetric Nanofiber Membrane with commercial wound dressings

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Results

Introduction

Infection detection remains a major challenge in wounds covered with commercial dressings, as direct wound monitoring requires dressing removal, which can disrupt healing and cause secondary injury. A colorimetric smart nanofibrous membrane capable of detecting bacterial presence without removing the dressing offers a promising solution for early infection identification. Ensuring the compatibility of this membrane with widely used wound dressings is therefore essential for broad clinical application. The membrane changes color from yellow to green in response to bacterial lipase; thus, the ability of lipase to diffuse through various dressings and reach the membrane must be assessed. This study evaluates the compatibility of our colorimetric nanofibrous membrane with different commercially available foams and dressings to ensure accurate bacterial detection.

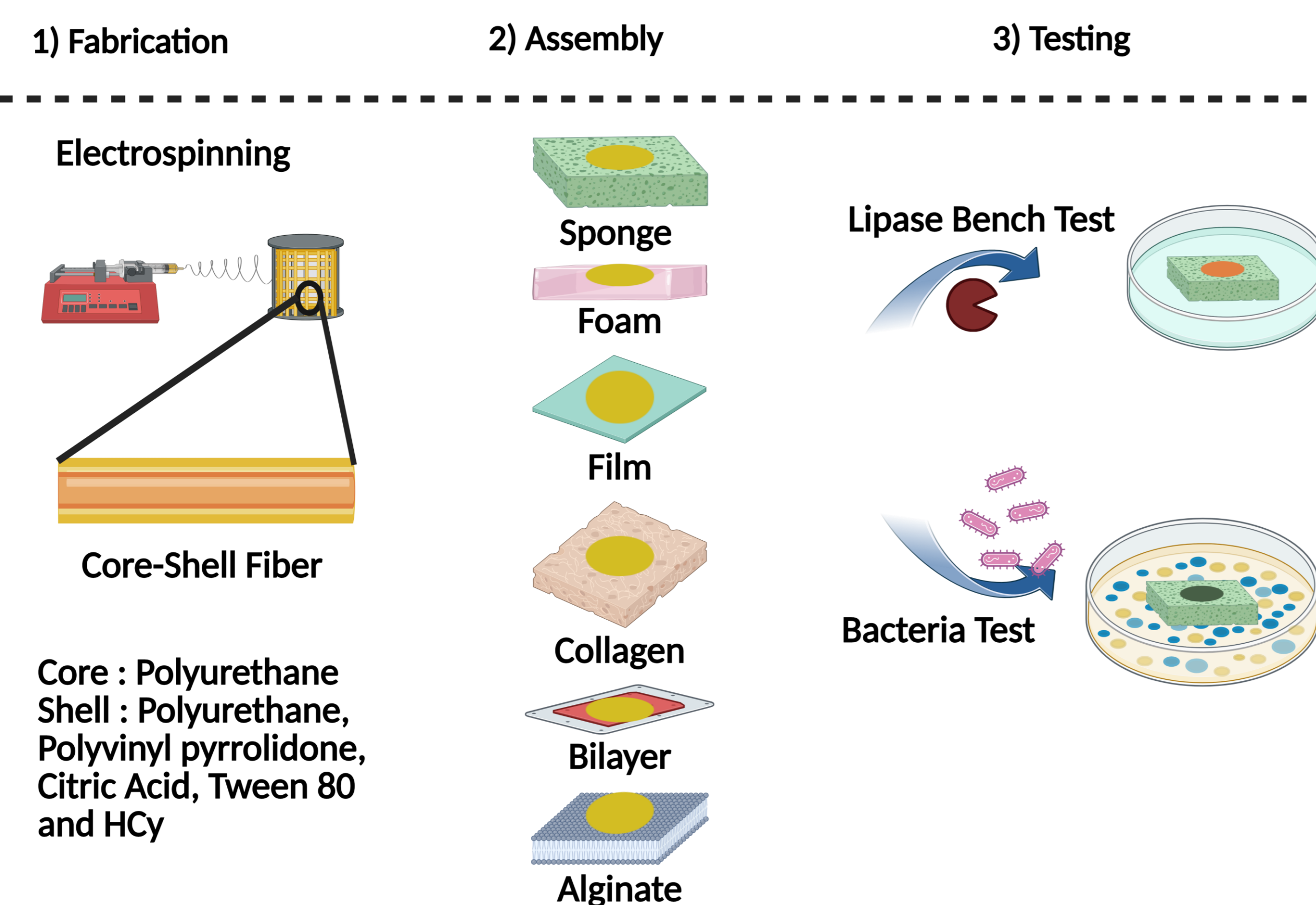
Objectives

✓ Evaluate the compatibility of the membranes and its color changing performance with different wound dressing.

Aims

- 1) To determine the color changing performance in the presence of different foams.
- 2) To determine thresholds of exudate for different foam-membrane combination.
- 3) To ensure bacterial detection in the presence of different wound dressings.
- 4) To enable rapid bacterial detection at concentrations below infection-level thresholds

Methodology



Conclusion

The integration of the colorimetric membrane with various foam dressings of different compositions confirms its ability to detect bacterial lipase activity across wounds with low, medium, or high exudate levels. Neither foam materials nor protective films impeded membrane functionality, and the characteristic yellow-to-green transition occurred within 6–18 hours. These findings support the membrane's compatibility with commercially available wound dressings and transparent backings, enabling real-time bacterial detection without the need for dressing removal.

Take Away Message

✓ The nanofibrous colorimetric membrane functions effectively when integrated with different commercial foam dressings and protective layers, enabling non-invasive monitoring of bacterial activity without removing the dressing. Its rapid visual response and compatibility with various wound environments highlight its potential as a simple and accessible tool for early infection detection across clinical, home-care, and field settings.

Lipase Bench Test

Leaching in the presence of lipase with low and high exudate condition.

Condition	Water	Condition 1	Condition 2
Volume	5 mL no lipase	500 μ L, 10 mg/mL lipase	5 mL, 10 mg/mL lipase
Front			
Back			
Cross			
Diffusion rate	0	9.4% (: 0.66 \pm 0.26 mm out of 7 mm)	35.7% (2.5 \pm 0.55 mm out of 7 mm)

Capacity (mL/cm²) Volume at Change (mL/cm²) Threshold (mL/cm²)

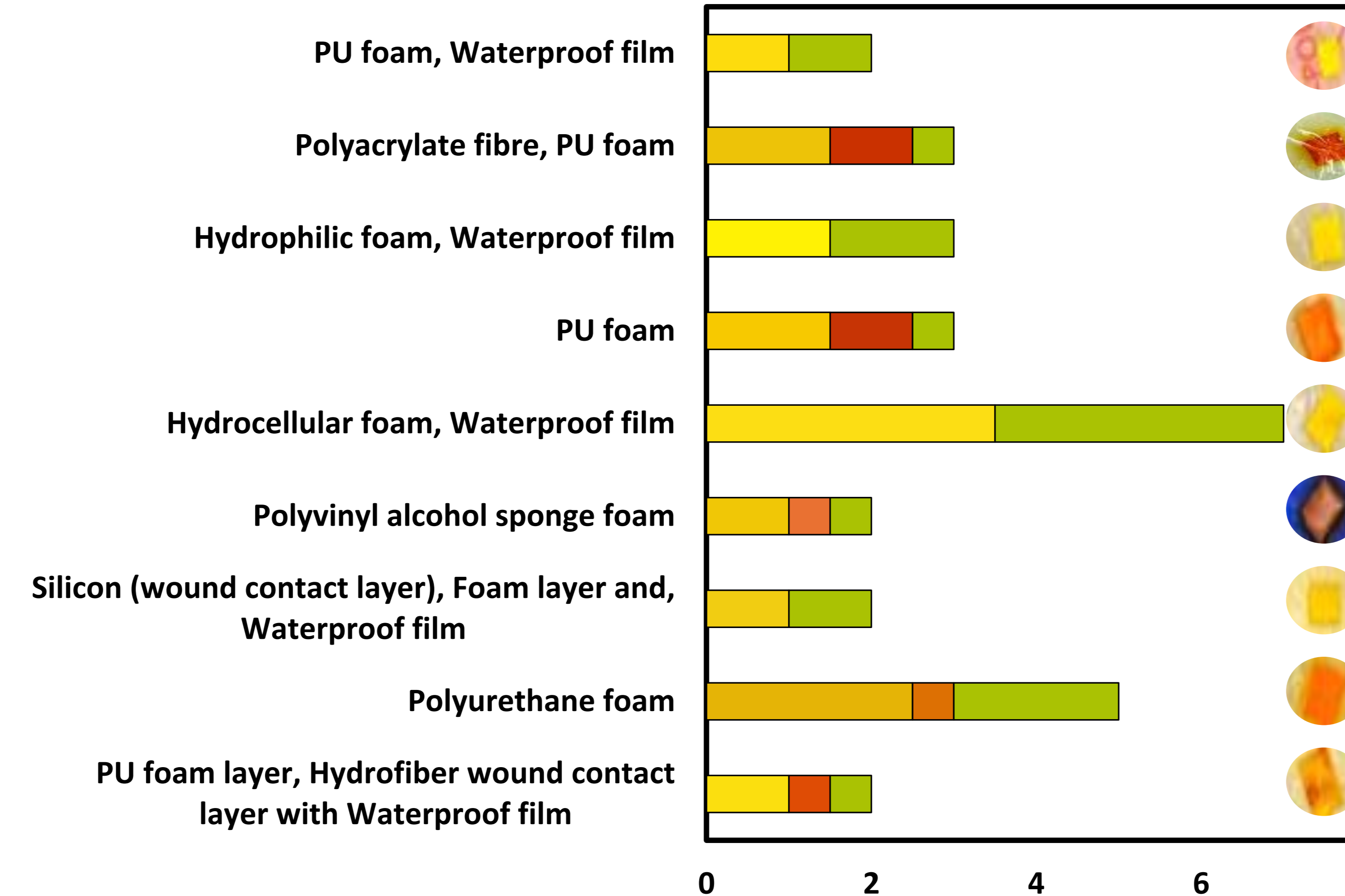


Figure 1. Lipase response color change in the presence of different dressings.

Bacteria Test

Foams	<i>E. coli</i>	<i>P.aeruginosa</i>	MRSA	Control
PU foam layer, Hydrofiber wound contact layer with Waterproof film				
Polyurethane foam				
Silicon (wound contact layer), Foam layer and, Waterproof film				
Polyvinyl alcohol sponge foam				
PU foam				
Hydrophilic foam, Waterproof film				
Polyacrylate fibre, PU foam				
PU foam, Waterproof film				
Sodium carboxymethyl cellulose				
Alginate				
Collagen				
Biosensor				

Foams	<i>E. coli</i>	<i>P.aeruginosa</i>	MRSA	Control
PU foam layer, Hydrofiber wound contact layer with Waterproof film				
Polyurethane foam				
Silicon (wound contact layer), Foam layer and, Waterproof film				
Polyvinyl alcohol sponge foam				
PU foam				
Hydrophilic foam, Waterproof film				
Polyacrylate fibre, PU foam				
Biosensor				

Figure 2. A) Bacterial response color change in the presence of different dressings A) no exudate, B) with exudate.

References

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