Production of Butanal from Propylene, Carbon Monoxide and Hydrogen using Recycle Stream

Swetank Sahai

NIT Warangal

BACKGROUND AND DESCRIPTION

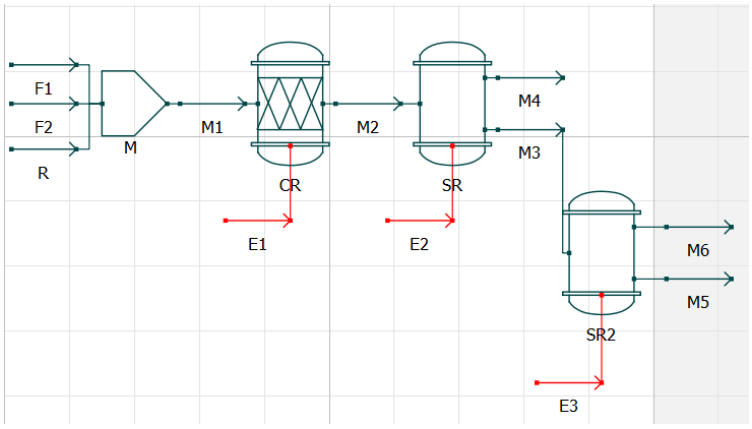
Hydroformylation of propylene to produce butanal is well known and practised widely. For economic reasons, the raw material used for such **industrial scale** processes has been propylene, which contains about 90-95 % **propylene**, with the majority of the balance being **propane**.

It is desirable that the unreacted propylene, carbon monoxide and hydrogen are **recycled**. It is also important to prevent excessive propane build up in the reaction system due to the recycle of the unreacted components. However, propane and propylene are difficult to separate and thus, in order to prevent propane accumulation, a purge stream is also required. This removal of propane however also involves the removal of Some propylene resulting in some inefficiencies and economic debits in the process.

REACTION: $C_3H_6 + CO + H_2 \rightarrow C_4H_8O$

A feed Propylene containing traces of Propane(inert) is mixed with another stream of carbon monoxide and hydrogen along with a recycle stream and is then converted into butanal in the reactor. The total conversion with respect to Propylene is 0.9. Using compound separators, pure butanal as well as hydrogen/carbon monoxide streams as well as a recycle stream containing propylene and propane is obtained. However, to reduce the amount of inert, a purge is also established.

FLOWSHEET



RESULTS

Compositions

Mole Fraction	FEED F1	FEED F2	RECYCLE R	STREAM M1	STREAM M2	STREAM M3	STREAM M4	STREAM M5	STREAM M6
Propylene	0.95	0	0.55	0.28	0.06	0.12	0	0.55	0
Propane	0.05	0	0.45	0.02	0.05	0.10	0	0.45	0
Carbon Monoxide	0	0.5	0	0.35	0.18	0.39	0	0	0.5
Hydrogen	0	0.5	0	0.35	0.18	0.39	0	0	0.5
Butanal	0	0	0	0	0.53	0	1	0	0

Flow Rates

STREAM	Flow Rate(mol/sec)
FEED F1	50.0
FEED F2	120.0
RECYCLE R	3.4
STREAM M1	173.4
STREAM M2	84.5
STREAM M3	40.1
STREAM M4	44.4
STREAM M5	9.0
STREAM M6	31.1

These results are comparable to a similar flowsheet used in the DWSIM.