

# **1,2,4-Trimethylbenzene Transformation Reaction Compared With Its Transalkylation Reaction With Toluene Over USY Zeolite Catalyst**

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**AMER CHEMICAL SOC, INDUSTRIAL ENGINEERING CHEMISTRY RESEARCH; pp:  
4459-4467; Vol: 46**

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## **Summary**

1,2,4-Trimethylbenzene (TMB) transalkylation with toluene has been studied over USY zeolite type catalyst using a riser simulator that mimics the operation of a fluidized-bed reactor. Reaction mixtures of 50:50 wt % TMB and toluene were used for the transalkylation reaction. The range of temperature investigated was 400-500 degrees C with time on stream ranging from 3 to 15 s. The effect of reaction conditions on the variation of the p-xylene to o-xylene product ratio (P/O), distribution of trimethylbenzene (TMB) isomers (1,3,5-TMB to 1,2,3-TMB), and values of xylene/tetramethylbenzene (X/TeMB) ratios are reported. Comparisons are made between the results of the transalkylation reaction with the results of pure 1,2,4-TMB and toluene reactions earlier reported. Toluene, which was found almost inactive, became reactive upon blending with 1,2,4-TMB. This shows that toluene would rather accept a methyl group to transform to xylene than lose a methyl group to form benzene under the present experimental conditions. The experimental results were modeled using a quasi-steady-state approximation. Kinetic parameters for the 1,2,4-TMB disappearance during the transalkylation reaction and in its conversion into isomerization and disproportionation products were calculated using the catalyst activity decay function based on time on stream (TOS). The apparent activation energies were found to decrease as follows: E-transalkylation > E-isomerization > E-

disproportionation.

### References:

1. ALKHATTAF S, 2006, APPL CATAL A-GEN, V305, P21, DOI 10.1016/j.apcata.2006.02.043
2. ALKHATTAF S, 2006, ENERG FUEL, V20, P946, DOI 10.1021/ef050415b
3. ATIAS JA, 2003, IND ENG CHEM RES, V42, P4162, DOI 10.1021/ie0300878
4. CEJKA J, 2002, CATAL REV, V44, P375
5. CEJKA J, 2004, APPL CATAL A-GEN, V277, P191, DOI 10.1016/j.apcata.2004.09.012
6. DAS J, 1994, APPL CATAL A-GEN, V116, P71
7. DELASA HT, 1992, 5102628, US
8. DUMITRIU E, 2002, APPL CATAL A-GEN, V237, P211
9. EARHART HW, 1982, KIRKOTHMER ENCY CHEM, V18, P882
10. HANIKA J, 2003, PET COAL, V45, P78
11. JONES CW, 1999, APPL CATAL A-GEN, V181, P289
12. KO A, 1994, J CHIN CHEM SOC-TAIP, V41, P141
13. KRAEMER DW, 1991, THESIS U W ONTARIO L
14. MIRTH G, 1994, STUD SURF SCI CATAL, V83, P287
15. PARK SH, 2000, CATAL TODAY, V63, P267
16. ROGER HP, 1997, MICROPOROUS MATER, V8, P151
17. ROGER HP, 1998, J CATAL, V176, P68
18. ROGER HP, 2000, STUD SURF SCI CATAL, V130, P281
19. TSAI TC, 1994, OIL GAS J, V92, P115
20. TSAI TC, 1999, APPL CATAL A-GEN, V181, P355
21. TUKUR NM, 2005, CHEM ENG PROCESS, V44, P1257, DOI 10.1016/j.cep.2005.02.009
22. WANG I, 1990, IND ENG CHEM RES, V29, P2005

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