TECHNICAL BULLETIN – April 2011

Solvent Reformulation to Replace or Reduce Methyl Ethyl Ketone Usage

The current global shortage of methyl ethyl ketone (MEK) has led to high pricing and wide interest in reformulating to replace or reduce MEK usage. OXEA, the oxo people, present the following information pertinent to potential MEK replacement and discuss the benefits and limitations associated with such action. The information is based on practical experience as well as computer simulation and prediction tools. Of course, **this information is a suggested starting point only and must be verified by appropriate laboratory product and performance testing specific to your product formulation.**

In looking at replacement opportunities, the primary objectives were to match the evaporation rate and broad dissolving capability of MEK so that other formulation components could remain unchanged. Matching MEK's solubility parameters is a good indicator that resins or other solutes will remain soluble in the new blend thus preserving the dissolving capability. A blend of 40% n-propyl acetate and 60% acetone is an excellent match for MEK's evaporation rate and solubility parameters. These and other important properties are presented in the table below.

Property	**MEK**	**40% n-Propyl Acetate 60% Acetone Blend**
Evaporation rate (n-BuAc = 1)	4.03	4.03
90% Evaporation time, secs	121	121
Solubility Parameters, $cal^{1/2}$ $cm^{-3/2}$		
Dispersion	7.6	7.6
Polarity	4.4	4.0
Hydrogen Bonding	2.5	3.5
OVERALL	9.1	9.2
Flash point, ºF	20	7 (estimated)
Surface Tension, dynes/cm @ 25ºC	24.0	23.4
Solvent composition at 50% evaporated	100% MEK	61% n-propyl acetate
Solvent composition at 80% evaporated	100% MEK	93% n-propyl acetate
Blush resistance, % RH @ 80ºF	45	Approximately 30

Use of a n-propyl acetate / acetone combination to replace MEK offers several benefits in today's environment:

1. Lower cost thus increasing your product's competitiveness
2. Better availability of n-propyl acetate and acetone reducing supply issues

3. In the U.S., the EPA and many states have granted acetone VOC-exempt status because it does not photochemically react with nitrous oxides in air to form ozone. Thus replacing MEK with n-propyl acetate and acetone reduces the formulation's VOC content.

There may also be a few limitations of the n-propyl acetate / acetone switch. Acetone's very low flash point will likely give the finished formulation a lower flash point than when using MEK. Also, blush resistance will probably be reduced. **It is incumbent on the formulator to determine the suitability of this blend for their particular product and application**.

There are many MEK containing products amenable to substitution with a combination of n-propyl acetate and acetone without affecting drying rate. Most amenable to reformulation are wax removers / surface cleaners, spray gun and brush cleaners, adhesive removers, purge and flush solvents, diluents and reducers, clean-up solvents, etc. Wood coatings and stains, automotive refinish products, industrial and maintenance coatings, solvent borne adhesives such as acrylic PSAs, and gravure inks are also possible candidates for reformulation. Automotive OEM and aerospace coatings should be approached with care.

Summary:

The current shortage and resultant high price of MEK is not expected to change in the near future. Reformulation with n-propyl acetate and acetone offers multiple advantages including cost and availability. OXEA is the world's largest producer of n-propanol / n-propyl acetate. Our n-propyl acetate production facilities are located in Bay City, Texas and Marl, Germany.

OXEA Corporation
1505 West LBJ Freeway
Suite 400
Dallas, TX 75234 USA
1-972-481-2700

info@oxea-chemicals.com

OXEA GmbH
Otto-Roelen-Straße 3
46147 Oberhausen Germany
49 208 693-3100

www.oxea-chemicals.com