

## Tetrahydrofurfuryl Alcohol (THFA®) vs. N-Methylpyrrolidone (NMP)

### *Comparative Properties*

#### THFA®

- Not on California Prop 65 list
- Non-HAP
- Not listed on SARA 313 (TRI)
- Biodegradable material from renewable natural resource:
- EPA approved inert for pre- and post-harvest agricultural applications under 40 CFR 180.910 (formerly 40 CFR 180.1001(c))
- Worldwide registration (TSCA, EINECS, DSL, ENCS, ECL, PICCS, and others)
- FEMA GRAS listing
- 21 CFR 172.515 Listed Food additives permitted for direct addition to food for human consumption - Synthetic flavoring substances or adjuvants
- 21 CFR 175.105 Listed Indirect food additives: Adhesives and components of coatings – Adhesives
- 21CFR 176.210 Listed Indirect food additives: Paper and paperboard components – Defoaming agents used in the manufacture of paper and paperboard

#### NMP

- California Prop 65: NMP is listed as a developmental toxin
- Non-HAP
- Listed on SARA 313 (TRI)
- Biodegradable material derived from non-renewable petrochemical resources
- EPA approved for only pre-harvest agricultural applications under 40 CFR 180.920 (formerly 40 CFR 180.1001(d))
- Worldwide registration (TSCA, EINECS, DSL, and others)
- Not FEMA GRAS listed
- Not 21 CFR 172.515 listed
- Not 21 CFR 175.105 listed
- Not 21 CFR 176.210 listed

#### Notes:

TRI: NMP was listed in 1994 on SARA 313 (TRI)

#### Prop 65:

On June 15, 2001, the Office of Environmental Health Hazard Assessment (“OEHHA”) of the California Environmental Protection Agency listed NMP as a chemical known to the State of California to be a Developmental Toxin under the Safe Drinking Water and Toxic Enforcement Act of 1986 (“Proposition 65”). Proposition 65 is a comprehensive list of chemicals known to the State of California to cause cancer or reproductive toxicity. Thus NMP may not knowingly be discharged or released into water or onto/into land where such chemical passes or probably will pass into any source of drinking water, notwithstanding any other provision or authorization of law.

# Tetrahydrofurfuryl Alcohol (THFA®) vs. N-Methylpyrrolidone (NMP)

## Comparative Properties

### Physical Properties of THFA®

|   |                  |  |       |
|---|------------------|--|-------|
| Molecular Weight .....                          | 102.13g/mol      | Kauri-Butanol Value .....                                    | >150  |
| Appearance .....                                | Colorless Liquid | Specific Heat, Liquid at 20°C, cal/g°C .....                 | 0.424 |
| Boiling Point at 760 mm, °C .....               | 178              | Heat of Vaporization, cal/g .....                            | 120.6 |
| Vapor Pressure at 20°C, mmHg.....               | 0.11             | Heat of Combustion, kcal/mol<br>(at constant pressure) ..... | 709.5 |
| Freezing Point, °C.....                         | Below -80°C      | Flash Point (open cup)                                       |       |
| Specific Gravity at 20/20°C .....               | 1.054            | °C .....   | 84    |
| Pounds per Gallon at 20°C .....                 | 8.79             | °F.....  | 183   |
| Refractive Index $n_D^{20}$ .....               | 1.452            | Auto-Ignition Temperature, °C.....                           | 282   |
| Surface Tension at 25°C, dynes/cm.....          | 37               | Flammability Limits in Air                                   |       |
| Viscosity at 20°C, cps Absolute .....           | 6.24             | Lower vol %.....   | 1.5   |
| Solubility Parameter (Hansen Solubility Theory) |                  | Upper vol %.....   | 9.7   |
| Nonpolar .....                                  | 9.8              | Dielectric Constant at 23°C .....                            | 13.6  |
| Polar .....                                     | 5.0              | Relative Evaporation Rate                                    |       |
| Hydrogen Bonding .....                          | 7.8              | ( <i>n</i> -butyl acetate=1.00) .....                        | 0.03  |
| Rate of Biodegradation                          |                  |  |       |
| Sludge Test, mg COD/g hr.....                   | 40.0             |  |       |

### Contact Information

United States:

3324 Chelsea Avenue • Memphis, TN 38108

Phone: 877-895-PENN • Fax: 901-320-4002

www.pennakem.com • Email: PennUSA@pennakem.com

Europe:

Merwedeweg 4 • Port # 5630 • NL-3198 LH Europoort • The Netherlands

Phone: 0031 181 261 110 • Fax: 0031 181 261 140

Email: PennEuro@pennakem.com • Check www.pennakem.com for European Agent Contacts