

Technical specification of reactor L-101A

Adiabatic reactors with a packed catalyst layer, i.e. trickle bed reactor, are used for the hydrogenation of pyro-benzene.

Reactions in the process of selective hydrogenation are exothermic, which is manifested by an increase in the temperature of the catalytic layer. To prevent other undesirable reactions, such as hydrogenation of olefins and aromatics, the temperature rise in each catalytic bed must be controlled. In each layer of the catalyst in the reactors, it must be limited to a maximum of 60°C, which is maintained by means of a cold "quench" current. At any moment of reactor operation and at any point of the catalyst, the temperature must not exceed 200°C.

In the GHU section of the Ethylene plant, there are two adiabatic reactors with two catalyst layers each. The heights of the alumina and catalyst layers are marked on the drawing in Figure 1. The internal parts of the reactor (floors, quenching chamber and upper layer grid supports) will form the upper catalytic layer (first layer). On top of the upper layer, baskets are placed in the designated places. The purpose of these baskets is to collect sawdust and corrosion particles carried by the reaction mixture, which would otherwise clog the catalyst. The first layer can be seen as a protective layer. It is smaller in volume and the supply current passes through it first. The second layer is the main one and larger in volume, where most of the reaction should take place.

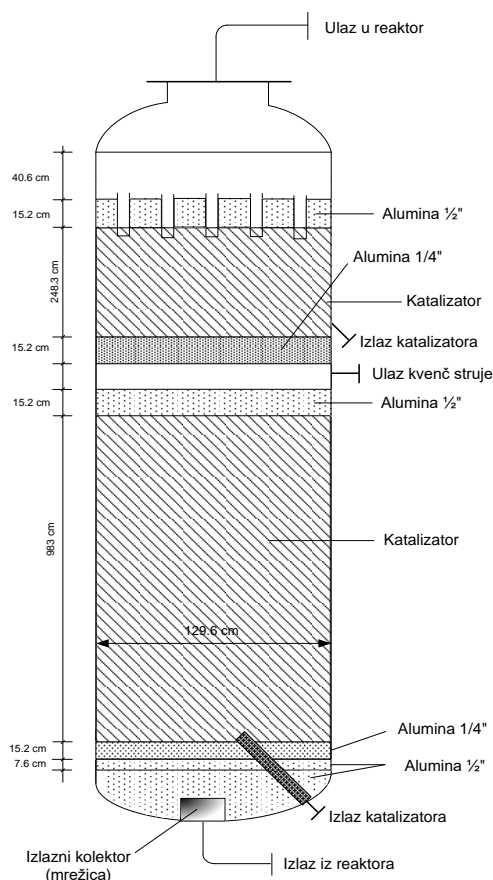


Figure 1.

Overview

Licensors of the unit: IFP (1973)

2 reactors: one in operation+ 1 in spare (L101 A/B)

Two beds reactor:

Catalyst in reactor: LD 241 (L-101A) and LD 551 (L-101B) (Axens)

Active component is Nickel

1st catalytic bed volume: 3.23 m³

2nd catalytic bed volume: 12.94 m³

Claims

- sulfur-resistant catalyst (H₂S, thiophene, mercaptans etc.)
- high activity
- high selectivity
- high stability
- good regenerability
- low pressure drop
- operating manual (loading, start up, regeneration etc.)

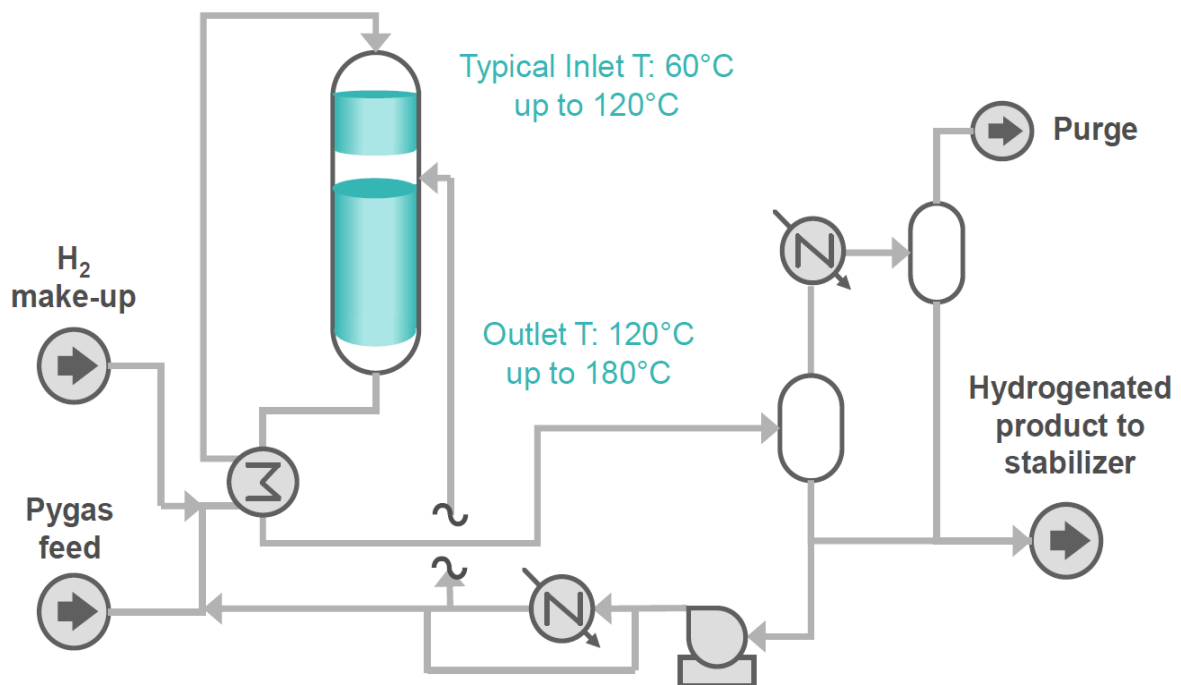


Figure 2.

Feedstock quality

Detail composition, wt%		
	FEED 1	FEED 2
C4 Olefin	0.41	0.41
C5 Olefin	1.77	1.99
C6 Olefin	0.56	0.63
C7 Olefin	0.17	0.19
C8 Olefin	0.04	0.05
C4 Diolefin	0.59	0.59
Cyclopentadiene	9.06	10.21
Isoprene	2.63	2.96
C5 Diolefin	2.93	3.31
C6 Diolefin	3.46	3.91
C7 Diolefin	1.04	1.17
C8 Diolefin	0.26	0.29
DCPD	2.12	2.39
Benzene	34.57	32.28
Toluene	15.37	14.34
Xylene	7.305	6.818
Ethyl Benzene	2.435	2.273
Indene	4.070	4.59
C9 Up To 205°C Aro	4.070	3.8
Styrene	5.890	6.64
C5 Paraffin	0.86	0.8
C6 Paraffin	0.31	0.28
C7 Paraffin	0.08	0.08
Total	100	100

Properties		
	FEED 1	FEED 2
Density, kg/m ³	842	838
Diene Value, g I ₂ /100g	48	53
Bromine Number, g Br/100g	80	89
IBP (ASTM D86)	45 –62	
10% (ASTM D86)	58 -75	
30% (ASTM D86)	78 -95	
50% (ASTM D86)	83 -100	
70% (ASTM D86)	100 -117	
90% (ASTM D86)	145 -167	
EBP (ASTM D86)	188 -205	

Impurities	
Free Water	Nil
Existing gums, mg/100 ml	30 max
As + P, wtppb	60 max
Hg, wtppb	10 max
Sulphur, ppmw	200 (2) (min 100 –peak at 800)
CS ₂ , ppm	10 max
Pb+ Si, wtppb	60 max

Hydrogen Make-up	
Composition, vol%	
H ₂ ,min	95.03
C ₁	4.97
Impurities	
CO, mol ppm	10 max

Operating conditions and expected performances

Main Operating Conditions		
Fresh feed flow rate	kg/h	18 500 –24 228
Recycle Rate	kg/h	0 –5 728
Quench rate	kg/h	32000 –49 300
H ₂ Make-up Rate	kg/h	300 -360
Reactor inlet temperature operating window	°C	65 -130
Reactor outlet temperature operating window	°C	125 -180
Reactor inlet pressure operating window	kg/cm ² g	30 -32
Estimated maximum pressure drop across catalytic bed	kg/cm ²	3.0

Performances		
Product Properties		
Expected reactor effluent Styrene Content	wt%	<0.15
Expected Diene value	gl2/100g	<1.2
Catalyst Performance		
Expected first cycle length before regeneration	months	>24
Lifespan of a catalyst	years	>5