Production of Styrene from toluene and methanol

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Background & Description:

Styrene is a cyclic monomer compound generally by benzene and ethylene. Here the production of styrene is proposed using a catalytic process from toluene and methanol in a single step instead of the traditional three step method without the addition of steam. It incorporates a more economic route.

Reaction 1:

Toluene + methanol --> styrene + hydrogen + water

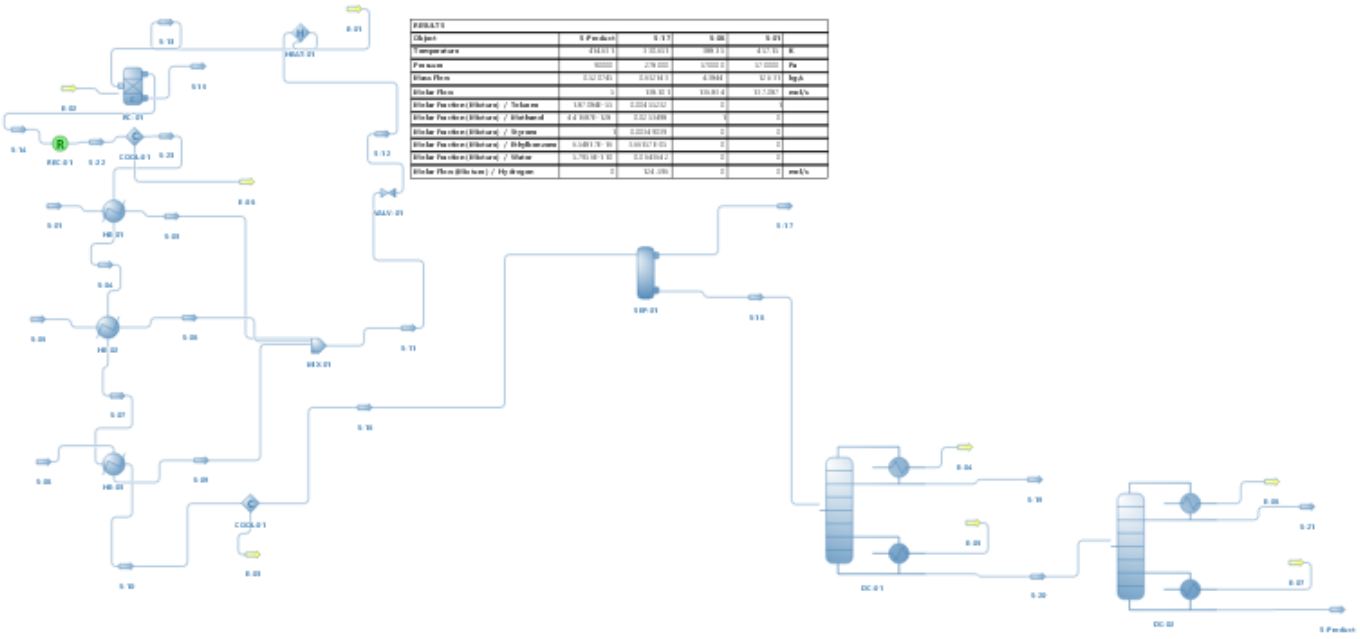
Reaction 2:

Toluene + methanol --> ethyl benzene + water

Process:

The process initially involves passing toluene (S-01) and methanol (S-08) streams into a heat exchanger. The thermodynamic property used is Soave- Redlich - Kwong (SRK) for accuracy .The products are passed through a mixer and then through a heater, thereafter passing it through a conversion reactor. The liquid stream from the phase separator is fed to the 1st distillation column, the bottom product of which is fed to a second distillation column. The bottom product of the 2nd distillation column gives majorly styrene.(S-product)

Flowsheet:



Results:

RESULTS					
Object	S-Product	S-17	S-08	S-01	
Temperature	414.631	330.651	388.15	457.15	K
Pressure	90000	278000	570000	570000	Pa
Mass Flow	0.520745	0.632143	4.3844	12.631	kg/s
Molar Flow	5	138.101	136.834	137.087	mol/s
Molar Fraction (Mixture) / Toluene	1.87084E-55	0.00455232	0	1	
Molar Fraction (Mixture) / Methanol	4.41687E-128	0.0253498	1	0	
Molar Fraction (Mixture) / Styrene	1	0.00349039	0	0	
Molar Fraction (Mixture) / Ethylbenzene	6.54817E-16	3.66157E-05	0	0	
Molar Fraction (Mixture) / Water	5.7956E-110	0.0643642	0	0	
Molar Flow (Mixture) / Hydrogen	0	124.596	0	0	mol/s

Thus according to this flow sheet, we get majorly styrene as our desired product.

Conclusions:

Hence, the method of production of styrene from toluene and methanol is a single step process compared to the conventional method which is performed in three steps using benzene and ethylene. Also we get apt results for our product stream.