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RECOVERY OF PROPYLENE FROM LPG

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Abstract- LPG consists of an propylene, butylenes and many other hydro carbon mixtures. The allowable quantity of propylene in LPG is about 5%. Though Propylene has many adverse effects it is used as feedstock for many reactors and used as light power fuel. LPG is a form of natural gas which has rich portion of propylene in it. on demand necessity of lighter power fuel in the market demands for the more propylene supply. This paper reveals the promising removal technology of propylene from the LPG. Distillation and catalyst hydrogenation technologies are used for the separation of propylene from the hydrocarbons. But the later was costly when compared to the former. In our proposed technology cost effective methods are used for the same purpose. From our method about 95% pure propylene is being obtained.
Keywords: LPG, cumene, C3-C4 splitter, centrifugal pump, propylene.

1. INTRODUCTION

Liquefied petroleum gas commonly known as LPG are being a part of the day to day life since the last two decades. LPG consists of propylene, butylenes and many other hydrocarbons. They are also simply called as propane. Other than being used as cooking equipment they are also used as fuel, aerosol propellant, refrigerant, etc.

There is a maximum allowable limitation of 5% of propylene in the LPG. But due to the adulteration in LPG the propylene level is being raised in order to obtain the high profit in the propane fuel market.

Propylene also known as methyl ethylene is an fossil fuel and also comes as an by product during refining and processing of crude oil and natural gas. Hydrocarbons are cracked to give many other by products including propylene. Since hydrocarbons are much needed source of energy propylene is higher in demand in fuel market. Other than cracking of hydrocarbons propylene are also produced by other chemical methods like fractional distillation and refining. The propene obtained by this method is about 60-70%. Switching to Light steam cracking feedstocks with low propene has over taken the gasoline usage which causes the propylene to emerge as a in-demand product in the market there by increasing its production in a noticeable level.

2. PROPYLENEPRODUCING

2.1 Methods

2.1.1.Olefin Metathesis

Olefin metathesis, is an disproportionation method which involves the bond breakage between ethylene and butenes which are then reversed to produce propylene. Propylene produced by this method is about 90% in molecular weightage. This process is used as an optional when there is shortage of butene feedstock. Here ethylene is inputted to the ethylene-dimerization unit which outputs butene.

2.2. Dehydrogenation

In this method the propane is converted into propene by the removal of hydrogen molecules and the hydrogen is given as an by-product. The propene produced by this method is about 85% in molecular weightage. The by-products obtained from this method are used as fuel for this method itself thereby downsizing the external fuel requirement.

Many dehydrogenation plants are being constructed around the world for the production of propene. There are many techniques to produce the propene by this method. The differences in each method will be the reactor design, catalyst used and the conversion rates. So far five technologies has been identified and licensed.

3. FLUID CATALYTIC CRACKING

Fluid catalytic cracking (FCC) method uses traditional cracking technique under severe compressed conditions such as keeping high steam rate, high ratio of catalyst to oil under high temperature. These conditions are maintained so as to increase the amount of propylene produced. This unit is fed with the paraffin residue inputs to produce propylene weighting about 20-25 mol % also byproducting the gasoline.

In this technology large Olefins molecules (C4-C8) are cracked by the catalytic action so as to produce more propene and ethylene in fewer amount.

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4. FEATURES OF PROPYLENE

Propylene is soluble in most organic solvents. It readily react with water to form propylene glycol. Reaction with phenol and alcohol result in ester. It can be isomerized into allyl alcohol, acetone in the presence of SiO2, Al2O3, at 500 °C. Propylene has strong reaction when combined with the acids, bases, metal and alkalies resulting in the fire explosion.

Due to its high vapour pressure and its tendency to hydrolyse, propylene does not persist in soil or water. The suggested values for the organic carbon partition coefficient and bio-concentration factor also indicate that partitioning to soil or sediment will be negligible. If propylene is released to the atmosphere, it will be react photo chemically with hydroxyl radicals. Due to its relatively high water solubility, propylene may be removed from air by rain.

5. PROPOSED METHOD FOR RECOVERY

5.1 Propylene recovery is done by the following process

- Borsing process
- Oleflex process
- UOP process

Among the available process the method of UOP is adapted for the recovery of propylene as they are simple, economical and low pressure operated. The entire process is explained in the following sections.

- Reactor section
- Product recovery section
- Catalyst regeneration section

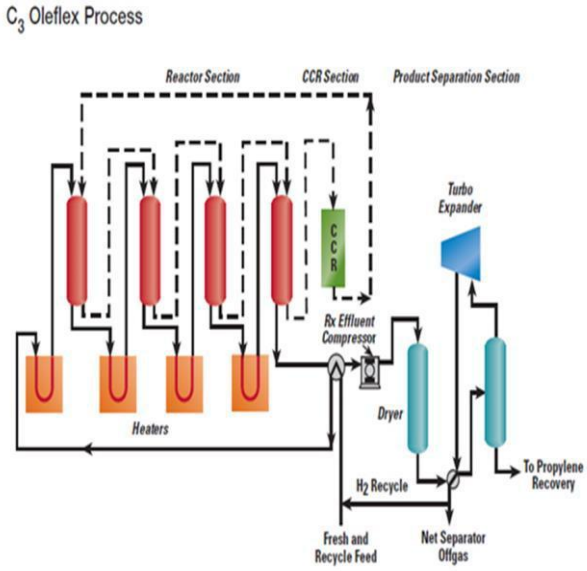

Fig.1.C3 Oleflex flowsheet

Fig.1 Shows the C3 Oleflex flowsheet which is discussed further. The reactor section has four reactors which flows radically, Heaters with charge and interchanges themselves and a heat exchanger. In the next section, that is in product recovery section the reactor effluent is cooled, the cool and the compressed effluent is then sent to the heat section to remove hydrogen from the effluent. The recovered gas has purity range in between 80-95%. Further the effluent is sent to a selective unit to remove the other hydrocarbons.

This liquid is then fed to the de-ethanizer and propane-propylene (P-P) splitter to obtain the chemically polymerized propylene. The propane which is not converted is sent again back to the reactor section.

The previous step is done using the Huls SHP process licensed by UOP. The last section, catalyst regeneration section burns out the carbon from the catalyst and recycles it for the fresh catalyst activity.

Propane is used as feedstock for the entire process. This propane is obtained from the fossil fuels and also as a by-product from the refinery and the processing units. The propane is also produced by different techniques such as Olefin metathesis, Dehydrogenation and Fluid catalytic cracking (FCC) method.

The catalyst used for this process is platinum which is used to accelerate the removal of hydrogen from the hydrocarbons. Fifth generation catalyst was introduces in the year of 2001 named as DeH-14 catalyst. This catalyst is used to accelerate high activity of dehydrogenation process. Table.1. shows the clear record of the splitter feed given to the plant.

Table.1. C3-C4 SPLITTER(FEED)

NAME	C3-C4 SPLITTER	C3-C4 SPLITTER	C3-C4 SPLITTER	C3-C4 SPLITTER
Components	Mol.wt	Wt %	Mol %	Kg/hr
H2O	18	0	0	0
Methane	16	0	0	0
Ethylene	28	0	0	0
Ethane	30	0.401	1.3	31.85
Propylene	42	78.772	173.3	6256.077
Propane	44	19.825	45.1	1574.5
i-butane	56	0.333	0.59	26.45
i-butyne	58	0.017	0.029	1.35
t2 butane	56	0.032	0.057	2.54
C2 butane	56	0.014	0.025	1.112
i-butane	58	0.578	0.99	45.90
n-butane	58	0.026	0.045	2.065
1,3 butadiene	54	0.002	0.0037	0.159
i-pentane	72	0	0	0
n-pentane	72	0	0	0
Total		100		
Total flowrate (kg/hr)				27508
Pressure (kg/cm2)				21.5
Temperature (0 c)				67
Total Mol.wt				51.8
Density (kg/m3)				505

6. BENEFITS OF PROPOSED METHOD

In this method high recovery rate of about 95% is achieved. The purity of the recovered propene is about 99 mol % of Nitrogen. The period of the payback is very short for the period of 1-3 years. The entire process is carried out in a safe environment ensuring the safe operation. This method is highly reliable when compared to others and the maintenance of the installation is cost effective and cheap.

In our proposed method the plants are subject to quick installation and the implement of the same is very easy through unit design. In addition to this our proposed model is retrofit in design that is it can be easily adapted with the existing installations.

7. CONCLUSION

With a global demand, PROPYLENE is one of the most important intermediates widely used in the production of various commercial materials. The project was done on the RECOVERY OF PROPYLENE about 95 the distillation column and double pipe heat exchanger were designed for the recovery of the propylene in the plant. Several aspects of safety and environmental concerns were discussed. The cost estimation of the plant was described for recovery and payback period accounts for about 4 years and 1 day.

8. RFERENCES

[1] C.MNarayanan., BhattaCharyaB.C .,"Introduction to Chemical Equipment Design", Published by New Central Book Agency (P) Ltd
[2] Dr.G.K Roy "Fundamentals of Heat and Mass Transfer", VII edition, Khanna Publishers, New Delhi. Forbes Marshall.,"Engineering Data Book"
[3] J.R Backhurst, J.H Harker, " Process Plant Design", Published by American Elsevier Pub. Co., 1973.
[4] Lloyd E. Brownell, Edwin H. Young "Process Equipment Design", Published by JohnWiley& Sons, 1959.
[5] Matthew Van Winkle "Distillation", McGraw Hill Book Company 1967, New York.
[6] Max S. Peter.,"Plant Design and Economics For Chemical Engineers", V edition, McGraw Hill Book Company, New York.
[7] McCabe W.L., Smith J.C., Peter Harriot.,"Unit Operation of Chemical Engineering", V edition, McGraw Hill, Book Company, New York.
[8] M.J Lockett.," Distillation Tray Fundamentals", Published by Cambridge University Press, 1986.
[9] M.V Joshi., V.V Mahajani., "Process Equipment Design", Published by Macmillan India Limited, 2000.
[10] Perry R.H., Green D.W., "Perry's Chemical Engineer's Handbook", VII edition McGraw Hill Book Company, New York.