perenniol™

Rapid reaction. **Proven performance.**

Key Excerpts and Conclusions derived from a Professional, Third Party (Troy Polymers, Inc.) Study comparing Reactivity and Flammability of Perenniol™ and commercial Petroleum-Based "equivalents" in an April 30, 2018 Report

Palmer Executive Summary

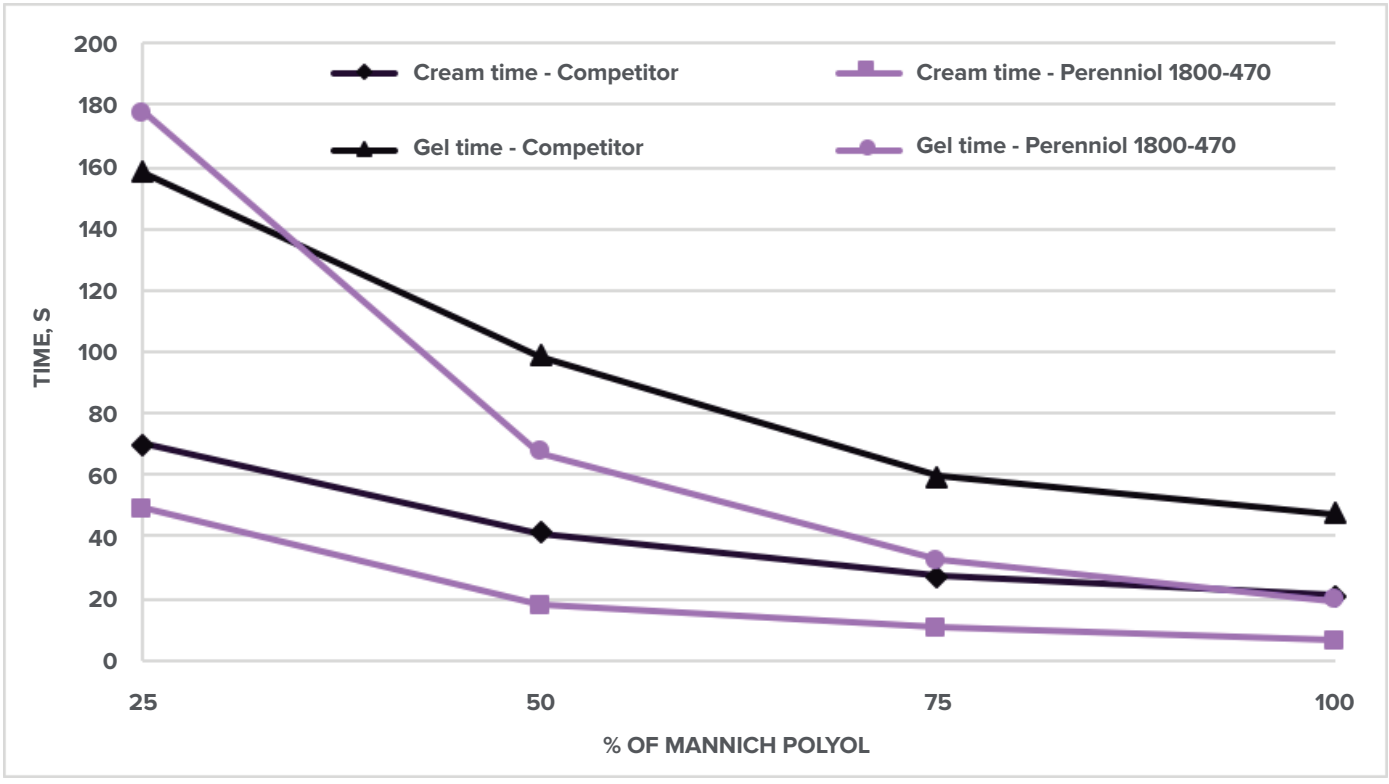
With very minor formulation adjustments, Perenniol™ polyols can be easily substituted for existing Mannich Polyols. This allows formulators to reduce/remove expensive catalysts and add renewable carbon content. Expect to observe improved hydrophobicity, metal adhesion and dimensional stability as well in the foam, based on chemistry, but further study is warranted.

Reactivity

Compared to non-renewable, widely commercial Mannich Polyols, Perenniol™ 1800-70 is significantly more reactive, allowing the formulator to significantly reduce (>50%) catalyst:

> *"Perenniol™ 1800-470 exhibited significantly higher reactivity than [redacted competitive 470 hydroxyl Mannich Polyol] polyol at the same catalyst concentration. In the non-catalyzed systems, Perenniol™ 1800-470 exhibited significantly faster cream time than [redacted competitive 470 hydroxyl Mannich Polyol] polyol, regardless of the level of these polyols as replacements for [redacted sucrose-initiated polyether polyol] in the formulations. In the non-catalyzed systems with 100% replacement of [redacted sucrose-initiated polyether polyol], Perenniol™ 1800-470 exhibited significantly higher reactivity than [redacted competitive 470 hydroxyl Mannich Polyol] polyol."*

Reactivity Comparison in Zero-Catalyst, Sucrose-Initiated Polyether Polyol Formulation with Various Degrees of Mannich Polyol Substitution:



Compared to non-renewable, widely commercial Mannich Polyols, Perenniol™ 1800-430 is more reactive as well:

> *"In the catalyzed system, Perenniol™ 1800-430 exhibited somewhat faster cream time and gel time, and comparable rise time and tack-free time to [redacted competitive 425 hydroxyl Mannich Polyol]. In the non-catalyzed system, Perenniol™ 1800-430 exhibited somewhat faster cream time in comparison to [redacted competitive 425 hydroxyl Mannich Polyol] at higher levels (50%, 75%, and 100%) in the formulation."*

Compatibility

Perenniol™ polyols exhibited similarly good compatibility with both sucrose and other Mannich-based Polyols typically found in rigid spray-foam formulations. Blends were created and studied for five (5) weeks at both room temperature and 50*C.

It is expected that compatibility with blowing agents will improve in systems with Perenniol™ and system shelf lives will be extended, but further studies must be completed.

> *"Most of the properties, including dimensional stability and burning characteristics of foams prepared with 25% and 50% Perenniol™ 1800-470 and Perenniol™ 1800-430, respectively, were comparable to those prepared with the same levels of corresponding [redacted competitive 470 hydroxyl Mannich Polyol] and [redacted competitive 425 hydroxyl Mannich Polyol] polyols (Tables 10-13). Foams based on either one of Perenniol™ polyols exhibited somewhat lower compressive strength, however, this can be likely addressed through formulation adjustments."*

Cell Structure, Dimensional Stability and Adhesion

Foams made with Perenniol™ polyols exhibited similarly good cell structure, dimensional stability and adhesion to cardboard as compared to widely commercial Mannich-based Polyols typically found in rigid spray-foam formulations.

Made in the USA by Palmer International

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