

Conversion of Propylene Trimer (Nonene) to Nonylphenol using Catalyst Resin

Introduction

Thermax with its continuous innovation & improvement strategy, approached one of the largest manufacturers of nonylphenol in the world for adding value to their processes. Customer is one of the pioneer companies manufacturing industrial chemicals, important intermediates, surfactants etc. The customer has been producing alkyl phenol with the capacity of 16000 MT/month-mainly, nonylphenol and dodecylphenol by catalytic conversion of propylene trimer at elevated temperature. The customer was using a heterogeneous catalyst in fixed bed continuous flow reactor as well as in stirred reactor for performing these conversions. The major product of reaction i.e. nonylphenol gets distilled out and the bottom part consisting mainly di-nonylphenol is further converted to nonylphenol to increase the overall yield.

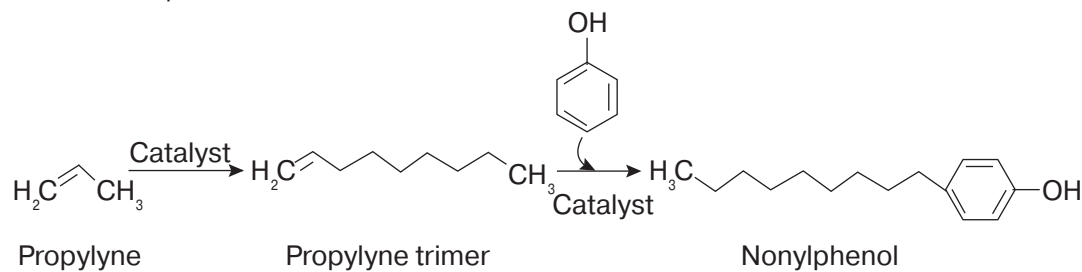
Challenges

Thermax offered **Tulsion® T-6812 MP** to substitute the existing solid acid catalyst used by the customer and to demonstrate the performance of **Tulsion® T-6812 MP** concerning various parameters such as catalytic activity, % conversion, reduce side reaction and by-product formation. With provided benefits, the customer decided to opt **Tulsion® T-6812 MP** resin initially for the secondary reaction, where the reaction conditions were harsh. It was also decided to consider our catalyst for the primary reaction butonly if it meets the requirements for conversion in secondary reaction.

Performance Criteria

Following criteria were fixed to evaluate the performance of Tulsion catalyst:

- % conversion of P-nonylphenol to be minimum 92 % of total alkylated phenol formed during reaction.
- Catalyst should last at least 20 cycles of conversion in the stirred reactor.
- Moisture content in phenol should be less than 2 %.



Typical Reaction Conditions

Type of reactor	Primary reaction – Fixed bed – Continuous flow Secondary reaction – Stirred reactor
Reactants	Primary reaction – Propylene trimer and phenol Secondary reaction – Di-nonylphenol & phenol
Catalyst	Polymeric catalyst Tulsion® T-6812 MP
Quantity of catalyst	5 % of total reactant (Approx.)
Reaction temperature	Elevated temperature
Digestion time	3-4 Hours at reaction temperature

A primary evaluation was carried out by charging 350 kgs of **Tulsion® T- 6812 MP** in the pilot reactor to study the conversion of di-nonylphenol to nonylphenol. The reaction was carried out under relatively harsh conditions.

Results

Tulsion® 6812 MP met all necessary performance criteria and lasted for more than 50 cycles. It gave confidence to the customer for considering T- 6812 MP in the main reactor (stirred vessel) for primary reaction as well. Tulsion catalyst performed successfully for more than 250 cycles.

Conclusion

Tulsion® 6812 MP performed exceptionally well in both fixed bed and main reactor (stirred vessel). These results gave a further boost for using **Tulsion® T-6812 MP** in main column reactor for which the customer procured 3 MT of T-6812 MP. Till date, the customer is using our **Tulsion®** catalyst resin for continuous production.

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Registered Office


Thermax Limited
D- 13, MIDC Industrial Area,
R D Aga Road, Chinchwad,
Pune 411 019, India
Email: enquiry@thermaxglobal.com
Customer Care: 1800-209-0115


Business Office


Environment House,
Plot No. 90-92, BG Block,
MIDC, Bhosari,
Pune, Maharashtra 411 026
Email: enquiry@thermaxglobal.com
Customer Care: 1800-209-0115


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