

ETHOCEL™ ETHYL CELLULOSE POLYMER IN SCREEN PRINTING TECHNOLOGY

GSS

2021

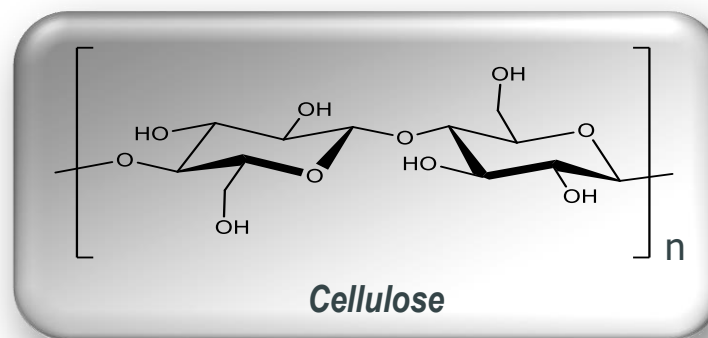


CONTENT

- **ETHOCEL™ ethyl cellulose polymer introduction**
- **Applications in Screen Printing**
- **Commonly used solvents in screen printing**
- **Dissolving performance in solvents**
- **Impacts of molecular weight/intrinsic viscosity**
- **Impacts of Ethoxyl % substitution level**
- **New: Tight spec grades**

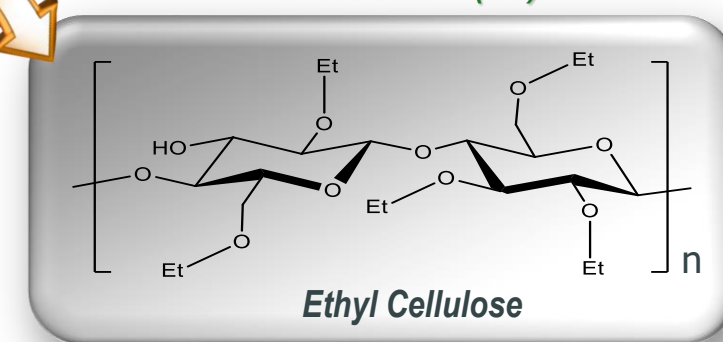
ETHOCEL ETHYL CELLULOSE POLYMER

- Structure
- Portfolio



NaOH
Ethyl Chloride

ETHOCEL™ (EC)



Substitution

Defined as ethoxyl content

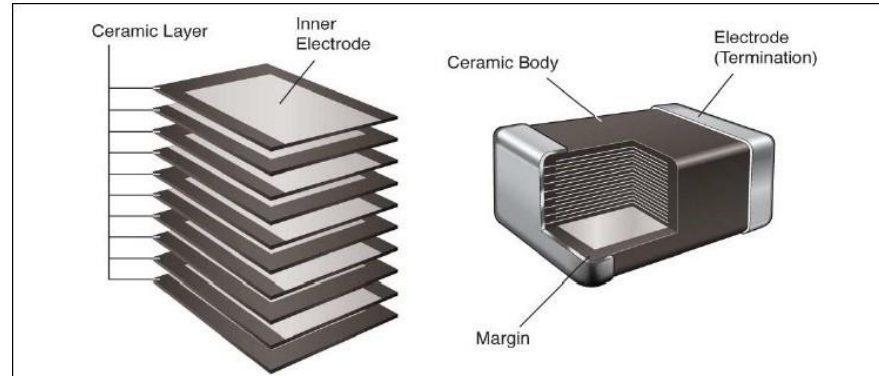
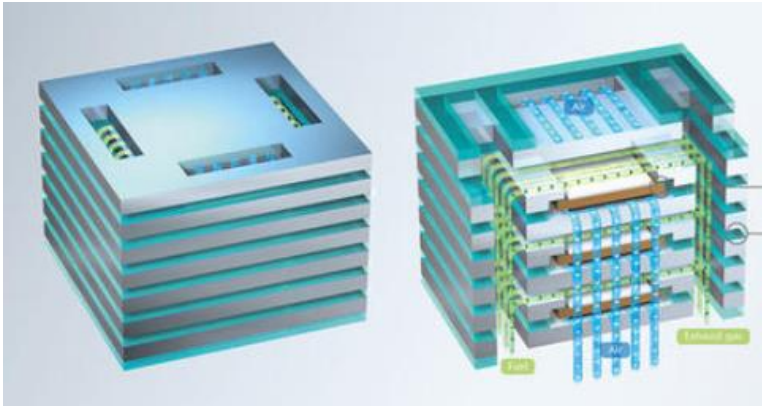
Medium: 45-47%

Standard: 48-49.5%

Product	Ethoxyl content (%)
ETHOCEL Standard 4	48.0 – 49.5%
ETHOCEL Standard 7	48.0 – 49.5%
ETHOCEL Standard 10	48.0 – 49.5%
ETHOCEL Standard 20	48.0 – 49.5%
ETHOCEL Standard 45	48.0 – 49.5%
ETHOCEL Standard 100	48.0 – 49.5%
ETHOCEL Standard 200	48.0 – 49.5%
ETHOCEL Standard 300	48.0 – 49.5%
ETHOCEL Medium 70	45.0 – 47.0%

APPLICATIONS IN SCREEN PRINTING

- Multi Layer Ceramic Capacitors (MLCC): inner electrodes, ending electrodes
- Similar products: LTCC/HTCC/Resistors
- Photo voltaic (PV) : front silver paste, back silver paste, aluminum paste
- Solid Oxides Fuel Cell (SOFC)
- Displays: PDP



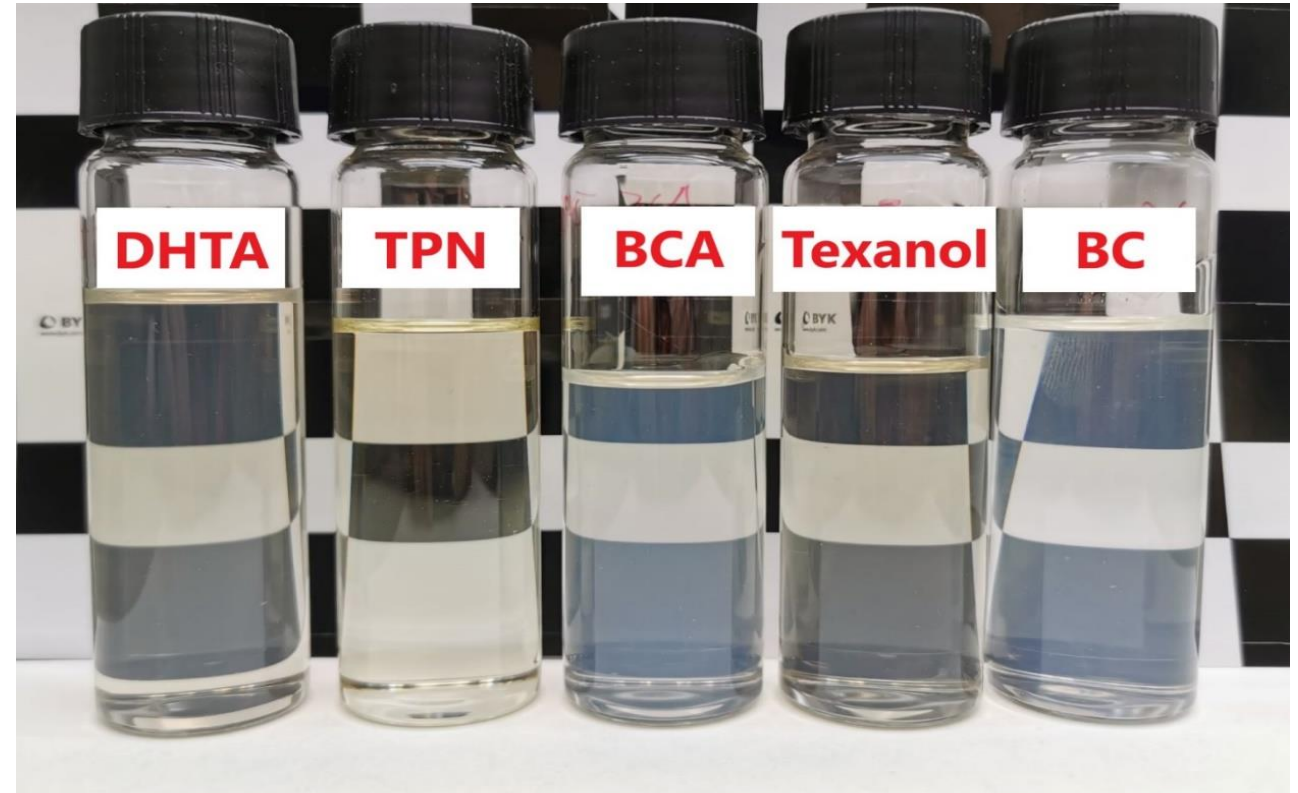
ADVANTAGE OF ETHOCEL

- Dissolvable in various organic solvents
- High dispersion for metal and glass particles: Ag, Al, Ni...
- Ideal Rheology: adjustable viscosity/shear thinning/Thixotropic...
- High compatibility with other ingredients in metal pastes
- Easy burn out during calcination

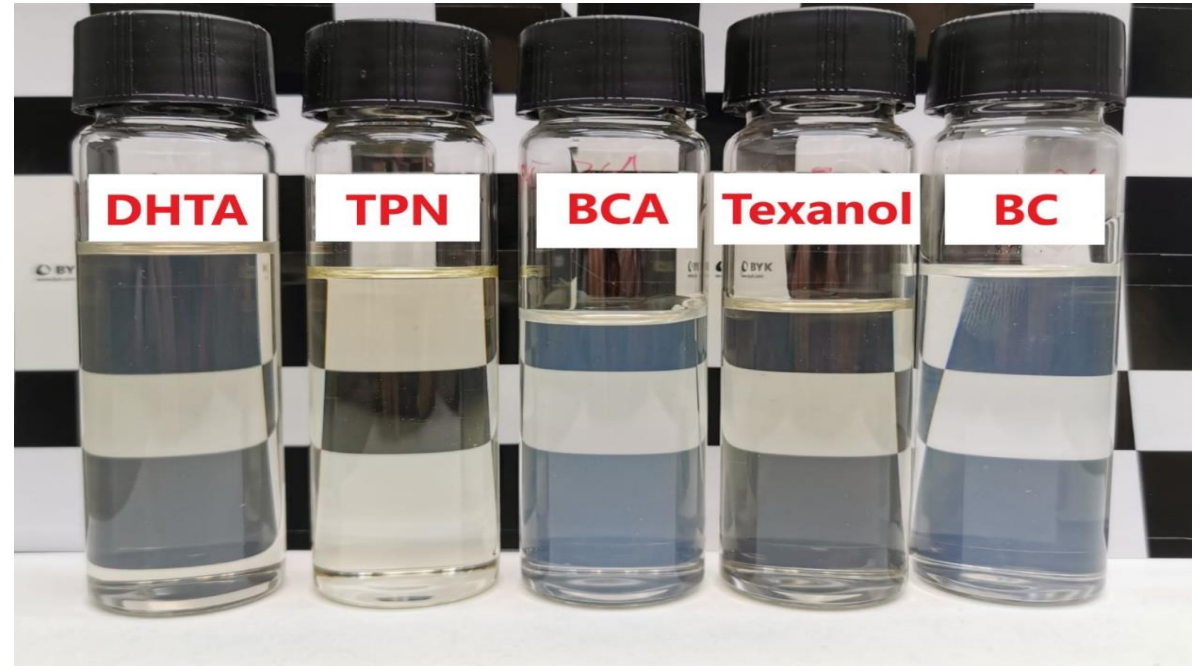
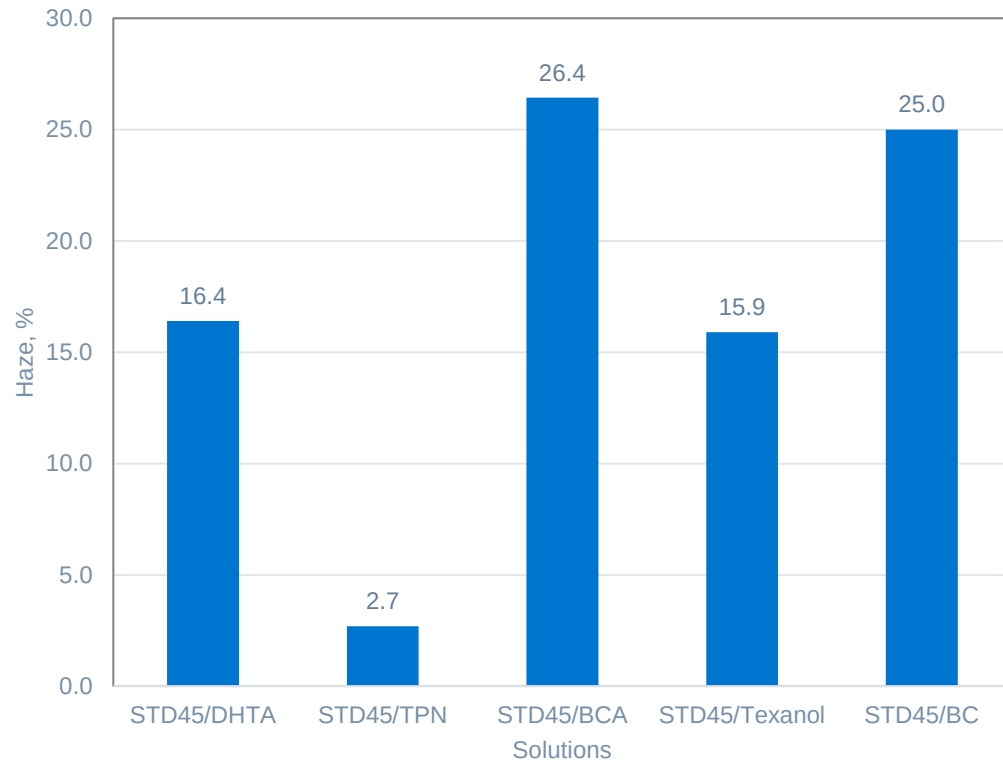


ETHOCEL SOLVENTS IN SCREEN PRINTING

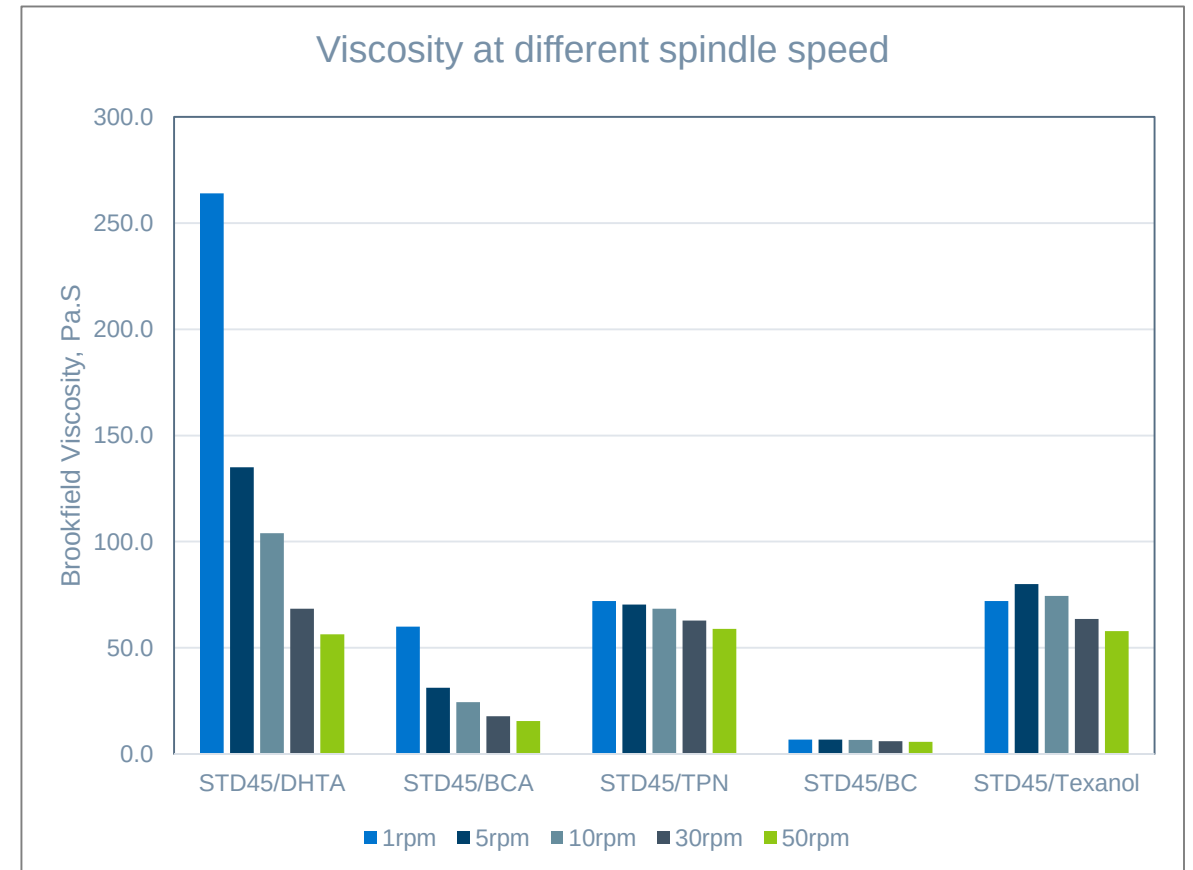
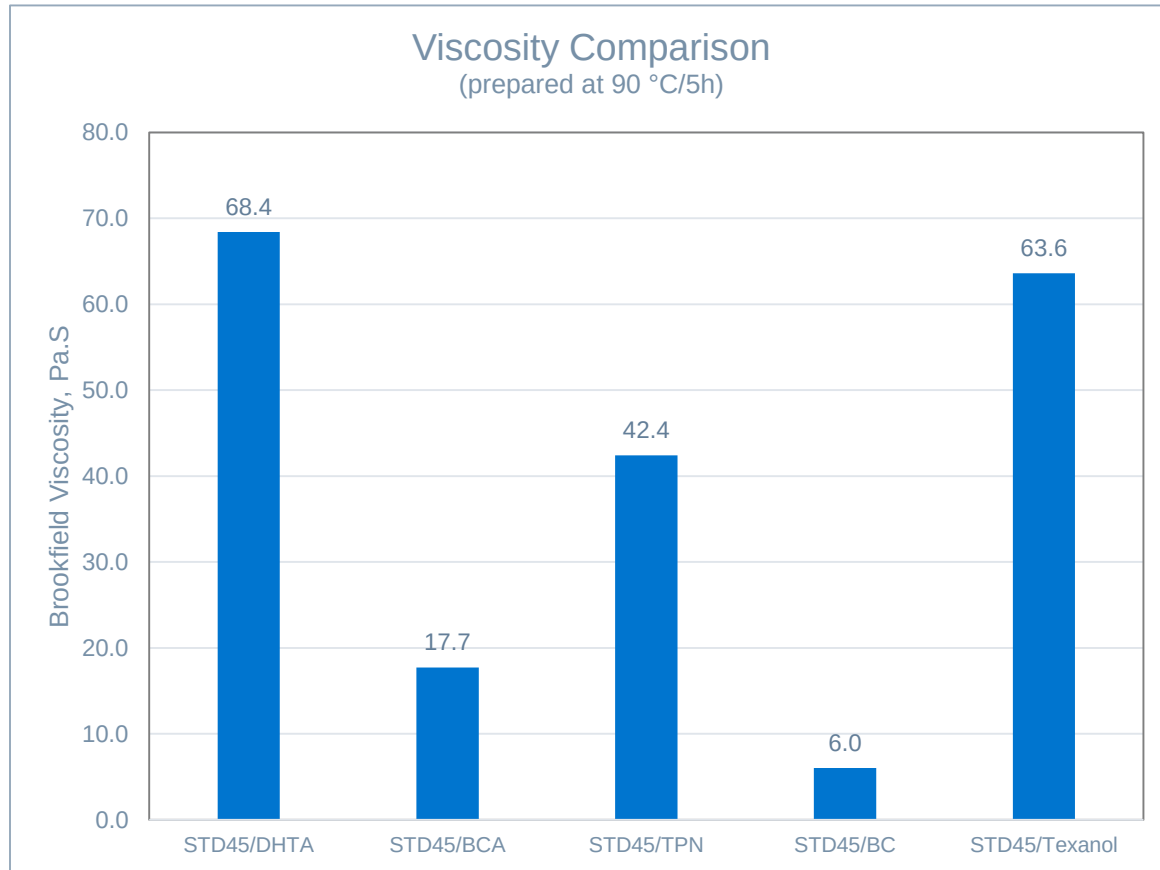
- **Terpineol**
- **BC:** butyl carbitol, diethylene glycol monobutyl ether
- **BCA:** butyl carbitol acetate
- **Alcohol ester-12** (Texanol): 2,2,4-Trimethyl-1,3-pentanediolmono(2-methylpropanoate)
- **DHTA:** Di Hydro Terpinyl Acetate



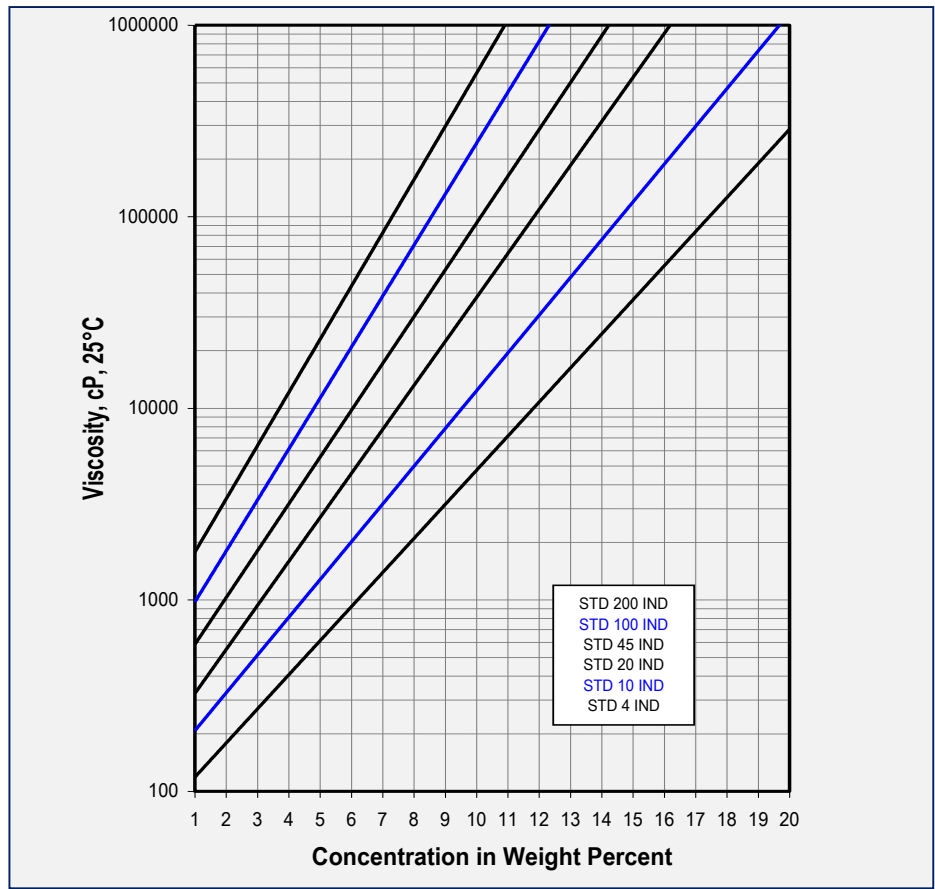
DISSOLVING OF ETHOCEL IN SOLVENTS



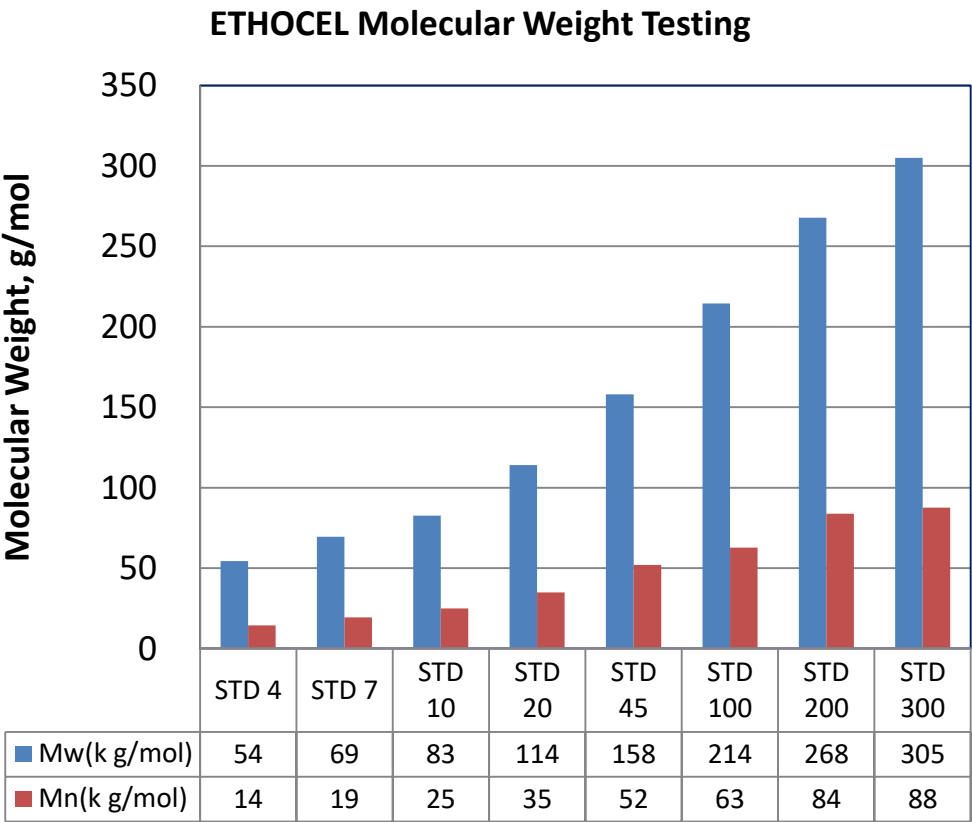
VISCOSITY AND RHEOLOGY



IMPACTS OF INTRINSIC VISCOSITY



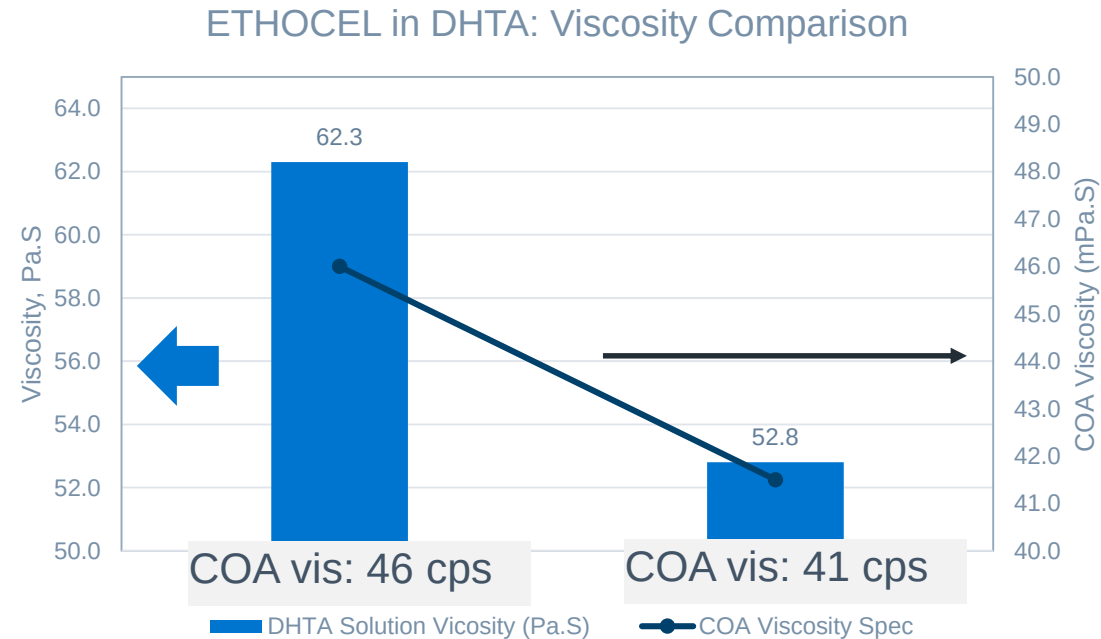
Viscosity in Terpeneol



IMPACTS OF VISCOSITY IN PRODUCT SPEC

Sample: STD45, similar DS (48.6 & 48.7), different viscosity spec (41 vs 46)

Solvent: Terpeneol, BCA, DHTA

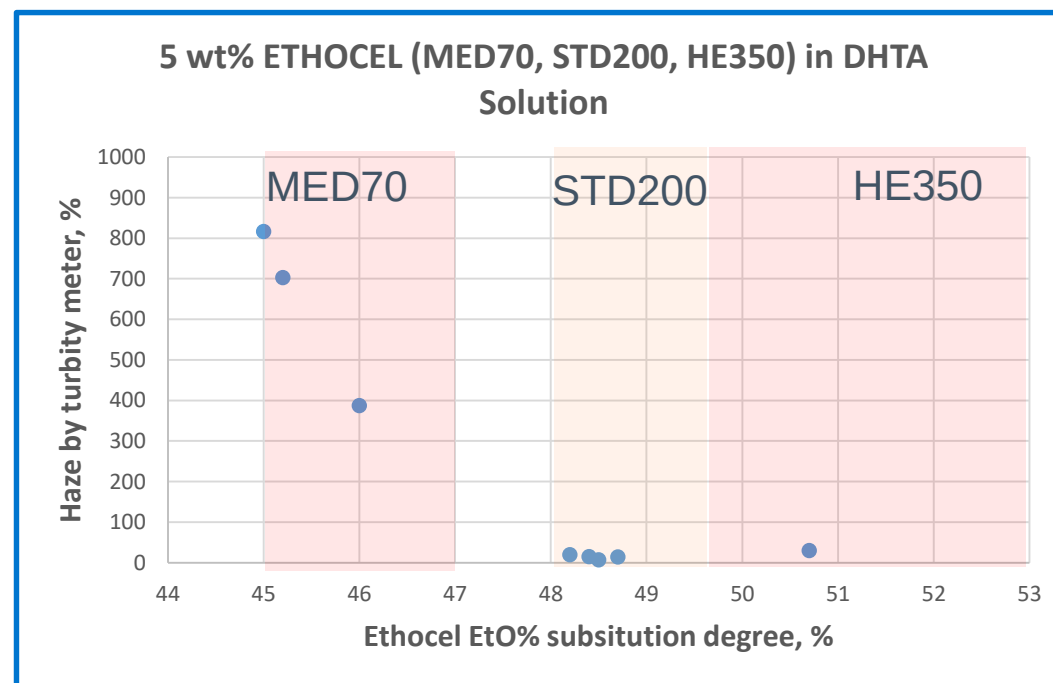
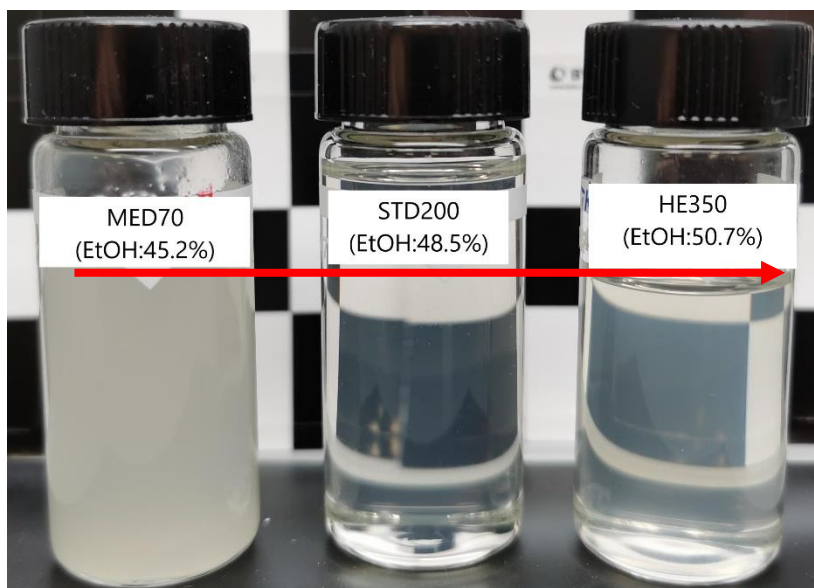
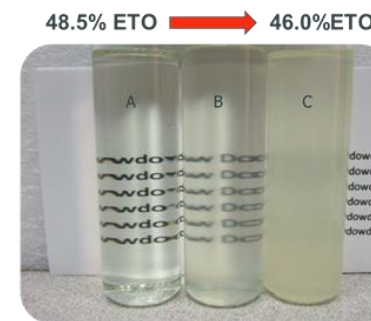


Higher viscosity spec, much higher viscosity in DHTA

IMPACTS OF ETHOXYL SUBSTITUTION

Sample: STD200 (48.5%), MED70 (45~46%), HE350 (50.7%)

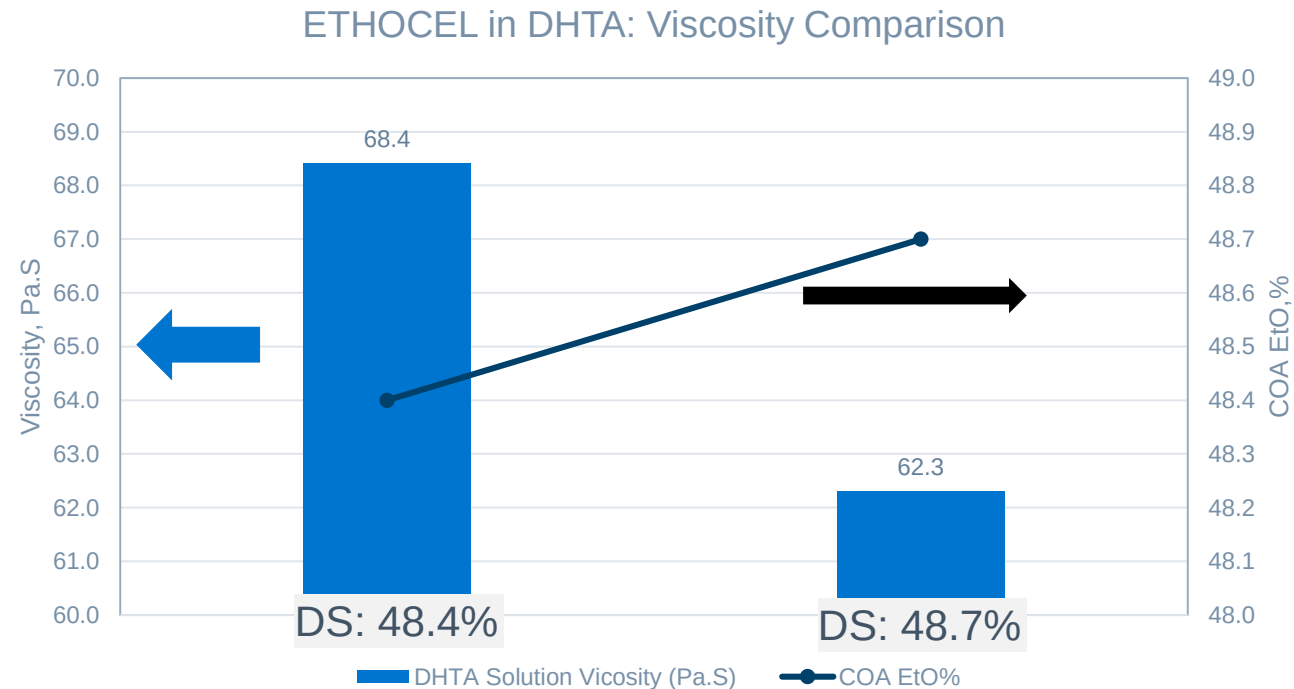
Solvent: DHTA; solid content: 5 wt%



IMPACTS OF ETHOXYL SUBSTITUTION

Sample: STD45, similar viscosity spec (44 & 46) , different DS spec (48.4 vs 48.7)

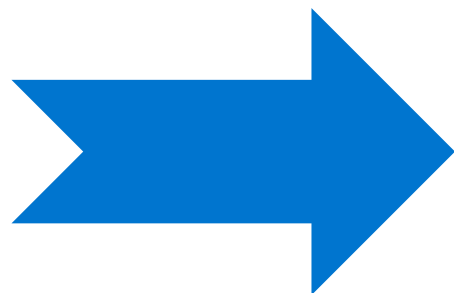
Solvent: DHTA



In DHTA, low DS lead to higher Viscosity

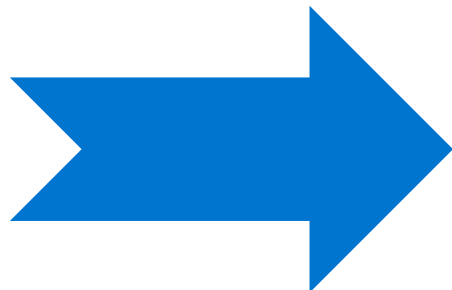
OUR NEW OFFERING

Viscosity SPEC:
Target $\pm 10\%$



Viscosity SPEC:
Target $\pm 5\%$

Substitution SPEC:
48.0 ~ 49.5%



Substitution SPEC:
48.5 ~ 48.9%

- **Narrow viscosity spec grades:**
 - ETHOCEL STD4 TS
 - ETHOCEL STD20 TS
- **Narrow substitution degree grades:**
 - ETHOCEL STD45 TS
 - ETHOCEL STD200 TS
- **More to come**

THANKS