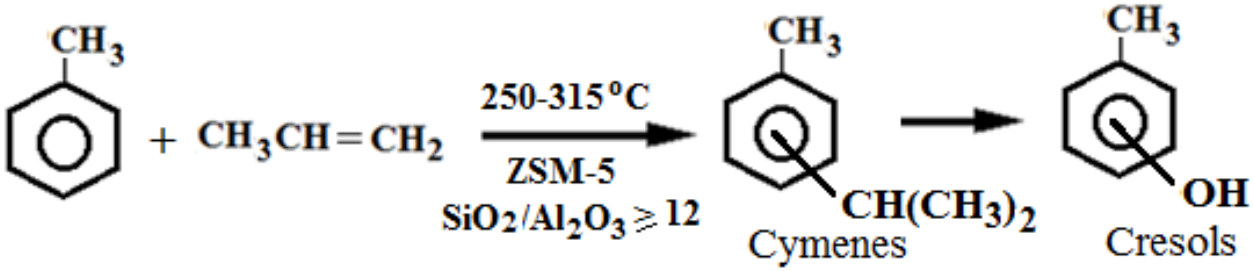
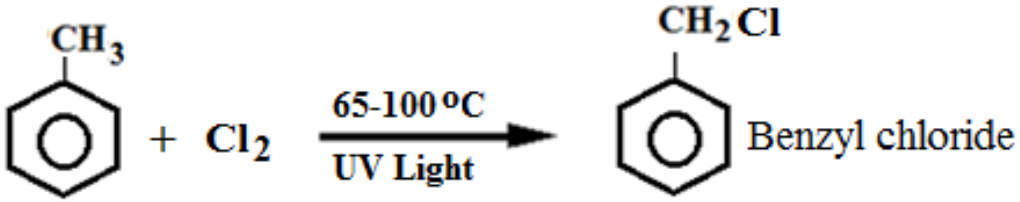
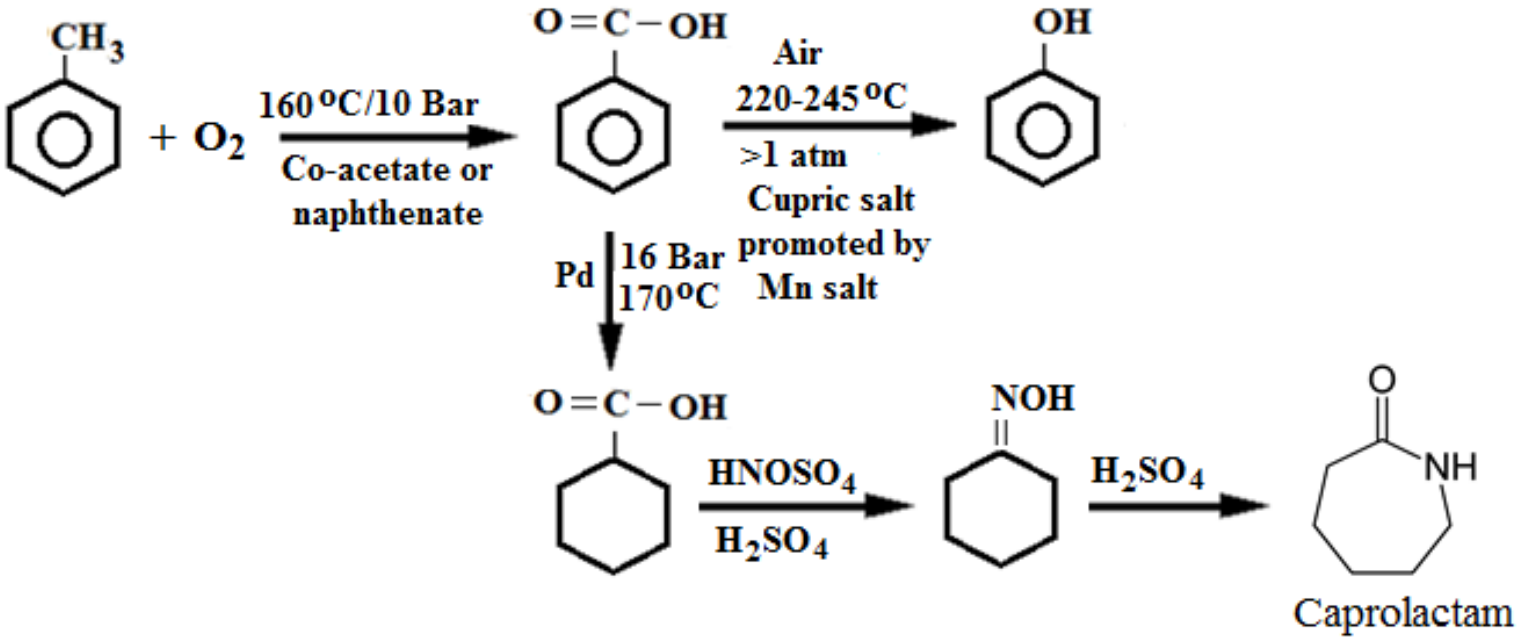
Petrochemical Technology

Chemicals from Toluene

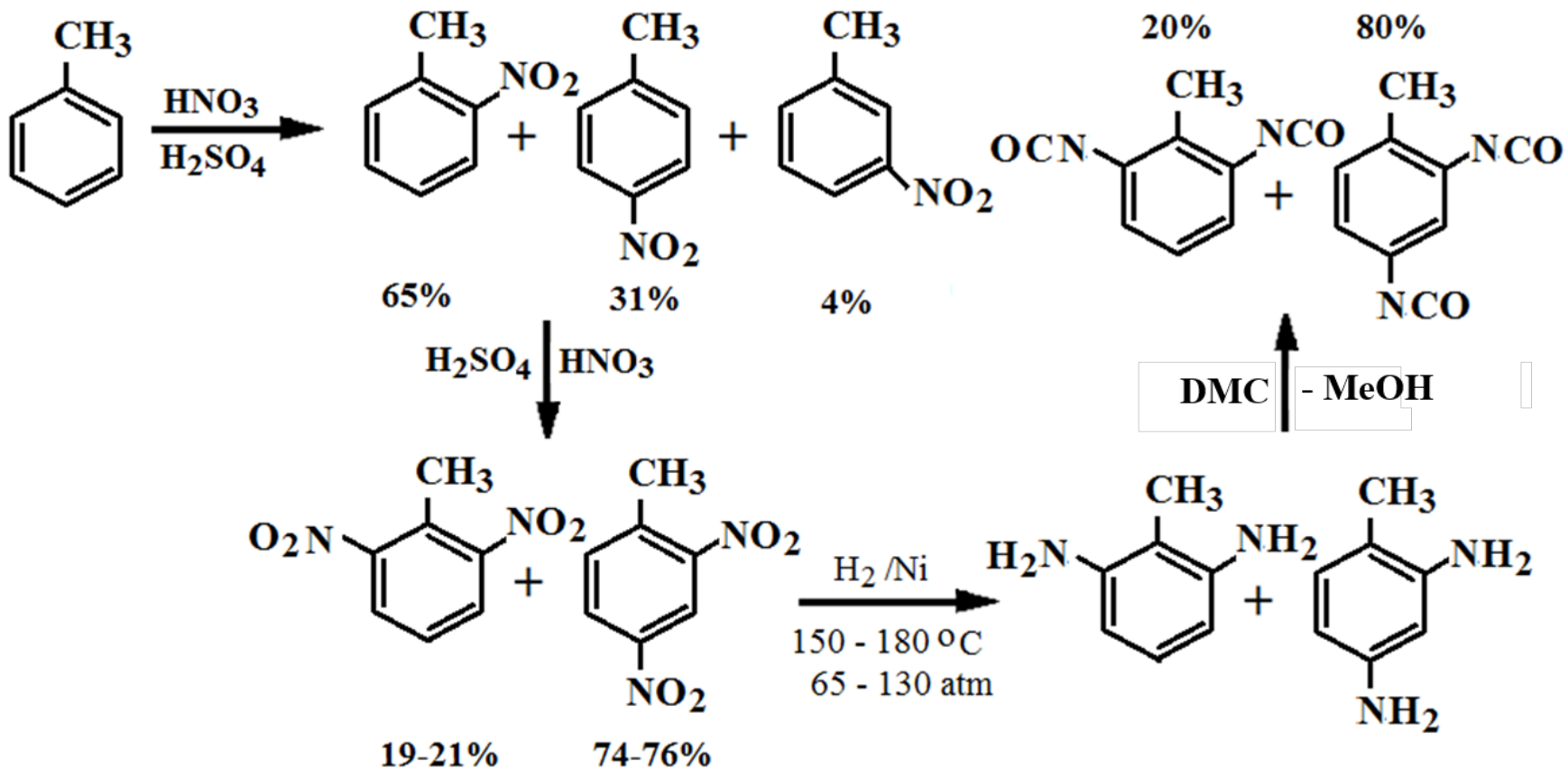
Chemicals from Toluene



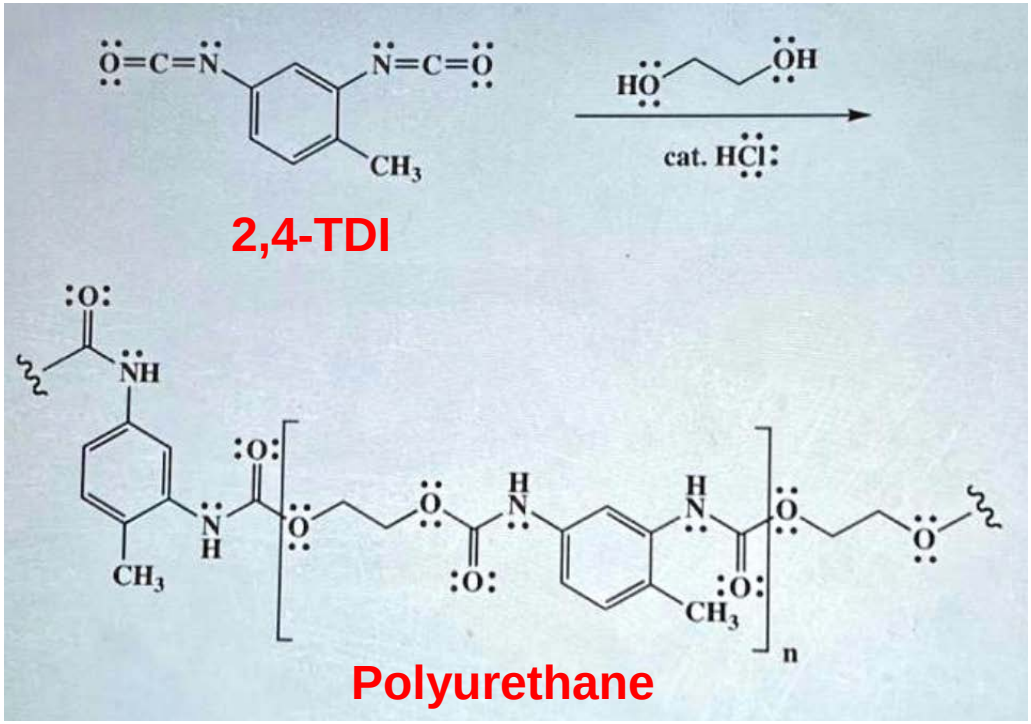




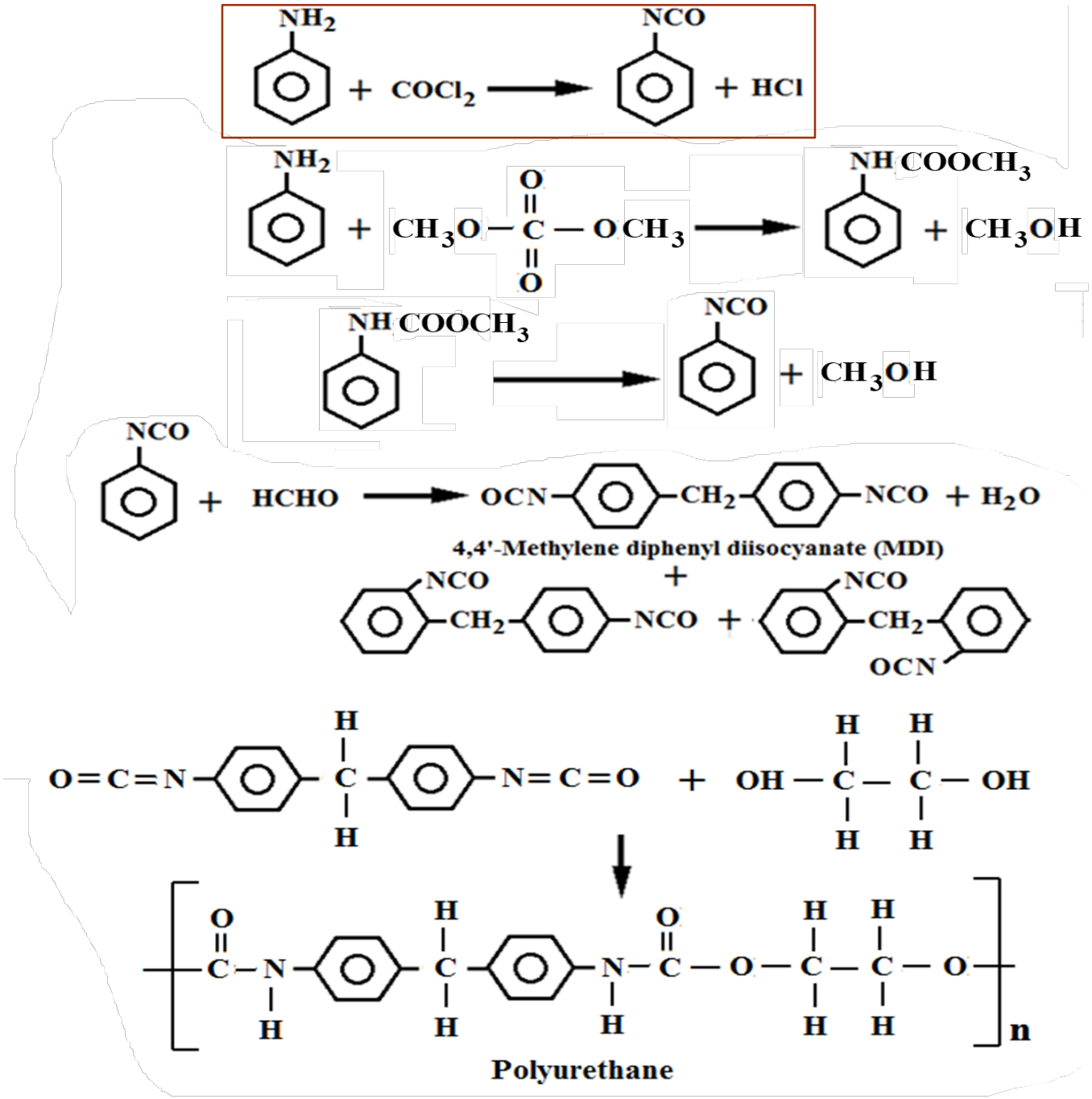
Toluene Diisocyanate (TDI) from Toluene



Jeeru, Lakshmana Rao; Saikumar Reddy R., V.; Pradhan, Sayantan; Kundu, Gautam; and Pradhan, Narayan C. Kinetics of Solid Acids Catalyzed Nitration of Toluene: Change in Selectivity by Triphase (Liquid-Liquid-Solid) Catalysis. *Asia-Pacific J. Chem. Engg.* 2018, *6 (6)*, 870-878.

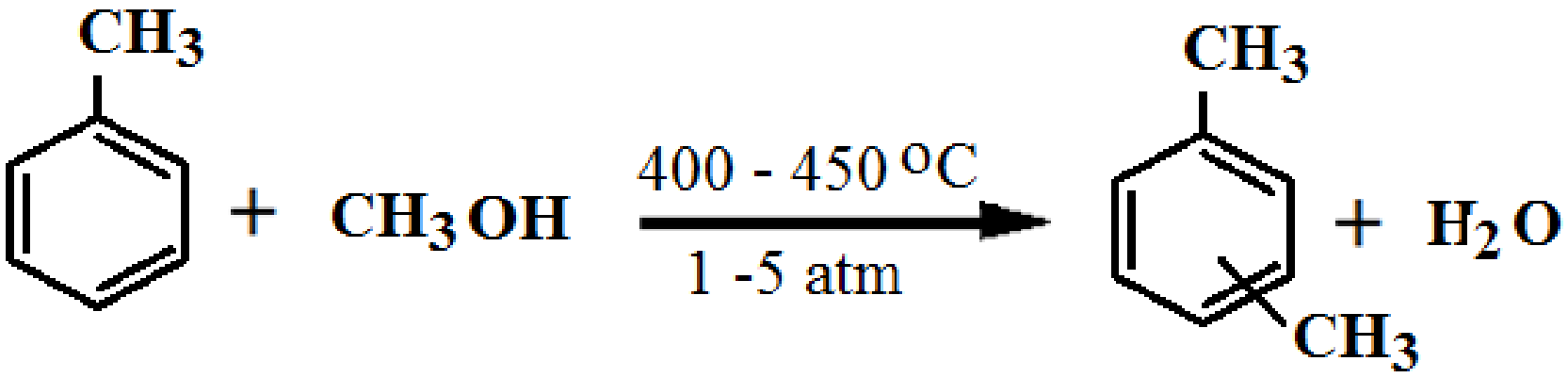


The term TDI stands for toluene diisocyanate. It is useful in the production of polyurethane. TDI is used mainly for the production of flexible foam, including bedding and furniture, carpet underlayer, packaging applications, etc. TDI material is also important in the manufacture of coatings, sealants, adhesives, and elastomers. Similarly, TDI material is useful in transportation applications where it helps to make automobile parts lighter, leading to improvements in vehicle fuel efficiency and, therefore, energy conservation.


NH2
NCO
+ COCl2
+ HCl
NH2
+ CH3O — C — OCH3
O
O
NH COOCH3
+ CH3OH
NH COOCH3
NCO
+ CH3OH
NCO
+ HCHO
OCN — CH2 — NCO + H2O
4,4'-Methylene diphenyl diisocyanate (MDI)
NCO
CH2
NCO
+
NCO
CH2
OCN
O=C=N
N=C=O
+
OH — C — C — OH
H
Polyurethane
n

The reforming process typically produces BTX in the ratio of 1:1:1 (B:T:X). However, the worldwide demand of these aromatics is in the ratio of 5:1:3 (B:T:X). As a result, toluene is the cheapest among the three basic aromatics. Again, among the three xylene isomers, *p*-xylene is in highest demand followed by *o*-xylene and then *m*-xylene. Typically, the demand ratio for xylene isomers is 3:1:35 (*o*-:*m*-:*p*-). Aa a result, attempts have been made to make valuable products from toluene by methylation (to produce xylenes) and disproportionation (to produce benzene and xylenes).

Xylenes from Toluene by Alkylation with Methanol

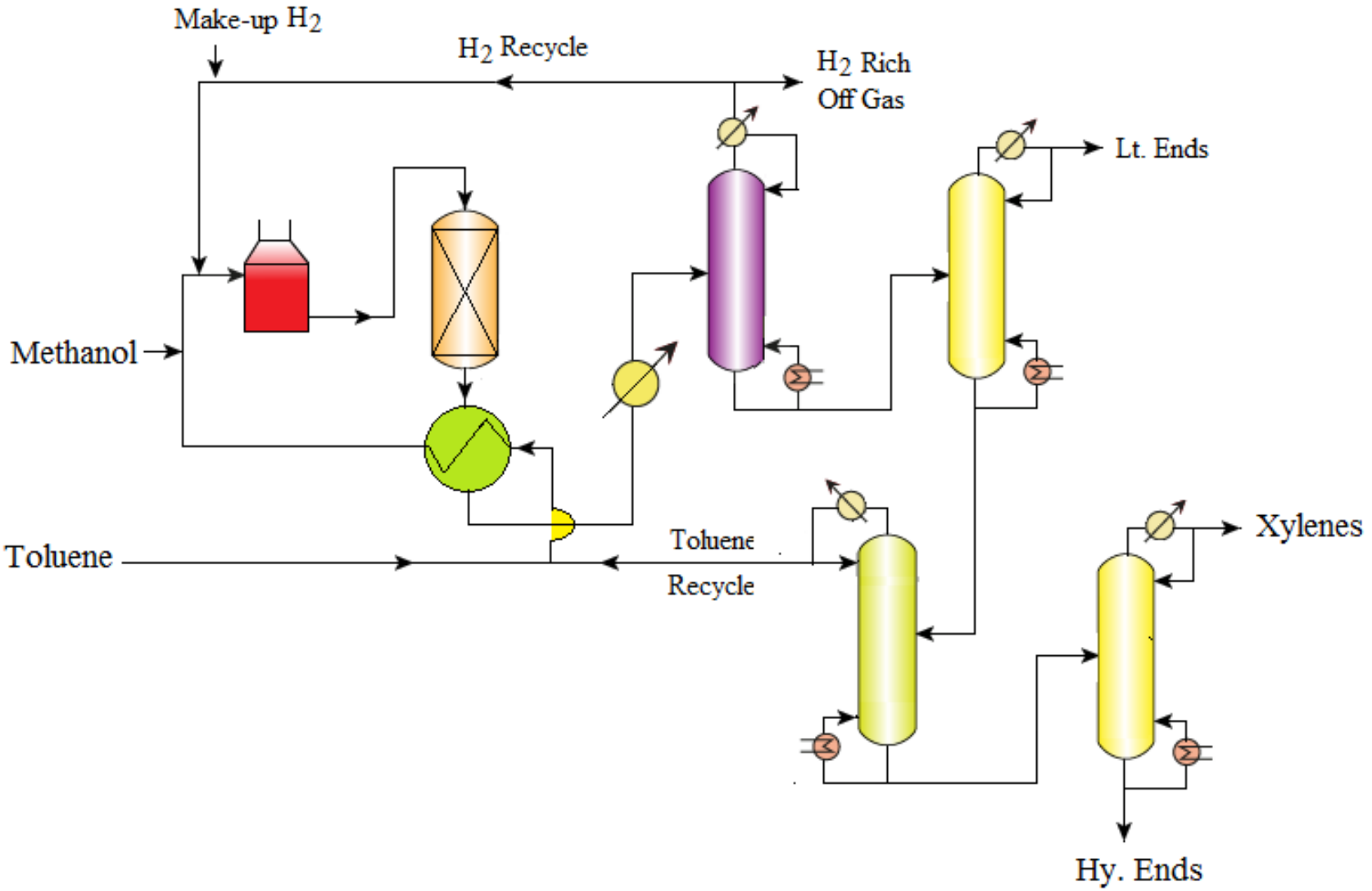


High silica Zeolite catalyst

WHSV = 1-2 h^{-1}

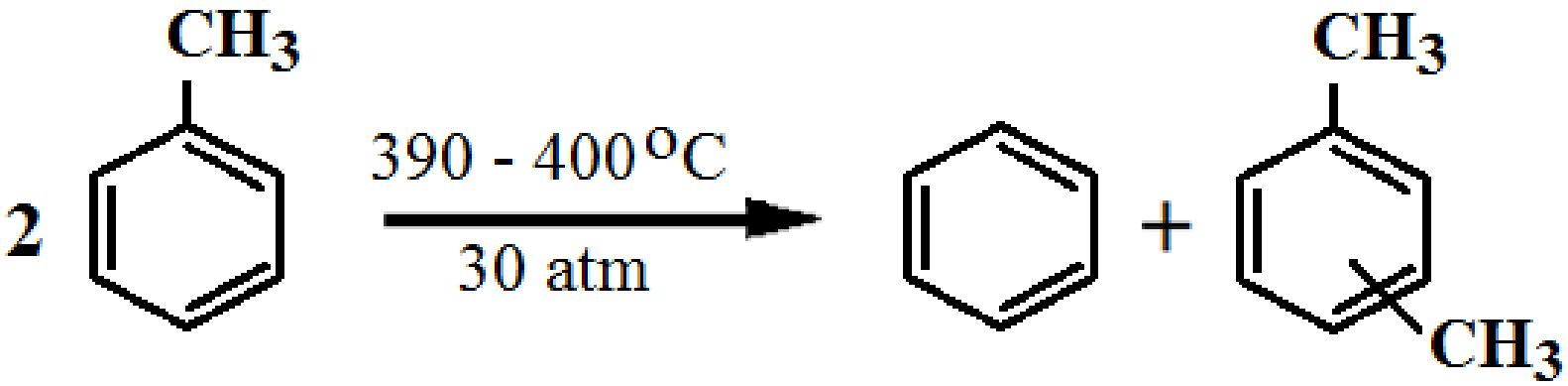
p-Xylene selectivity (wt%) = 80-90

[GT-TolAlk Process]



Production of Xylenes by Methylation of Toluene

Xylenes from Toluene by Selective Disproportionation



High silica Zeolite catalyst

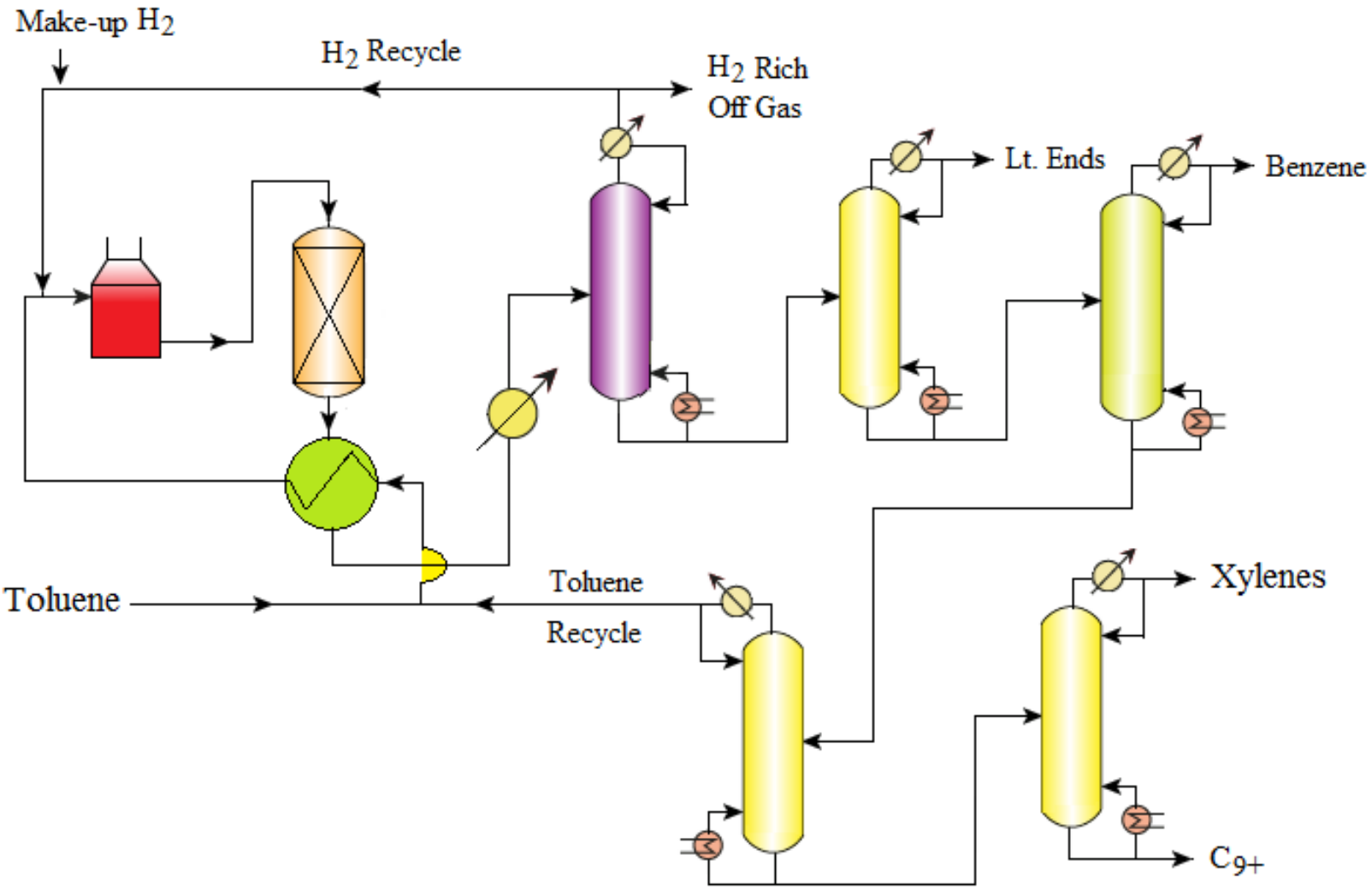
WHSV = 4.0 - 4.5 h^{-1}

Toluene conversion = 28 - 30%

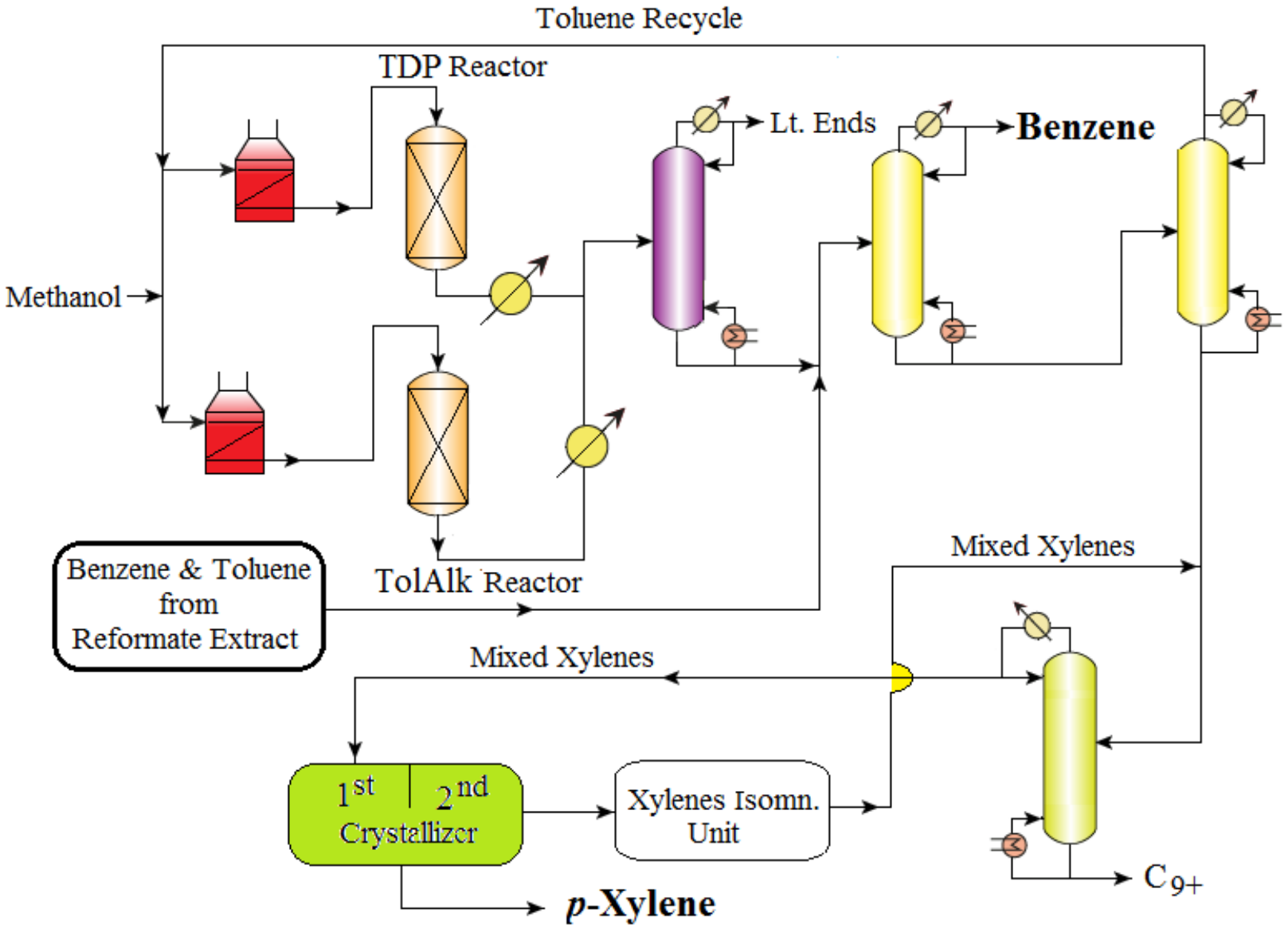
p-Xylene selectivity (wt%) = 80-90

[GT-STDP Process]

GT-STDP and GT-TolAlk are world class technologies from IPCL and GTC Technology Corpn., Houston, TX, USA (Earlier Glitsch Technology Corporation).



Production of Xylenes by Selective Toluene Disproportionation (STDP)



Optimized Aromatic Complex for Maximum Production of *p*-Xylene

Thank you!