

Ecomate® in West Asia, Expanding Your Horizons

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Introduction to ecomate

- We are here for you!
- NDA and Patent Position
- Properties of ecomate
- Handling and Storage
- Challenges
- Formulation Assistance

Patents

PATENT SITUATION

- World Wide Patent position
- 15 individual country patents

NDA – non-disclosure agreement

- Experience - *ecomate systems commercialized for 11 years*
- Speeds Conversion
 - **Protects YOU** [formulations secure]
 - **Protects US** [allows us to protect technology]

Liquid BAs

Blowing Agent:	ECOMATE	HFC-245fa	nC5
MW	60	134	72
Boiling Pt, C	31.5	15.3	36
Lambda	10.7	12.2	15
GWP ₁₀₀	0	950	11
ODP	0	0	0

- Solubility, Lambda worsen →
- Environmental issue with 245fa
- Flammability issue with HCs, ecomate?

Flammability

Blowing Agent:	HFC-134a	HFC-152a	ECOMATE	nC5	cC5
MW	102	66	60	72	70.1
Boiling Pt, C	-26.2	-25	31.5	37	49
Flash Pt, C	NONE	-50	-19	-40	-37

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LFL	NONE	3.9	5	1.4	1.1
UFL	NONE	16.9	23	7.8	8.7

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- Ecomate less flammable than HFC-152a, HCs
- FSI Ecomate PU systems are rated as **COMBUSTIBLE**, not flammable. Do not require Red Label
- Hydrocarbon Blended Systems are **FLAMMABLE!**

How does ecomate compare?

	ecomate	141b	245fa	365mf c	365/22 7 93 / 7	n-C5	cC5
Mol wt	60	117	134	148	149,6	72	70
Bpt, C	31,5	32	15,3	40,2	30	36	49
Sp Gr	0,982	1,24	1,32	1,25	1,28	0,62	0,75
Lambda	10,7	10	12,2	10,6	10,7	14*	11*
LEL/UEL	5,0 – 23,0	7,6 – 17,7	n/a	3,5 – 9,0	3,8 – 13,3	1,4 – 17,8	1,4 – 8,0

What's wrong with HFCs?

NOTHING - *EXCEPT*

- HIGH MW = HIGH COST
- LAMBDA POORER than 141b [=10]
- GWP HIGH!
- Don't DECOMPOSE in Soil
- Building a GWP LEGACY

HFC PROPERTIES

	134a	245fa	365mfc /227ea
MW	102	134	150
BP	-26.2	10	30
λ	14	12	10.7
ODP	0	0	0
GWP	1430	1030	964
VOC	EXEMPT	EXEMPT	N/A

Benefits of Ecomate

EVERYTHING

- **LOW MW = LOW COST**
- **LAMBDA CLOSE to 141b [=10]**
- **GWP LOW!**
- **DECOMPOSES in Soil, Air**
- **NO GWP LEGACY**

ECOMATE PROPERTIES

	134a	245fa	365mfc /227ea	Ecomate
MW	102	134	150	60
BP	-26.2	10	30	32
λ	14	12	10.7	10.7
ODP	0	0	0	0
GWP	1430	1030	964	0
VOC	EXEMPT	EXEMPT	N/A	0

Handling and Storage

OVERVIEW - Treat as Flammable until in a mixture

- BP 31,5 C
- Flash Pt -19 C
- LEL/UEL 5% / 23%

STORAGE – Mild steel pressure vessels, store outside

Keep Dry! Non-Corrosive if kept DRY

GROUNDING – necessary with Transfer

PUMPS – Diaphragm pumps best

SEALS – PTFE [Teflon], Kalrez, or EPDM

Handling and Storage

METERS – SS Turbines w/ Tungsten Carbide bearings

HOSES – Convoluted 321 SS with 304 SS braid

PIPE –

Schedule 80 welded carbon steel if > 25cm

304 SS with SS compression fittings if < 25cm

BATCHING – always w/ N2 blanketed headspace

- In-line mixing
- From bottom with agitation
- Pre-blended into polyol stream

Advantages

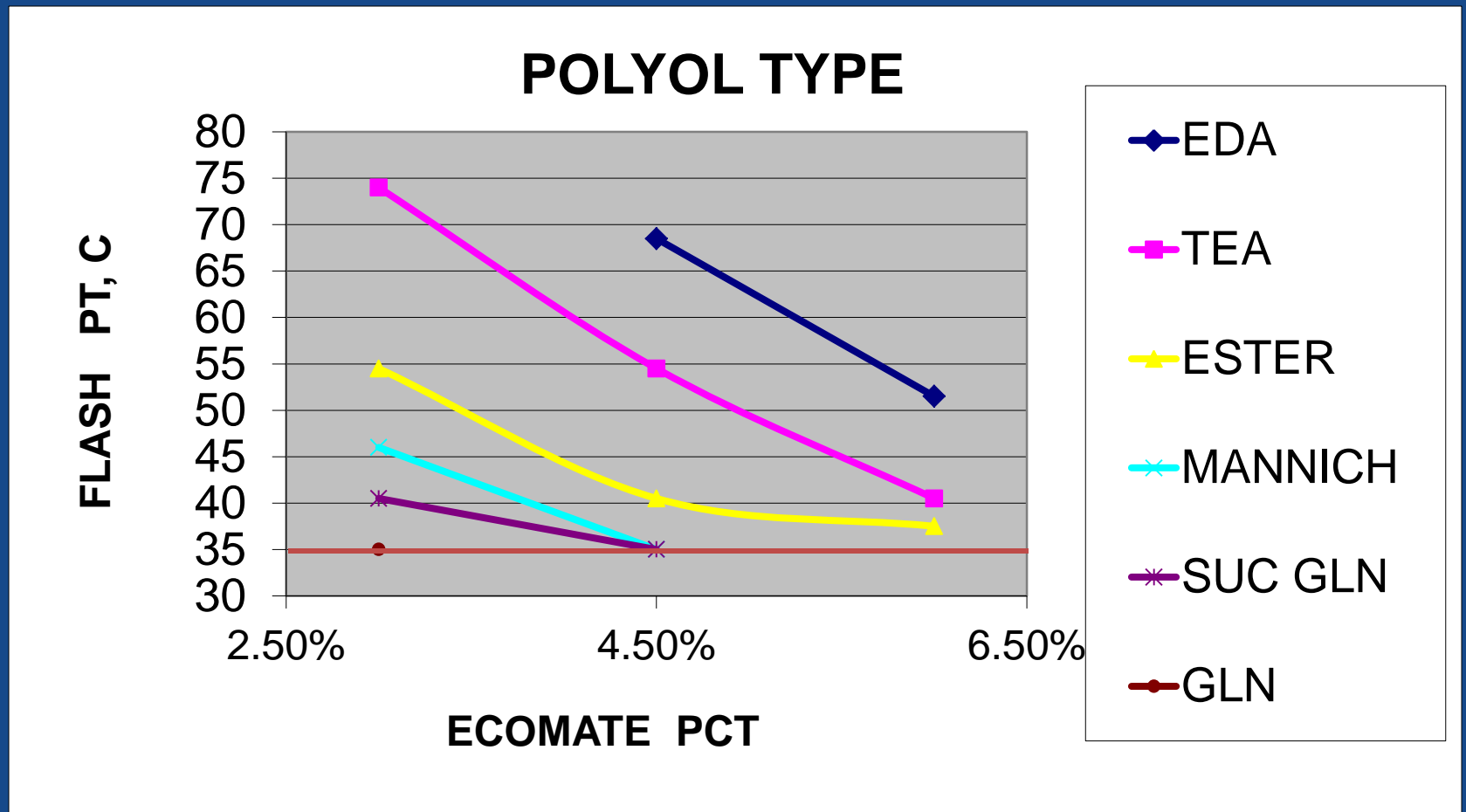
- **ecomate** closest to **141b**
- Most **Environmentally Benign**
- **Cost Competitive**
 - Use Less – lower MW
 - No Plant Conversions required
 - No Fire Load – use less FRA
 - Equivalent Properties
- A **Drop-in** for **Flexible & Integral Skinned Foam**
- **HOWEVER** - Not exact Drop-in In **Rigid Foams**

Challenges w/ ecomate

in Rigid Foam

- **Combustibility (SYSTEMS SHIPPING)**
 - In polyols, flash point can be $> 35^{\circ}\text{C}$
 - If less than 5% used, and
 - in right polyols
- **Dimensional Stability**
 - Ecomate stronger than HCFC-141b
 - Must compensate

Flash Point, °C



Dimensional Stability

in RIGID PUR & PIR foams

- **Stronger Solvency than 141b**
 - Can use any Raw Materials
 - Use less, yet with same viscosity
- **Requires:**
 - Higher Functionality,
 - Higher Cross Link Density, or
 - Higher Index

Spray Foam Challenge

- **Keeping 1/1 by volume, and maintaining Index**
 - Ecomate uses ~half of 141b amount [say 6 v 12 parts]
 - **SpGr** also **lower** [0.98 v 1.24]
 - Both drive Index down
 - Requires judicious use of Esters, FRAs, other ingredients

BA Blending

- Ecomate compatible with ALL competitive BAs
- Most blends are covered by patents
- Why blend?
 - For the same reasons you blend today
 - May need some froth
 - Better control of rise and flow profiles
 - Economics
 - Properties improvement

Formulation Assistance

After signing NDA we will eagerly assist you in development of optimized ecomate systems

FIN



Thank you for your attention!
Questions?