



FlexiSolv™ Microemulsions

Product Description

FlexiSolv™ solvent solutions are designed to offer an optimum balance of performance, affordability and health and environmental benefits to the formulator and end-user in a rapidly changing regulatory environment. These products (patents pending) are effective alternatives to many conventional solvents.

The FlexiSolv™ microemulsions are a line of semi-formulated products ideal for aqueous cleaning applications. They are compatible with a wide variety of other solvents and additives and can be used "as-is" by the end user or by the formulator as the core in a fully-formulated product. FlexiSolv™ microemulsions let you do more with less because some of the solvent in a formulation can be replaced with water. Because of their flexibility, they provide an excellent solution for formulators who are looking to reduce the time and cost of getting their products to market.

Performance

The microemulsion series encompasses a range of products with differing functionalities designed to meet the diverse needs of the global cleaning market.

Microemulsions are clear, thermodynamically stable, single phase solutions of two or more immiscible liquids which offer the user strong solvency power in a water-dilutable, water rinseable system.

FlexiSolv™ microemulsions deliver the advantage of both aqueous and organic systems. Aqueous formulations deliver the cleaning power of an organic solvent, while the water dilutability allows for easy rinsing.

With the ease of handling, product properties and near-neutral pH, FlexiSolv™ microemulsions are an excellent alternative to many conventional solvents.

Environmental, Health & Safety

The ingredients in the FlexiSolv™ microemulsion formulations were chosen not only for their effectiveness, but also for their environmental, safety

and health attributes. In a market facing increasing attention and regulations around ingredient chemicals, INVISTA's FlexiSolv™ microemulsions offer an attractive alternative to many conventional solvents.

All the ingredients in our microemulsions are:

- ✓ **Biodegradable¹**
- ✓ **Not considered VOCs (EU, US, CAN, CALIF)²**
- ✓ **Non-flammable³**
- ✓ **Not listed as a carcinogen⁴**
- ✓ **Not a Hazardous Air Pollutant (U.S. Clean Air Act)**
- ✓ **Not listed as an ozone depleting substance⁵**
- ✓ **Listed on most international chemical inventories**
- ✓ **REACH pre-registered by INVISTA**


Cost Benefits

FlexiSolv™ microemulsions are available both as an aqueous solution and a concentrate. Sourcing the concentrated form not only offers the advantage of extending shelf life, but also can provide savings on logistic and storage costs. Water can be added (demineralised water is recommended) by the formulator or end-user with the need of only mild agitation, resulting in a stable microemulsion. Other benefits can include:

- ✓ **Reduced final formulation costs**
- ✓ **Faster product development**
- ✓ **Slower evaporation – Deeper cleaning**
- ✓ **Reduced freight costs**

Applications:

FlexiSolv™ microemulsions offer effective and flexible products for the formulator to work with. They are suitable for multiple applications, such as:

-  **Paint Stripper**
-  **Graffiti Remover**
-  **Floor Cleaner/Wax Remover**
-  **Degreaser**
-  **Adhesive Remover**
-  **Ink Remover**
-  **Flux Remover**

Product Choice

There are a variety of different microemulsion products from which to choose, each one possessing differing functionalities designed to meet the diverse needs of the global cleaning market. The FlexiSolv™ microemulsions are offered in both aqueous and concentrated forms; the letter A at the end of the formulation name identifies this product as an aqueous blend, while concentrated blends are identified using the letter C.

As a guide to selection, the table below shows the effectiveness of FlexiSolv™ microemulsions in various cleaning tasks. Simply choose the most suitable starter formulation for your application and contact INVISTA to receive a sample or further information.

| Product / Application | FlexiSolv™ 1103A | FlexiSolv™ 1113A | FlexiSolv™ 1123A | FlexiSolv™ 1143A | FlexiSolv™ 1153A | FlexiSolv™ 2103A | FlexiSolv™ 1100C | FlexiSolv™ 1110C | FlexiSolv™ 1120C | FlexiSolv™ 1140C | FlexiSolv™ 1150C | FlexiSolv™ 2100C |
|---|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Alkyd paint, 3 coats, 60 min | 100% | 67% | 67% | 0% | 0% | 67% | 67% | 33% | 33% | 0% | 0% | 67% |
| Latex paint, 3 coats, 30 min | 100% | 67% | 67% | 33% | 33% | 100% | 67% | 33% | 67% | 33% | 33% | 67% |
| Polyurethane paint, 2 coats, 30 min | 100% | 67% | 0% | 0% | 0% | 0% | 100% | 67% | 0% | 0% | 0% | 0% |
| Permanent black marker on fiberglass | 90% | 80% | 95% | 100% | 88% | 96% | 86% | 76% | 84% | 90% | 71% | 85% |
| Epoxy adhesive on metal | 88% | 30% | 38% | 46% | 12% | 100% | 93% | 74% | 67% | 88% | 50% | 78% |
| Polyurethane adhesive on metal | Note1 | Note1 | Note1 | Note1 | Note1 | Note1 | 100% | 62% | 95% | 84% | 22% | 99% |
| Wheel bearing grease on metal | 50% | 11% | 97% | 30% | 6% | 23% | 55% | 58% | 88% | 45% | 53% | 45% |
| Lithographic printing ink on tile | 100% | 100% | 100% | 50% | 50% | 50% | 50% | 50% | 10% | 10% | 10% | 10% |
| Lithographic printing ink on tile; product on industrial wipe | 100% | 15% | 17% | 16% | 16% | 25% | Note 2 | Note 2 | Note 2 | Note 2 | Note 2 | Note 2 |
| Rosin flux on copper (not baked) | 90% | 78% | 44% | 75% | 56% | 30% | 66% | 56% | 25% | 50% | 49% | 26% |
| Rosin flux on copper (baked) | 64% | 58% | 68% | 52% | 65% | 47% | 47% | 67% | 64% | 29% | 62% | 65% |
| Bathroom soil on tile | 98% | 65% | 89% | 62% | 72% | 97% | Note 2 | Note 2 | Note 2 | Note 2 | Note 2 | Note 2 |

Percentage figures in the above table indicate percent of soil removed under test conditions designed to show relative performance of the various FlexiSolv™ microemulsions.

Note 1 – FlexiSolv™ microemulsions (aqueous formulations) were not tested on polyurethane adhesive because of chemical reaction with the moisture-cure polyurethane.

Note 2 – FlexiSolv™ microemulsion concentrates were not tested in applications that frequently use water-diluted formulations.

Microemulsion Aqueous Solutions

| Specification | FlexiSolv™ 1103A | FlexiSolv™ 1113A | FlexiSolv™ 1123A | FlexiSolv™ 1143A | FlexiSolv™ 1153A | FlexiSolv™ 2103A |
|-----------------------|-------------------------------|-------------------------------|---------------------------------------|-------------------------------|-------------------------------|-------------------------------|
| Water content, wt. % | 30-35 | 23-30 | 23-30 | 23-30 | 23-30 | 30-35 |
| Acid number, mg KOH/g | 5 max | 10 max | 5 max | 5 max | 5 max | 10 max |
| Color, Pt-Co (APHA) | 50 max | 50 max | 200 max | 50 max | 50 max | 50 max |
| Appearance | Clear to slightly hazy liquid | Clear to slightly hazy liquid | Clear to slightly hazy, yellow liquid | Clear to slightly hazy liquid | Clear to slightly hazy liquid | Clear to slightly hazy liquid |

| Physical Properties | FlexiSolv™ 1103A | FlexiSolv™ 1113A | FlexiSolv™ 1123A | FlexiSolv™ 1143A | FlexiSolv™ 1153A | FlexiSolv™ 2103A |
|---|----------------------------|----------------------------|----------------------------|----------------------------|-------------------------------|----------------------------|
| Density, g/mL at ~22°C | 1.041 | 1.048 | 0.993 | 1.040 | 1.032 | 1.056 |
| Flash Point, °C | No flash at 93°C (aqueous) | No flash at 93°C (aqueous) | No flash at 93°C (aqueous) | No flash at 93°C (aqueous) | No flash at 93°C (aqueous) | No flash at 93°C (aqueous) |
| Viscosity, cSt at 22°C | 9 | 7 | 13 | 12 | 11 | 8 |
| Refractive Index | 1.4589 | 1.4471 | 1.4547 | 1.4526 | 1.4517 | 1.4075 |
| pH | 6.8 | 5.4 | 5.3 | 6.3 | 4.7 | 5.6 |
| Freezing Point, °C | ~0°C | ~0°C | ~0°C | <-12°C | ~0°C | ~0°C |
| Initial Boiling Point, °C | ~100°C (aqueous) | ~100°C (aqueous) | ~100°C (aqueous) | ~100°C (aqueous) | ~100°C (aqueous) | ~100°C (aqueous) |
| Odor | Mild aromatic | Mild, sweet, aromatic | Mild, vegetable oil odor | Mild, sweet, aromatic | Mild, slightly sharp aromatic | Mild, sweet |
| Kb Value | >200 | >200 | 25 | >200 | 25 | >200 |
| Vapor pressure at 20°C, excluding water, calculated using Raoult's Law, mm Hg (kPa) | 0.006 (0.001) | 0.008 (0.001) | 0.006 (0.001) | 0.007 (0.001) | 0.006 (0.001) | 0.005 (0.001) |
| % VOC Content: according to: US EPA 40 CFR 59.203(f) ^{1,2} (Consumer Products) | 0% | 0% | 0% | 0% | 0% | 0% |
| % VOC Content: according to: EU Solvents Emissions Directive – 1999/13/EC ² | 0% | 0% | 0% | 0% | 0% | 0% |
| US EPA Method 24 ⁷ | 50 | 63 | 41 | 63 | 63 | 51 |
| Water dilutability for microemulsion, % water | 0-100% | 0-25% | 0-45% | 0-100% | 0-100% | 0-25% |
| Shelf Life ⁶ | 2 years | 6 months to 1 year | 2 years | 2 years | 2 years | 6 months to 1 year |

Microemulsion Concentrates

| Specification | FlexiSolv™ 1100C | FlexiSolv™ 1110C | FlexiSolv™ 1120C | FlexiSolv™ 1140C | FlexiSolv™ 1150C | FlexiSolv™ 2100C |
|-----------------------|-------------------------------|-------------------------------|--------------------------------------|-------------------------------|-------------------------------|-------------------------------|
| Water content, wt. % | 5 max | 5 max | 5 max | 5 max | 5 max | 5 max |
| Acid number, mg KOH/g | 2 max | 2 max | 2 max | 2 max | 2 max | 2 max |
| Color, Pt-Co (APHA) | 50 max | 50 max | 200 max | 50 max | 50 max | 50 max |
| Appearance | Clear to slightly hazy liquid | Clear to slightly hazy liquid | Clear to slightly hazy yellow liquid | Clear to slightly hazy liquid | Clear to slightly hazy liquid | Clear to slightly hazy liquid |

| Physical Properties | FlexiSolv™ 1100C | FlexiSolv™ 1110C | FlexiSolv™ 1120C | FlexiSolv™ 1140C | FlexiSolv™ 1150C | FlexiSolv™ 2100C |
|--|---------------------|-----------------------|--------------------------|-----------------------|-------------------------------|---------------------|
| Density, g/mL at ~22°C | 1.051 | 1.056 | 1.012 | 1.044 | 1.039 | 1.071(24°C) |
| Flash Point, °C | >93°C | >93°C | >93°C | >93°C | >93°C | >93°C |
| Viscosity, cSt at 22°C | 26 | 15 | 18 | 38 | 24 | 12 (25°C) |
| Refractive Index | 1.5077 | 1.4874 | 1.4931 | 1.4906 | 1.4909 | 1.4358 |
| pH (10% solution in water) | 6.7 | 6.7 | 5.5 | 5.8 | 4.7 | 5.1 |
| Freezing Point, °C | < -12°C | < -12°C | < -12°C | < -12°C | < -12°C | ~20°C |
| Initial Boiling Point, °C (d = decomposes) | 217°C (d) | 181°C (d) | 168°C (d) | 194°C (d) | 169°C (d) | 163°C (d) |
| Odor | Mild aromatic | Mild, sweet, aromatic | Mild, vegetable oil odor | Mild, sweet, aromatic | Mild, slightly sharp aromatic | Mild, sweet |
| Kb Value | >200 | >200 | >200 | >200 | >200 | >200 |
| Vapor pressure at 20°C, excluding water, calculated using Raoult's Law, mm Hg (kPa) | 0.027 (0.004) | 0.029 (0.004) | 0.024 (0.003) | 0.026 (0.003) | 0.024 (0.003) | 0.029 (0.004) |
| % VOC Content: according to: US EPA 40 CFR 59.203(f)1 ² (Consumer Products) | 0% | 0% | 0% | 0% | 0% | 0% |
| % VOC Content: according to: EU Solvents Emissions Directive – 1999/13/EC ² | 0% | 0% | 0% | 0% | 0% | 0% |
| US EPA Method 24 ⁷ | 75 | 82 | 57 | 82 | 82 | 75 |
| Water dilutability for microemulsion, % water | 0-100% | 0-50% | 0-70% | 0-100% | 0-100% | 0-50% or 90-100% |
| Shelf Life ⁶ | 2 years | 2years | 2 years | 2 years | 2years | 2years |

Compatibility

Microemulsion Concentrates

The table below shows results of compatibility tests of FlexiSolv™ microemulsion concentrates with various polymers. OK indicates less than ~5% change in weight or physical dimensions after a 5-day soak test at 50°C. When weight or physical dimensions changed by about 10% or more, the polymer is designated as

not recommended (NR). Intermediate results are designated as Test, indicating that the polymer should be further tested under specific end-use conditions to determine suitability. This table is intended only as a preliminary guide; it is always essential to test polymers for compatibility before use.

| Plastics & Elastomers | FlexiSolv™ 1100C | FlexiSolv™ 1110C | FlexiSolv™ 1120C | FlexiSolv™ 1140C | FlexiSolv™ 1150C | FlexiSolv™ 2100C |
|----------------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| ABS | NR | NR | NR | NR | NR | NR |
| Acetal | OK | OK | OK | OK | OK | OK |
| Acrylic | NR | NR | NR | NR | NR | NR |
| Black polyurethane rubber | NR | NR | NR | NR | NR | NR |
| Buna-N rubber | NR | NR | NR | NR | NR | NR |
| Butyl rubber | OK | OK | OK | OK | OK | OK |
| Chlorosulfonated polyethylene | Test | NR | NR | Test | NR | NR |
| EPMD Rubber | OK | OK | OK | OK | OK | OK |
| Fluoroelastomer | OK | Test | OK | OK | OK | NR |
| Fluorosilicone rubber | OK | OK | OK | OK | OK | OK |
| HDPE | OK | OK | OK | OK | OK | OK |
| LDPE | OK | OK | OK | OK | OK | OK |
| Natural gum rubber | OK | OK | NR | OK | OK | OK |
| Nylon 6/6 | OK | OK | OK | OK | OK | OK |
| PTFE | OK | OK | OK | OK | OK | OK |
| PVC | OK | NR | OK | OK | OK | NR |
| Polycarbonate | OK | NR | Test | OK | OK | NR |
| Polychloroprene rubber | Test | Test | Test | Test | Test | Test |
| Polyetherimide | Test | OK | OK | OK | OK | OK |
| Polyphenylene oxide | OK | OK | OK | OK | OK | OK |
| Polypropylene | OK | OK | OK | OK | OK | OK |
| Polysulfone | NR | NR | Test | OK | OK | NR |
| SBR rubber | OK | OK | Test | OK | OK | OK |
| Silicone rubber | OK | OK | OK | OK | OK | OK |

Rating: OK = Satisfactory for use
NR = Not recommended for use
TEST = Should be tested in the system before use

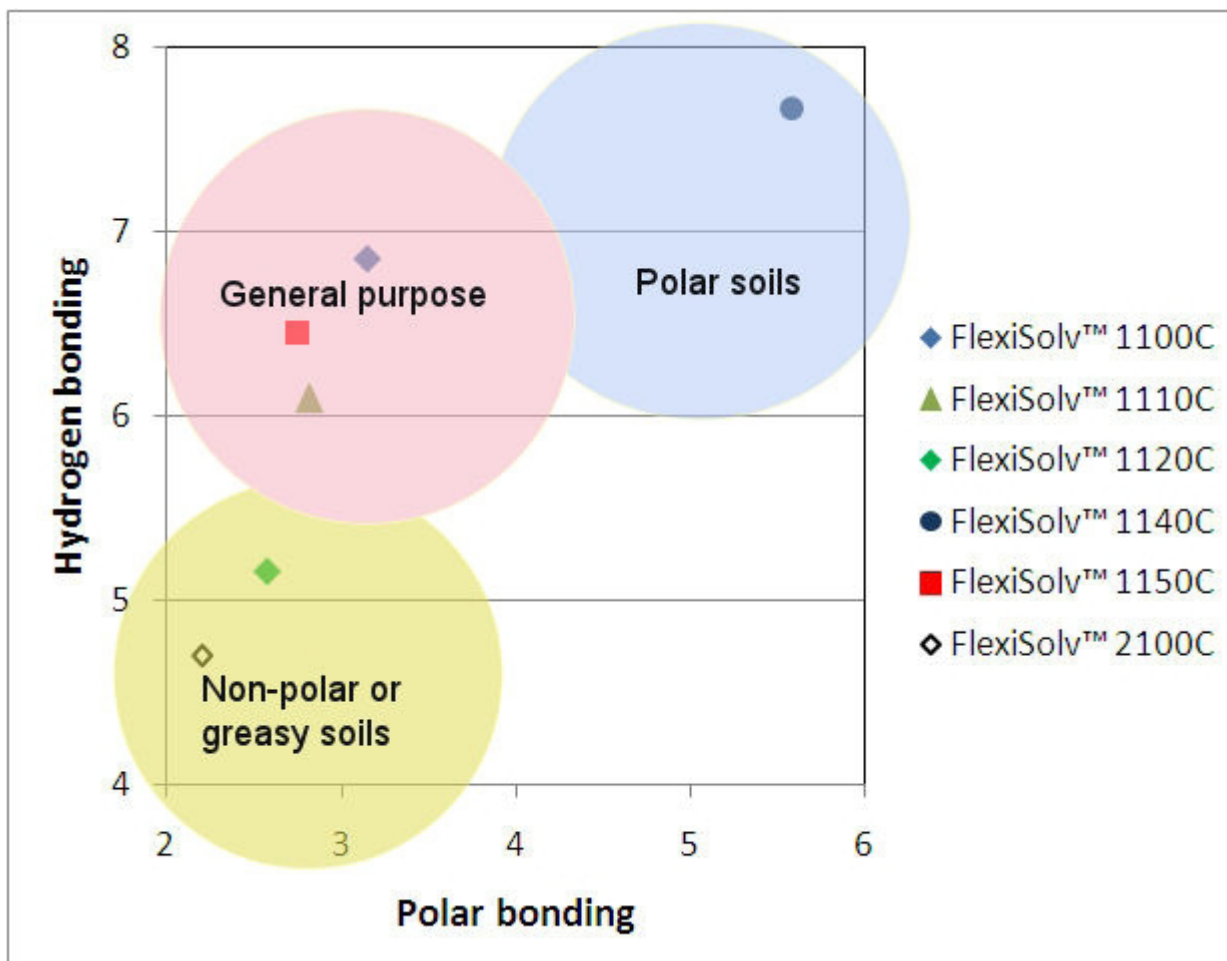
Hansen Solubility Parameter System

The compatibility of FlexiSolv™ microemulsions with a wide variety of co-solvents allows great flexibility in modifying FlexiSolv™ microemulsions to suit specific tasks. Hansen solubility parameters provide a powerful way to describe a soil or resin in terms of its non-polar, polar, and hydrogen bonding characteristics. Then, one can use the principle of “like dissolves like” to design FlexiSolv™ microemulsions that will be more effective at dissolving a particular soil or resin.

To make the formulator’s task easier, INVISTA has designed a family of FlexiSolv™ microemulsions, using carefully selected co-solvents to modify the Hansen parameters of the formulation. The graph below maps INVISTA’s FlexiSolv™ microemulsions in terms of

Hansen polar and hydrogen bonding parameters calculated for the solvent portion of the FlexiSolv™ microemulsions. FlexiSolv™ 1100C, 1110C, and 1150C microemulsion products are suitable for general-purpose use on moderately polar soils. FlexiSolv™ 1120C and 2100C microemulsions have been formulated to provide improved performance with non-polar or greasy soils, but are also suitable for general-purpose use on moderately polar soils. FlexiSolv™ 1140C microemulsion is more suitable for polar soils or resins.

Providing even more formulating flexibility, all FlexiSolv™ microemulsions may be used as concentrates, diluted with water in microemulsion form, or customized by addition of co-solvents and other modifiers.



Storage and Shipping

FlexiSolv™ microemulsion concentrates are shipped in HDPE drums. They may be handled using clean, corrosion-free mild steel, but any surface corrosion (e.g. from atmospheric oxidation) may cause iron contamination or color. FlexiSolv™ microemulsions, containing water, are shipped in HDPE drums and should not be handled using mild steel. FlexiSolv™ microemulsions and microemulsion concentrates may both be handled using stainless steel containers and equipment.

All FlexiSolv™ microemulsion concentrates remain homogeneous liquids at -12°C except for FlexiSolv™ 2100C, which may begin to crystallize if stored at temperatures below 20°C. FlexiSolv™ microemulsions, which contain water, typically freeze between 4°C and -12°C. In the event that FlexiSolv™ microemulsions freeze or begin to crystallize, even partially, the entire container of FlexiSolv™ microemulsion must be warmed and thoroughly agitated until all solid is dissolved, before being sampled or used in a formulation. Presence of solid material changes the

composition of the liquid portion of the mixture, which may adversely affect performance. Removal of liquid from partially-crystallized FlexiSolv™ microemulsion will irreversibly and irrecoverably alter composition and performance of the remaining material.

Shipping Name: FlexiSolv™ 1100C, 1110C, 1120C, 1140C, 1150C, 2100C, 1103A, 1113A, 1123A, 1143A, 1153A and 2103A microemulsions

Freight Classification: Resin Solvent NOIBN
DOT/IMDG/ADR Classification: Not regulated

Packages

Drums: 205 kgs/452lbs
HDPE drums

Bulk: Available upon request.

Global Chemical Inventories:

FlexiSolv™ microemulsions are on most international chemical inventories. See matrix below:

| FlexiSolv™ Microemulsions | U.S. TSCA | Europe EINECS | Australia AICS | Canada DSL | China IECSC | Japan ENCS | Korea KECI | Phillippines PICCS | New Zealand NZIoC |
|---------------------------|-----------|---------------|----------------|------------|-------------|------------|------------|--------------------|-------------------|
| 1100C | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 1110C | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 1120C | Yes | Yes | Yes | Yes | Yes | Yes | Yes | No | Yes |
| 1140C | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 1150C | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 2100C | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| | | | | | | | | | |
| 1103A | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 1113A | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 1123A | Yes | Yes | Yes | Yes | Yes | Yes | Yes | No | Yes |
| 1143A | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 1153A | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 2103A | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

Footnotes:

1. According to OECD definition, using empirical data, and results from EPI Suite™ modeling software.
2. EU Solvent Emissions Directive 1999/13/EC, US VOC Exemption for consumer products EPA 40 CFR 59.203(f)(1), Environment Canada's "Guidelines For Volatile Organic Compounds In Consumer Products", Nov. 2002, Section 94508(a)(80) of Title 17 of the California Code of Regulations.
3. According to Chapter 2.6 of the Globally Harmonized System of Classification and Labeling of Chemicals (GHS)
4. According to NTP, IARC, ACGIH, EU-Dangerous Substances Directive (67/548/EEC)- Annex I, and California Proposition 65
5. Reference: UNEP – *The Montreal Protocol on Substances That Deplete the Ozone Layer*
6. When stored in the original container, kept tightly closed and dry, in a well ventilated location.
7. VOC content determined by first measuring volatile content according to ASTM D2369, then adjusting for water content according to EPA Method 24 equation 24-4.

For Samples and Information:

INVISTA Specialty Materials • (800) 231-0998

Email: nisp@invista.com • Web address: www.FlexiSolv.com

This Product Data Sheet contains selected information about a specific INVISTA product, or group of products, and particular uses of the same. It relates only to the identified product and any identified uses, and is based on information available as of the date hereof. Additional information may be needed to evaluate other uses of the product, including use of the product in combination with any materials or in any processes other than those specifically referenced. Information provided herein with respect to any hazards that may be associated with the product is not meant to suggest that use of the product in a given application will necessarily result in any exposure or risk to workers or the general public. **THIS PRODUCT DATA SHEET DOES NOT CONTAIN A COMPLETE STATEMENT OF, AND DOES NOT CONSTITUTE A REPRESENTATION, WARRANTY OR GUARANTY WITH REGARD TO, A PRODUCT'S CHARACTERISTICS, USES, QUALITY, MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR THE SUITABILITY, SAFETY, EFFICACY, HAZARDS OR HEALTH EFFECTS OF THE PRODUCT, WHETHER USED SINGULARLY OR IN COMBINATION WITH ANY OTHER PRODUCT, EXCEPT TO THE EXTENT REQUIRED BY THE RELEVANT LAW AND REGULATIONS.** Purchasers and users of the product are responsible for determining that the product is suitable for the intended use and that their workers and the general public are advised of any risks resulting from such use. Nothing contained in this Product Data Sheet shall be construed to modify any of the commercial terms pursuant to which the product was sold by INVISTA including, but not limited to, terms and conditions addressing each party's respective rights and obligations with regard to warranties, remedies and indemnification.

If purchasers and users believe or have reason to believe that the Product Data Sheet or other information provided to them by INVISTA is inaccurate or in any way insufficient for any purpose, they should immediately notify INVISTA of the same, and of the basis for their belief (for example, studies, data, reports of incidents, etc.) so that INVISTA can determine whether modification or supplementation of the Product Data Sheet, or other measures, are appropriate. Failure of purchasers and users to timely provide such notice shall be deemed a waiver by purchasers and users of any and all claims, demands or causes of action, including causes of action based on an alleged failure to warn, for personal injury or damage to the environment or property arising from or attributable to the use of product.

This disclaimer shall be effective to the extent allowed by law. Should any provision be deemed to be ineffective or unenforceable, that provision shall be deemed severed from the disclaimer and the remaining provisions shall continue to have full force and effect.

INVISTA, DBE® and FLEXISOLV™ are trademarks of INVISTA. Copyright© 2011 INVISTA. All rights reserved