

High Moisture Transmission Rate and High Fluid Absorption Films for Wound Dressings

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STATEMENT OF PURPOSE

There is a market need for improved thin film wound dressings that will, ideally, adjust their fluid handling capacity [a combination of moisture vapor transmission rate (MVTR) and exudate absorption] according to the type of wound and/or progression of wound healing.¹ Literature reports show that “intelligent” film dressings change MVTR according to the moisture environment of a wound.² However, most thin film dressings lack fluid absorbance capability. We have been developing novel thin films that add the “fluid absorption” dimension to the film dressings and lay the foundation for multifunctional, advanced wound dressings.

METHODS

Proprietary thermoplastic polyether polyurethane polymer blends were developed at Lubrizol. Thin films of these polymer blends were prepared by solvent casting in water/organic solvents (e.g., tetrahydrofuran; alcohols). Films were drawn down on polyethylene substrates using an automatic film applicator with vacuum plate (Byko-drive, BYK Gardner, MD, USA) and dried at room temperature.

Films were removed from the substrate and characterized for free swell absorptive capacity in simulated wound fluid (BS EN 13726-1:2002), dry film tensile strength, dry film % elongation (ASTM D882-12) and MVTR (Permatran-W® 101K, Mocon, MN, USA).

Films prepared from polyurethane polymers (Pellethane® 5863-80A and Pellethane® 5863-90A, Lubrizol, USA) used in commercial film dressings manufacturing were used for comparison.

Commercial wound dressing films were also evaluated: Tegaderm™ Film (3M, MN, USA), Mepore® Film (Mölnlycke Health Care, Gothenburg, Sweden), Hydrofilm® (Hartmann Group, Heidenheim, Germany) and Polyskin™ II (Covidien, Dublin, Ireland).

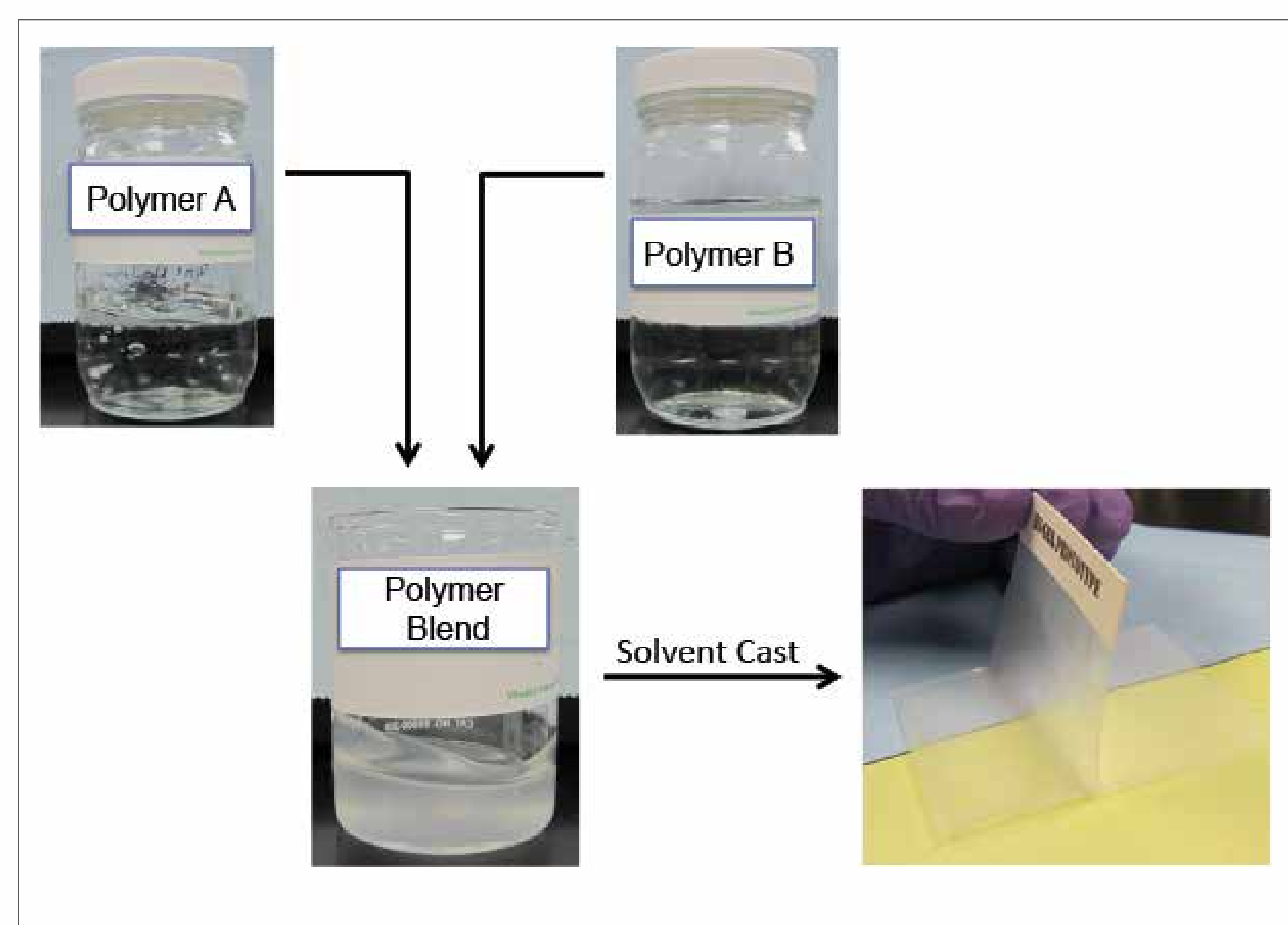


Fig. 1. High MVTR and high fluid absorption film preparation.

RESULTS

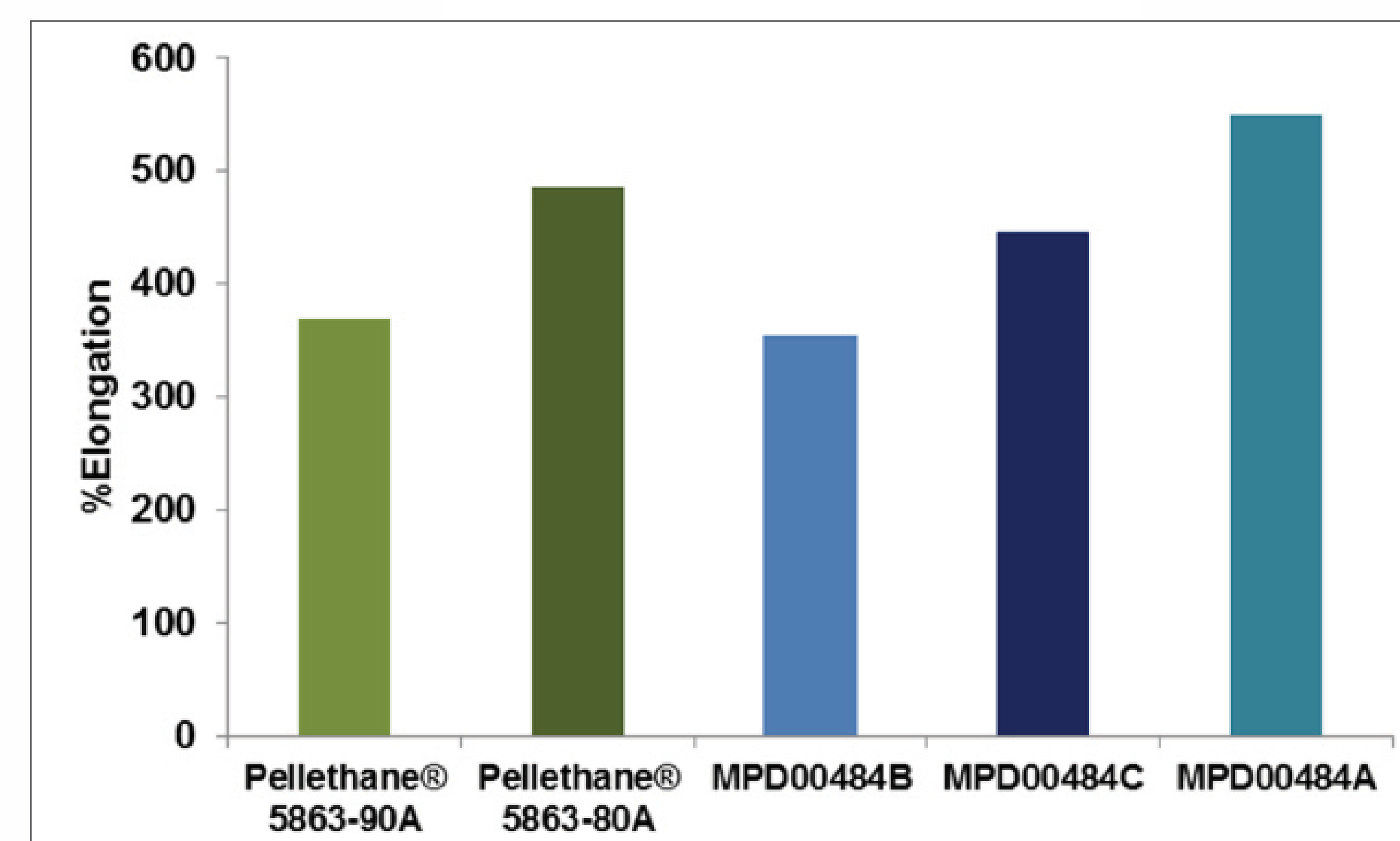


Fig. 2. % Elongation of novel polymer prototype films as compared with polymer films used in commercial film dressings.

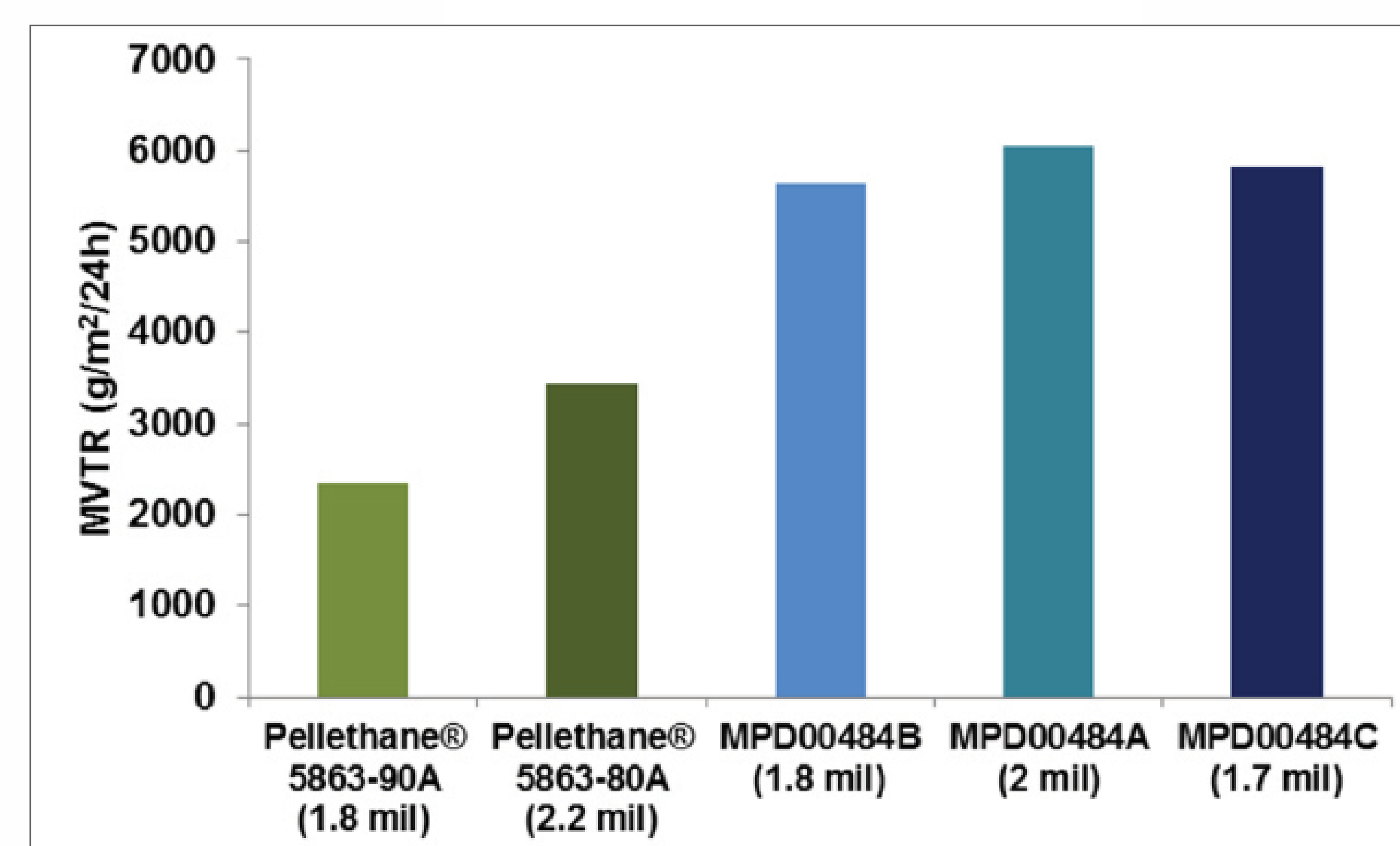


Fig. 3. MVTR of novel polymer prototype films as compared with polymer films used in commercial film dressings.

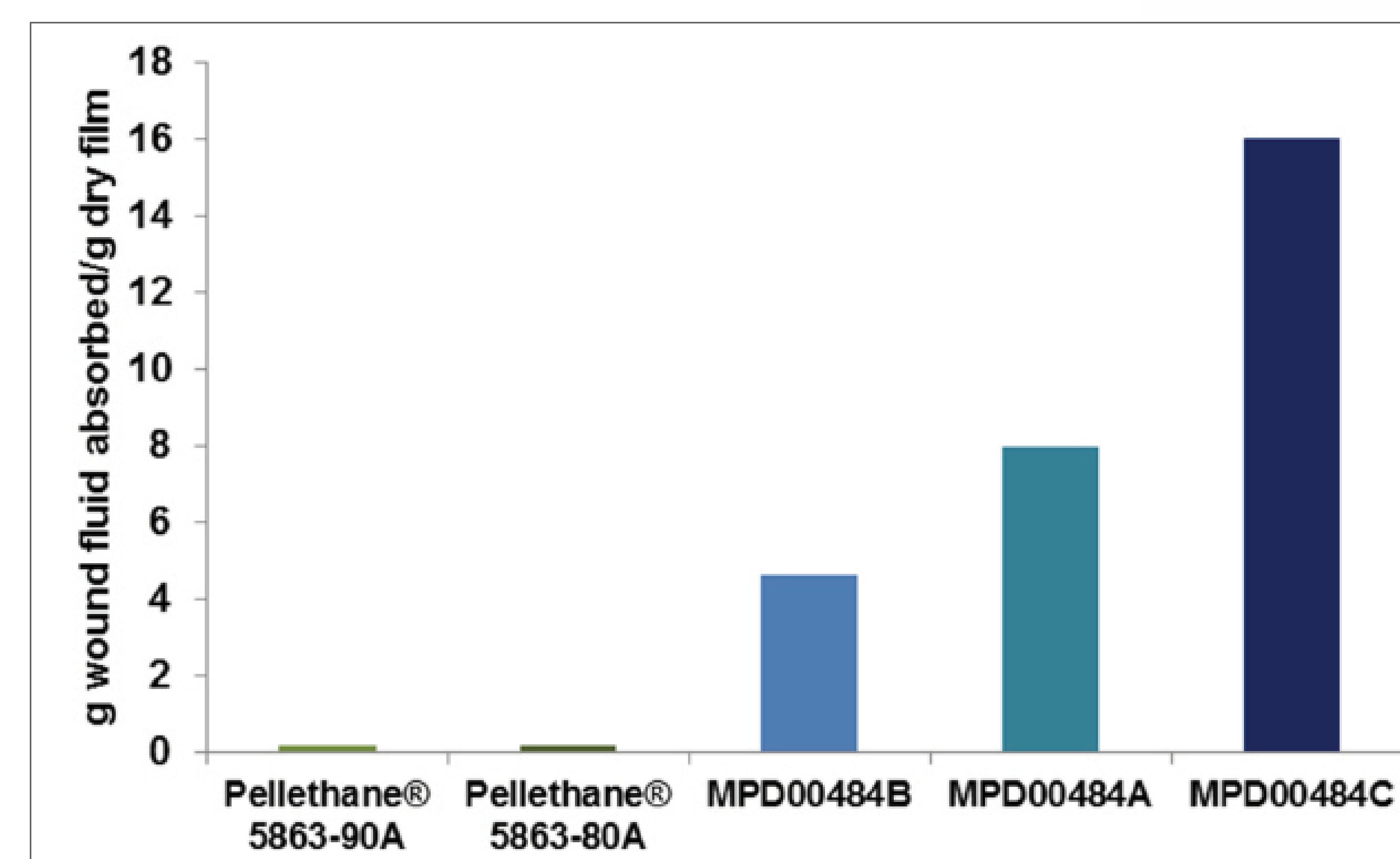


Fig. 4. Fluid absorbance of novel polymer prototype films as compared with polymer films used in commercial film dressings.

Table 1. Properties of commercial film wound dressings.

Commercial Wound Dressing Film* (film thickness)	% Elongation	MVTR g/m²/24h
Tegaderm™ Film (1.5 mil)	466	631
Hydrofilm® (1.5 mil)	470	1482
Mepore® Film (2 mil)	395	1001
Polyskin™ II (2 mil)	470	64

*Commercial film wound dressings have an adhesive layer. The film thickness includes the adhesive layer. These films have no fluid absorption.

DISCUSSIONS

Thin films of proprietary polyurethane blends of approximately 1–5 mil thickness with fluid absorbing properties and high MVTR were developed. The films under study were chosen to demonstrate the range and combination of properties that can be built in, and to demonstrate a wide range of possible applications in the design of multifunctional wound dressings. Figures 2, 3 and 4 illustrate the properties of three film prototypes (MPD00484A, MPD00484B and MPD00484C), developed in our laboratory, in comparison with films prepared from polyurethane polymers used in commercial film dressings.

The developed films in dry state have similar mechanical properties (e.g., % Elongation of 300–400) and exhibit more than twice the MVTR when compared with films prepared from polyurethane polymers used in commercial film dressings.

The increase in MVTR is significant and will allow more transmission of moisture through the dressing, which is critical to the overall fluid handling capacity of the thin film dressing.

The great benefit built in the developed films is the fluid uptake, which ranges from 400% to 3000% (referenced to dry film weight). Noteworthy, commercial film dressings have practically no fluid uptake (Table 1).

CONCLUSIONS

- Proprietary multifunctional thin films with fluid absorption and high MVTR have been developed.
- Innovative technology allows building in desired properties to design wound dressing films for a wide range of applications.
- These films are unique and represent a step forward in developing multifunctional, advanced wound dressings.

REFERENCES

1. Thomas S., “Surgical Dressings and Wound Management,” Medetec, Cardiff, South Wales; 2010
2. Palamand S., et al., *J Biomater Appl.* 1992; 198–215.