MEO-DMC catalyst
Characteristics of conventional polyaddition with alkaline catalysts

Conventional polyaddition of low molecular oxiranes has utilized for many years alkaline type catalysts.

However, they exhibited substantial disadvantages, as regards:

- limited polyaddition degrees of the obtained products,

- generation of side reactions resulting in disfunctionality of active centers,

- wide dissersion of homologues,

- troublesome catalyst residue in the reaction products.
DMC catalysts – advantages

- Reduction or elimination of polyether chain termination.
- High molecular weights, not achieved with other methods.
- Narrow fractional distribution.
- Extremely high activity:
  - low concentration (single ppm range),
  - high reaction rate.
- High selectivity – high quality
- High unit price but low cost of application.
A highly active DMC type catalyst was successfully prepared, as MEO-DMC trade name.

- It was positively tested using the following starters for oxyalkylation:
  - Polypoxypolypropylene diol
  - Castor oil
  - Selected fatty alcohol (C16)
The catalyst performance - initial stage activity test

**DMC CATALYST ACTIVITY**

Catalyst concentration:

\[ C_{\text{DMC}} = 113 \text{ ppm} \]

Average rate of PO consumption:

\[ R_{\text{DMC}} = 294 \text{ g PO/g starter} \times \text{g cat} \times \text{h} \]

**ALCALINE CATALYST ACTIVITY (KOH)**

Catalyst concentration:

\[ C_{\text{KOH}} = 12\,000 \text{ ppm} \]

Average rate of PO consumption:

\[ R_{\text{KOH}} = 0.64 \text{ g PO/g starter} \times \text{g cat} \times \text{h} \]

Blue line – fed PO; Red line – reaction temperature; Green line – overpressure

Dynamic trends from propoxylation of 100 g of PPG450 with 50 g of PO, at 130°C
The catalyst performance – full activity test

**DMC CATALYST ACTIVITY**

- **Catalyst concentration**  
  \( C_{\text{DMC}} = 28 \text{ ppm} \)
- **Average rate of PO consumption**  
  \( R_{\text{DMC}} = 320 \text{ g PO/g starter * g cat * h} \)

**ALCALINE CATALYST ACTIVITY (KOH)**

- **Catalyst concentration**  
  \( C_{\text{KOH}} = 3000 \text{ ppm} \)
- **Average rate of PO consumption**  
  \( R_{\text{KOH}} = 0.63 \text{ g PO/g starter * g cat * h} \)

\[ \frac{R_{\text{DMC}}}{R_{\text{KOH}}} = 508 \]
\[ \frac{C_{\text{KOH}}}{C_{\text{DMC}}} = 107 \]

Blue line – feeded PO; Red line – reaction demperature; Green line – overpressure

Dynamic trends from propoxylation of 100 g PPG450 with 500 g of PO, at 130°C  
\( \left( N_{\text{av.}} = 46; \ Mn = 2700 \right) \)
The product quality (PPG 2700 – $N_{av.} = 46$)

**Alkaline catalyst**

- $L_{OH(\text{theoretical})} = 41.6$
- $L_{OH(\text{KOH})} = 75.7$
- $M_n = 1483$ (55%)

**Meo-DMC**

- $L_{OH(\text{DMC})} = 43.4$
- $M_n = 2585$ (96%)

$M_n(\text{KOH}) = 1483$ (55%)  
$M_n(\text{DMC}) = 2585$ (96%)

* LOH (theoretical)
The catalyst performance – in ethoxylation

Dynamic trends from ethoxylation of \( C_{16} \) alcohol of average polyaddition degree \( N_{av}=3 \), at 130\(^\circ\)C
Our Meo-DMC catalyst is used for epoxide polymerization, that is, for polymerizing alkylene oxides such as propylene oxide and ethylene oxide to yield polyether polyols.

In conventional base catalyzed oxyalkylation reaction, propylene oxide and certain other alkylene oxides are subject to a competing internal rearrangement that generates unsaturated alcohols. The resulting products will contain allyl alcohol initiated monofunctional impurities. The monofunctional impurities tend to reduce the average functionality and broaden the polydispersity of the polyols.

Compared with similar polyols made using conventional basic catalyst, polyether polyols made from the Meo-DMC catalyst have low unsaturations, narrow molecular weight distributions, can have high molecular weight, and are useful in making a variety of polyurethane products.

Moreover this catalyst can be used with less amount (ppm) and reaction time of polymerization is reduced largely.
Reference literature

- A patent application was submitted to the Polish Patent Office, notification no. P.398518 (2012),
