



University of Technology

Department of Chemical Engineering

Branch of petroleum refinery

High Density Polyethylene

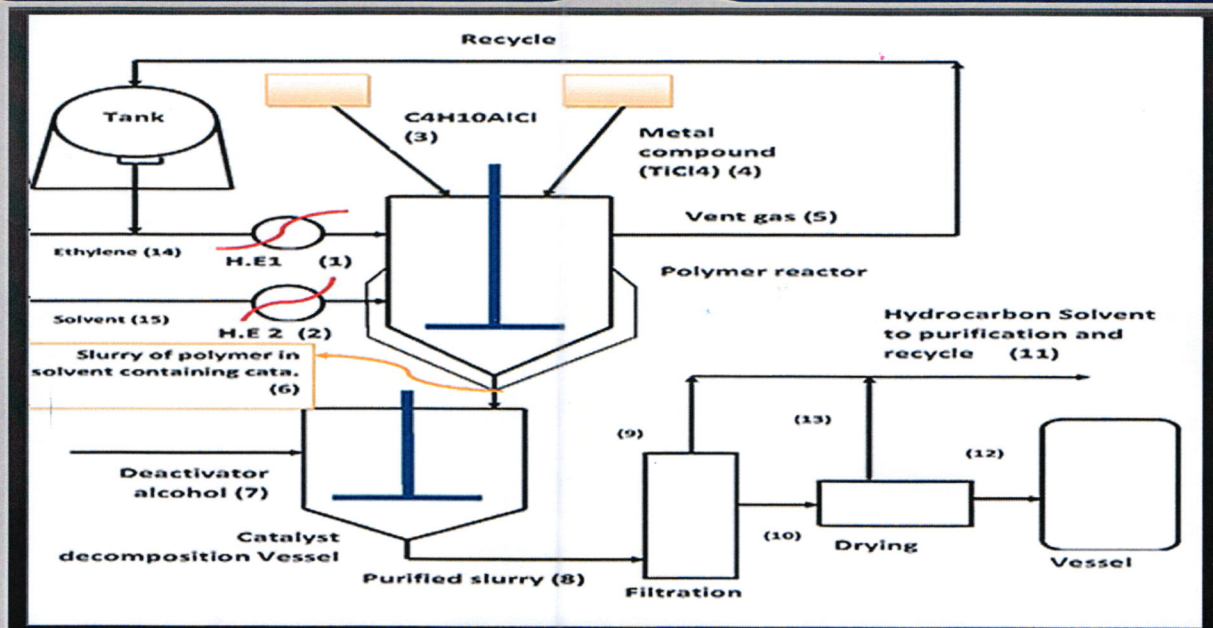


Abstract

High density polyethylene used in wide range of various industrial fields such as in bags, cars manufactures, furniture and other using. HDPE manufactured by the suspension polymerization method, to produce 30000 ton/year as it found in the plant of petrochemicals of Al-Basrah . we used (Zigler-Nutta) method . In this method high purity ethylene is introduced into the reactor vessel in which catalyst – TiCl_4 in alkyl aluminum $\text{C}_4\text{H}_{10}\text{AlCl}$ with condition of (130°C) and (20atm). We will make the material and energy balance on the process and design it and evaluate the cost of plant and it's location

uses

1. In manufacturing of many pieces of cars , templates, bottles and insulators
2. in manufacturing of home tools , shoes , balls , toys , boxes and the field of food saving
3. because of its resistance to heat , humidity and worse climate it used in covering of many equipment to safe it
4. HDPE combined with other polymers to create new material called copolymers that have many features



Production method

1. High-Pressure Process
2. Suspension (Slurry) Process
3. Gas-Phase Process
4. Solution Process
5. Ziegler Process

references

1. coulson and Richardson;chemical Engineering" Vol6 R.S.sinnott co;4th edn ;1985
- 2 . perry;"chemical Engineer's hand book";6th edn "pergamon press co.1986"
- 3 . high-density polyethylene-wikipedia,the free encyclopediawww.en.wikipedia.org/wiki/HDPE



Supervisor: Dr. Ghanim

Students: Amani Qusai

Mohammed Nezar



“Design of caustic wash system for light hydrocarbons such as LPG, NGL and Naphtha”

By supervision of : Dr. Adel Shareef

Name of students : 1- Amna Essam 2- Malak Riyadh 3- Mena Raid

Abstract

Impurities such as hydrogen sulfide and mercaptan compounds in light hydrocarbons usually cause bad odor, corrosion problem and air pollution after combustion. Therefore elimination of these impurities is very important. One of the processes for removing these compounds is (caustic wash process) that is applied in refineries and petrochemical plants for extraction of hydrogen sulfide and mercaptan compounds and organic acids from hydrocarbons. This process is safe, economic and performance effective which is also safe for environment. The VOP merox process is an efficient and economical catalytic process developed for the chemical treatment of petroleum fractions to remove sulfur present as mercaptans. This process is used for liquid phase treating of liquefied petroleum gases (LPG), natural gas liquid (NGL), naphthas, gasoline, kerosene set fuels and heating oils. It is also can be used to sweeten natural gas and synthetic gas merox treated products may finish products sent directly to storage without and further processing or intermediate products that may require either blending into finished stocks.

Uses

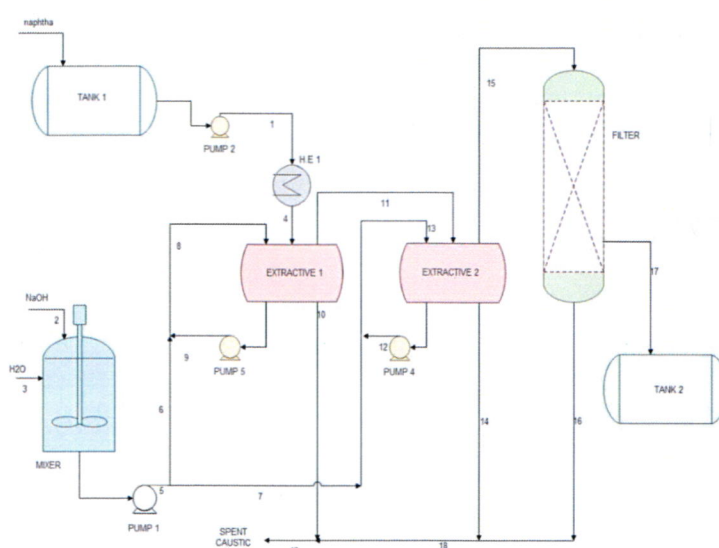
The major use of saturated hydrocarbons is as a mixture, sometimes with unsaturated or aromatic compounds, as heating fuels, motor fuels and lubricants. Saturated hydrocarbon also sever as raw materials for the production carbon black. In the chemical industry, the following processes are important

Removal Processes

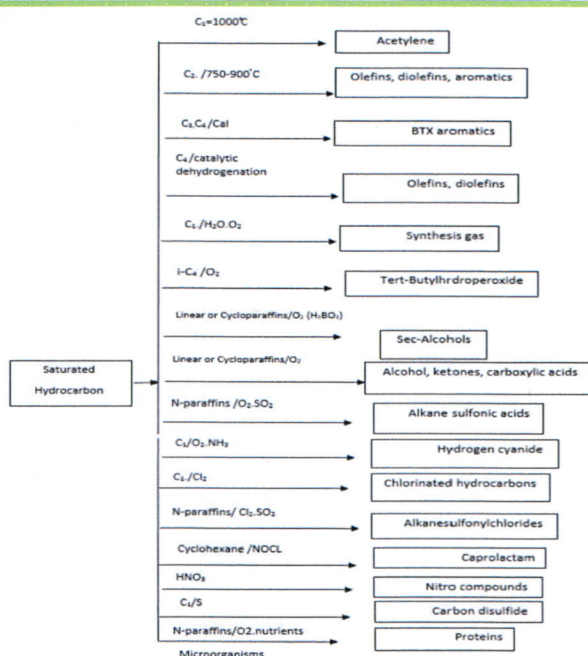
Mercox Sweetening can be accomplished in four ways :

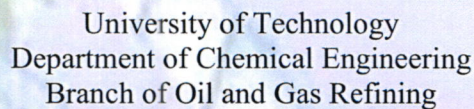
1. Fixed bed with circulation of caustic solution .
2. Minimum – alkali fixed bed (Minalk process).
3. Caustic free mercox treatment .
4. Caustic extraction process .

Caustic extraction process: Feed (naphtha) enters to two using 20% caustic solution, from the first stage 16% of Caustic solution is consumed and the total H_2S will be eliminated. Also the concentration of methyl mercaptan and ethyl mercaptan and propyl mercaptan in outline will be 13.2 ppm, 86.6 ppm and 402.1 ppm respectively. Then this naphtha stream enters to the second stage, where 15% of the caustic is consumed and the concentration of methyl mercatan, ethyl mercaptan and propyl mercaptan will be reached to 0.8 ppm, 24 ppm and 359.2 ppm respectively. The final product is pumped to the sand filter and then to the product tank.



- 1- www.vurup.sk/sites/vurup.sk/archivedsite
- 2- www.digilib.mercubane.acid/manger/filebook
- 3- www.vop.com
- 4- Daura refinery , Baghdad , Iraq
- 5- Coulson J.M and Richard son J.F Chemical Engineering design vol.6 4th edition , butterworth Heinemann, oxford(2005)
- 6- Kirk othmer , encyclopedia of chemical technology 4th edition vol12 , john wiley new York (1998)





Production of vinyl acetate monomer

The Name of Supervisor :- D.Zaidoon Muhsen Shaqor

Name of Students :-

- 1- Abdolassis Abod Younos
- 2- Muslim Hassan Alawy
- 3- Mustafa Nashaat Amjad

Abstract: The purpose of this project is to produce “vinyl acetate monomer” by using available and inexpensive materials. The product capacity 100,000 ton/year . This compound is an important industrial material . Although presence of several methods used for production , but this compound is produced mainly in such process (acetic acid , ethylene , and oxygen) and using the following raw material (AA , C_2H_4 and O_2). This material has been prepared first time in 1912 by klatte. And the importance of this material gradually increased after entering in many applications.

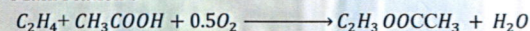
Production Methods :-

- 1- Reaction of Acetic Acid with Acetylene
- 2- Ethylidene Diacetate Process
- 3- Reaction of Acetic Acid with Ethylene and Oxygen
- 4- Reaction of Methyl Acetate with CO and H_2 .

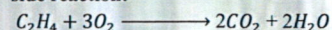
Process selection :

Reaction of Acetic Acid with Ethylene and Oxygen.

Main reaction :



side reaction:



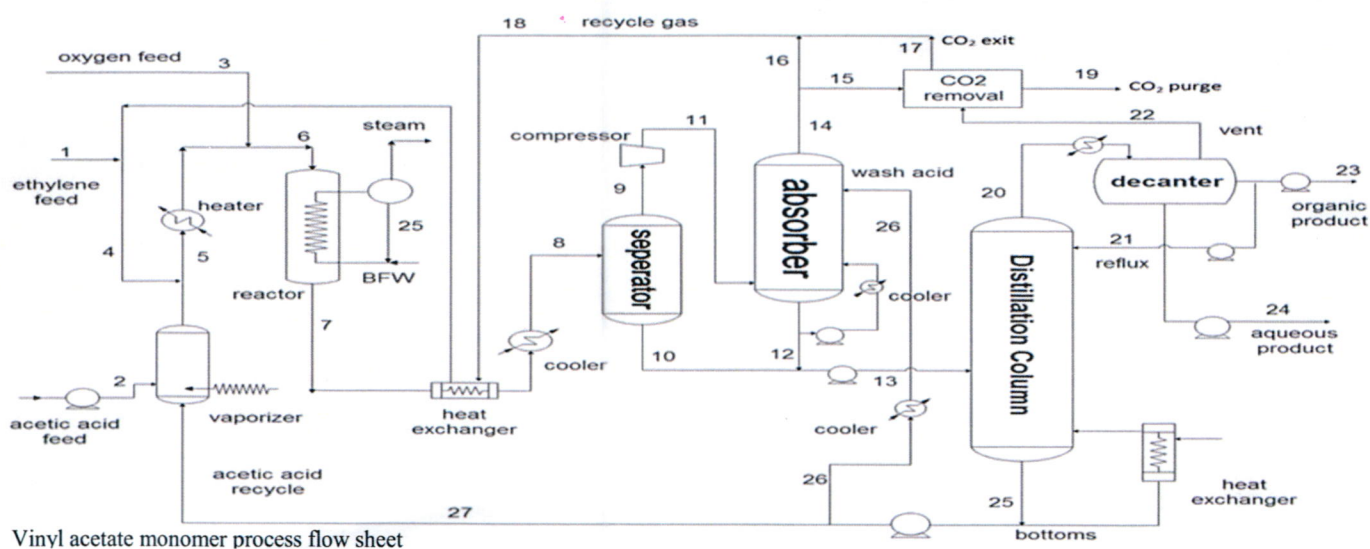
Uses :

vinyl acetate is product the following :

- 1-Poly vinyl alcohol used to produce paints ,adhesive ,coating for flexible substrates and sizing for polyester fiber-fill insulation textile produce insulation for magnatic wire ,inter- layer safety glass wash primers
- 2- polyvinyl alcohol used to produce adhesive ,coating and water soluble packing film product gas barrier layer in co- extruded packaging
- 3- vinyl acetate co-polymer are used to produce flexible film , coating ,adhesive , molding and insulation.

Object of project:

To Manufacture Production of vinyl acetate monomer Production capacity 100000 ton/day



Reference :

- 1-Perry ; "Chemical Engineering handbook " ; 6th edn"pergamon press CO.1986 ".
- 2-Kirk – othmer – encyclopedia of chemical Technology. "4th edn John Willey and Son co .2004.
- 3-Coulson and Richardson ; "Chemical Engineering " vol 6 –"R.S. sinoott Co.4th edn 1985 "
- 4- ullmanns – Encyclopedia of chemical Industries .
- 5-Tobpik – 4 ; "vinyl Acetate Monomer process – chemical process design".



University of Technology

Department of Chemical Engineering

Branch of Oil and gas refining



Production of methanol using steam Reforming of Natural Gas

The Name of Supervisor :-

Dr. Ghanim Magbul Alwan

Name of Students :-

1- Abbas Enaad Waheed
2- Tabarak Mahir Moneam

Abstract of Project :-

Methanol is a new future alternative fuels and it also widely uses as a raw material for MTBE and other materials. Pure methanol ,however, was first isolated in 1661 by Robert Boyle, who called it spirit of box, because the produced it via the distillation of boxwood. Approximately 70% of the methanol produced worldwide is used in chemical syntheses: in order of importance formaldehyde, methyl tetra butyl ether (MTBE), acetic acid, methyl methacrylate, and dimethyl terephthalate. The demand of this fuel is increasing in the world. production capacity of methanol about 100,000 ton/year , production of a crude methanol stream which is about 80% methanol and water , carried out over a catalyst.

Uses:-

Methanol used as raw material for product Formaldehyde, Methyl tetra-butyl ether, Acetic Acid and may be used in Other Synthesis Products. In the intensive search after the oil crisis for routes to alternative fuels, processes were developed that allowed fuels to be produced from synthesis gas with methanol as an intermediate. Methanol is used as an industrial solvent; antifreeze for automotive radiators and air brakes; an ingredient in gasoline and diesel oil antifreezes; an octane booster in gasoline, Methanol can be used directly or blended with other petroleum products as a clean burning transportation fuel.

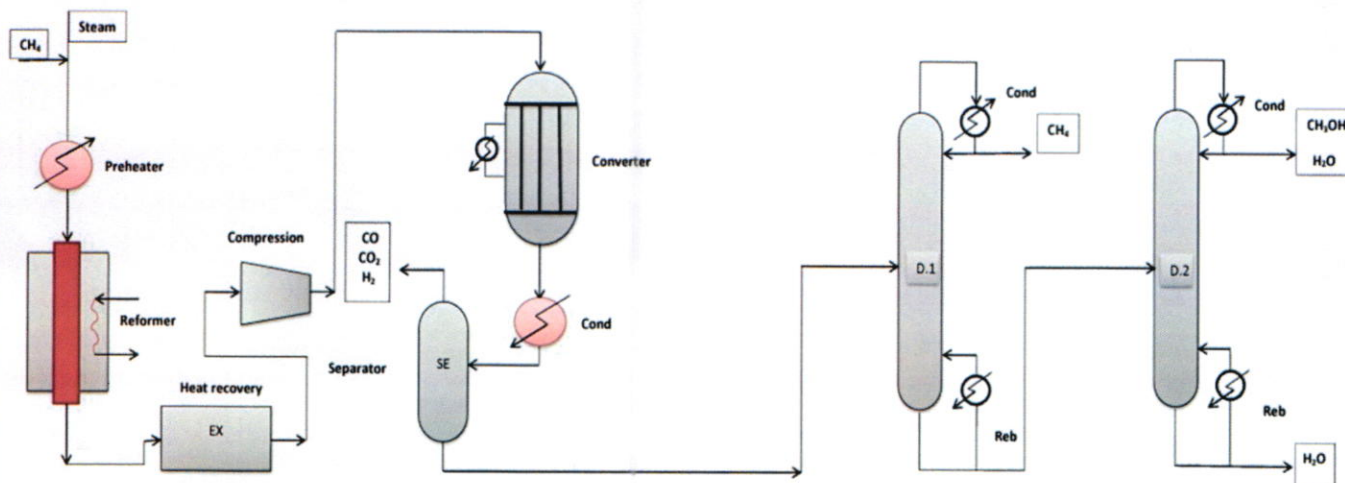
Production Methods :-

- 1- Steam-Reforming Natural Gas
- 2- Steam-Reforming of Naphtha
- 3- Other Synthesis Gas Generation process

Object of project:

To Manufacture Methanol From Natural Gas
Production Capacity =333.3 ton/day

PRODUCTION OF METHANOL USING STEAM REFORMING OF NATURAL GAS



Reference :-

- 1- Methanol – Wikipedia , The free encyclopedia
- 2- Hpa – methanol – general – info – vol2 – health protection Agency 2007 – prepared J.D.Pritchard – Version 2
- 3- Derived Syngas – Methanol and Methanol derivative
- 4- methanol – chemical compound – Britannic
- 5- ullmanns – Encyclopedia of chemical Industries .
"wiley – VCH verlage GmbH & Co. KGaA , weinheim ;4th edn – 2005"
- 6-Kirk – othmer – encyclopedia of chemical Technology.
"4th edn John Willey and Son co .2004"
- 7- Coulson and Richardson;
"Chemical Engineering" vol 6 "R.S.sinoott CO.4th edn 1985"
- 8- Perry ;
"Chemical Engineering handbook" ;6th edn "pergamon PPress CO 1986"



University of Technology
Department of Chemical Engineering
Branch of Oil & Gas Refinery



Abstract

Aniline is colorless, oily liquid which darkens on exposure to air and light. It has a characteristic amine odor of rotten fish and ignites readily, burning with a smoky flame. As an aromatic derivative, it is highly reactive with respect to electrophilic substitution reactions. It also combines with acids to form salts. Aniline is miscible with alcohol, benzene, chloroform, carbon tetrachloride. Commercially, aniline is produced upon reduction of nitrobenzene by a variety of reducing agents such as iron and hydrogen chloride, followed by a steam-distillation of the product. Aniline is used in rubber accelerators and antioxidants, dyes and intermediates, and there is another method to produce aniline from chlorobenzene and the selected method is production of aniline from phenol and we choose this method because of there is no side reactions

Students Name

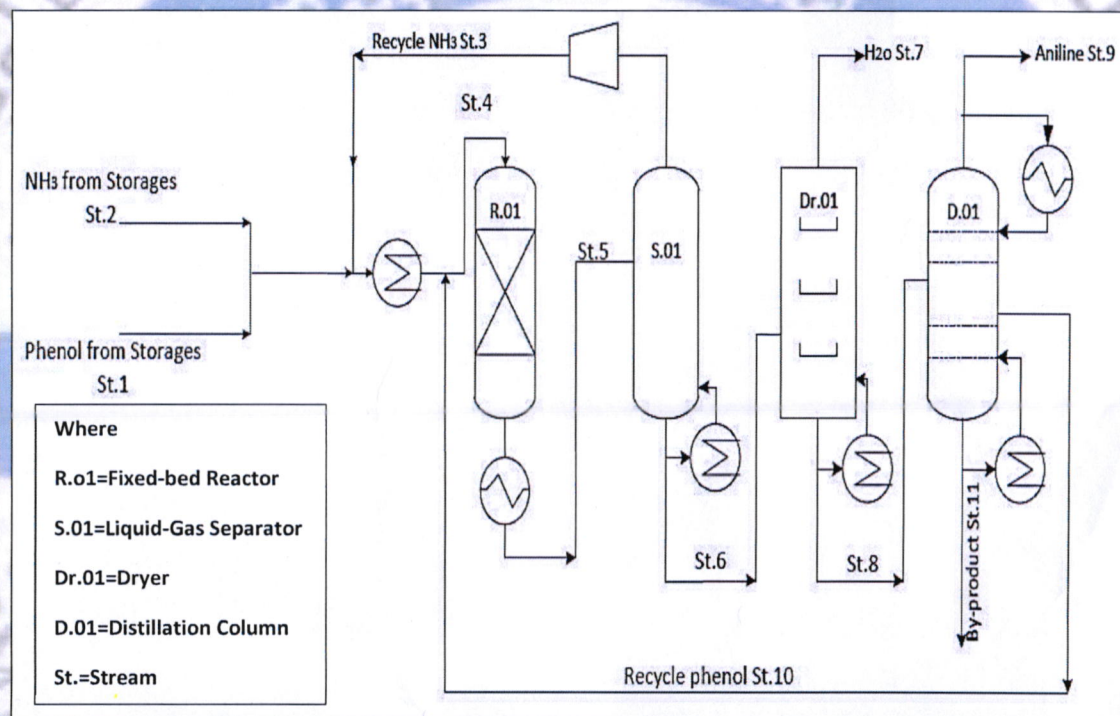
Mohammed Khalil

Mohammed Basim

Supervised By

Lec. Nagham Adeeb

Project for Production of Aniline from Phenol



References

- Kirk Othmer Encyclopedia of Chemical Technology (R), New York, Interscience Pub
- Ullmann's Encyclopedia of Industrial chemistry
- Chemical Engineering, Volume 6, Third Edition, "Chemical Engineering Design" R.K.Sinnott

Production Methods

- Manufacturing of Aniline from Nitrobenzene
- Manufacturing of Aniline from Phenol
- Manufacturing of Aniline from Chlorobenzene

Uses of Aniline

- Aniline is used for the preparation of methylene diphenyl di isocyanate ($C_{15}H_{10}N_2O_2$) used for the production of rigid polyurethane. These rigid polyurethane foams are good thermal insulators and used in nearly all freezers and refrigerators worldwide, as well as buildings.
- Herbicides (a substance that is toxic to plants and is used to destroy unwanted vegetation) (2%) and agricultural chemicals, 1968
- Dyes and pigments (2%) as a precursor to indigo, the blue of blue jeans and also as ink for tattoo. Other aniline dyes followed, such as fuchsine
- Solvent and rubber phenylenediamine ($C_6H_8N_2$) and diphenylamine ($C_{12}H_{11}N$), which are additives to rubber.



University of Technology
Chemical Engineering Department
Branch of Oil and Gas Refining



Project Name
Production of CO₂ Gas by burned of Natural Gas

The Students Name : 1- Ali Saffa Hassan 2- Tamara Sarmed Hadi

The Name of Supervisor : Dr.Khalid H. Rashid

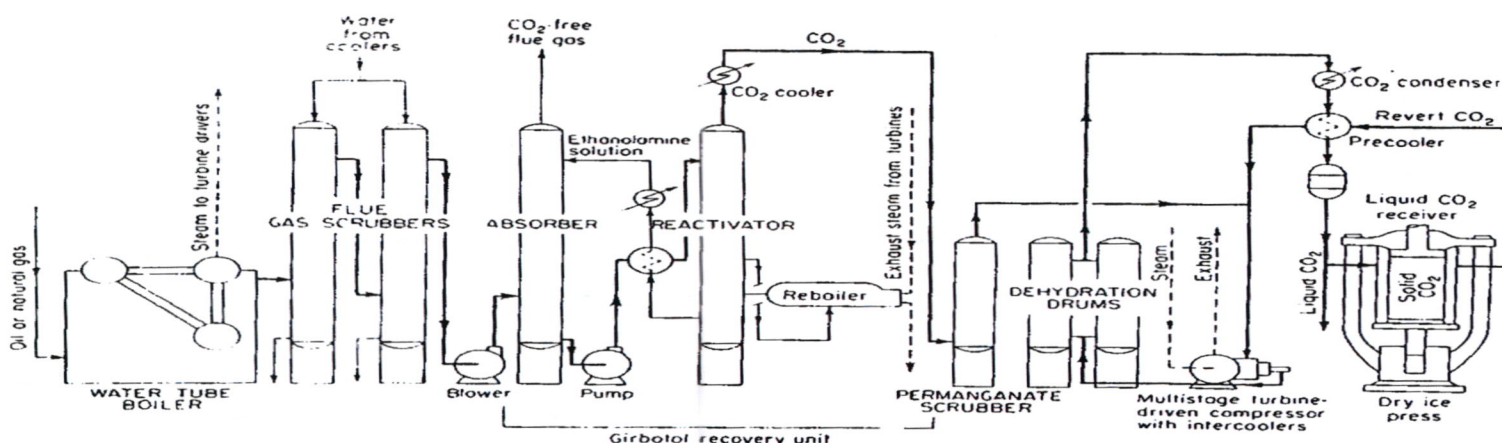
Abstract

Gas dual carbon dioxide (CO₂) has been prepared for the first time before the Scientist (Van Helmont), in the period confined between years (1577 to 1644) where he was during this long period, the Scientist mentioned the preparation of this article in several different ways, so he first cooked by in with fermentation Then in with treated carbon compounds by acids and then are also cooked by the burning of coal. This Scientist has studied the properties of the product specifications and all of these methods and techniques.

Uses of CO₂

- 1- Soft drinks, wines, are produced using gaseous carbon dioxide for carbonation. Carbon dioxide is used in water treatment to neutralize alkaline water. It is added to drinking water and carbonated beverages including beer and champagne to add sparkle .
- 2- Liquid carbon dioxide is used widely in the food industry for freezing meats, poultry, vegetable, and fruits. also used to increase recovery from oil and gas wells. Other industrial uses include the production of chemicals, plastics, rubber , metals, and electronic
- 3- Solid carbon dioxide (dry ice) is used to cool meats prior to grinding and also to refrigerate meat and poultry during transit and used to cool meats prior to grinding and also to refrigerate meat and poultry during transit .

Production Methods : 1- Carbon Dioxide from (N.G.) 2- Carbon Dioxide from Fermentation. 3- Carbon Dioxide from Carbonates



References:

- Ullmanns , Encyclopedia of chemical industries 2005 Wiley-VCH verlage GmbH & CO. KGaA ,weinheim ; 4th edn
- Krik -Othmer-"Encyclopedia of chemical technology ", 4th edn ; John willey and son Co.2004"
- Shreve : Chemical process Industries :1982



University Of Technology

Chemical Engineering Department

Branch : Chemical Processes

The Project Name : **Production of DME**



The Students Name : Yousif Mhsen &

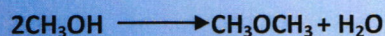
Zuhair Abdalkareem

The Name Of Supervisor :

Dr. Nabilah Adel Mohammed

Abstract of Project:

The object of this project is to produce Dimethyl ether (DME) also Known as methoxymethane ,is the organic compound with the formula CH_3OCH_3 . It is a colorless gas has boiling point(24.8-C°) The largest use of dimethyl ether in 2010 as substitute for propane in LPG used as fuel in household and industry Dimethylether is know manufactured wih two processes , first from natural gas and second by dehydration of methanol by the following reaction

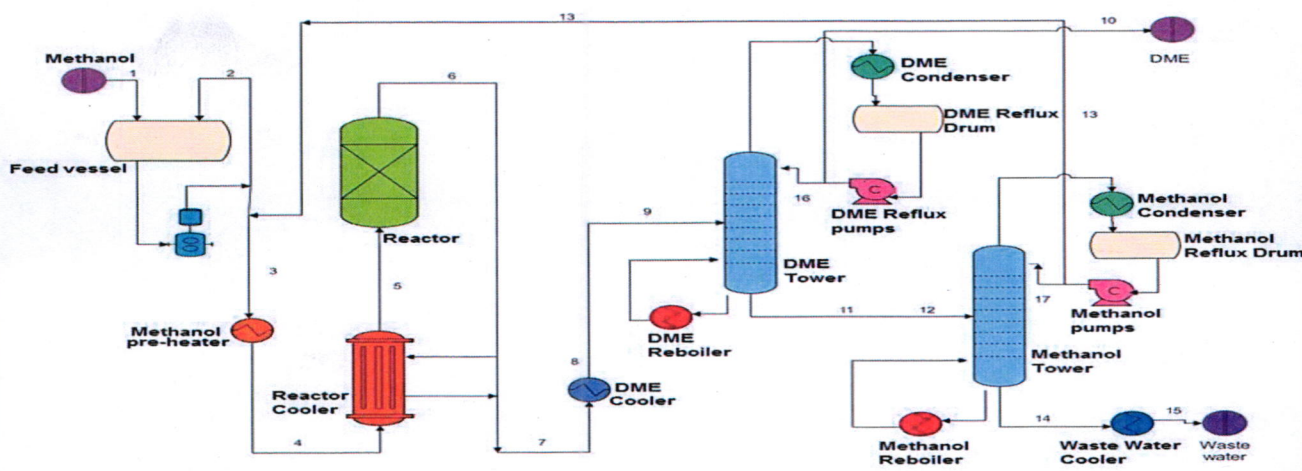


Uses :

- 1- The largest use of (DME) in 2010 as substitute for propane in LPG used as fuel in household and industry .
- 2- Used for the production of methylating agent, (dim ethyl sulfate).
- 3- Used for the production of acetic acid .
- 4-Used in the aerosol industry as a propellant.
- 5- (DME) is a low temperature solvent and extraction agent.
- 6-(DME) is being developed as a synthetic second generation biofuel (Bio DME).
- 7-(DME) is used in refrigerant blends with propane and butan
- 8-Unlike other alkyl ether ,DME resists autoxidation ,it is also relatively non-toxic.

Production Methods :

- 1- From natural gas
- 2- Dehydration of methanol



References:

- 1-Kirk_Othmer, Encyclopedia of Chemical Technology , 4th Edition , Vol. , John Wiley ; New York(1998).
- 2-Mcketta and John J., Encyclopedia of chemical processing and Design, 2nd Edition, Vol. Marcel Dekker, New York (1988).
- 3-Ullmann; Encyclopedia of Industrial Chemistry 2nd Edition, John Wily, New York (2005).
- 4-Faith, Keyes and Chlark; Industrial Chemicals 4th Edition, John Wiley; New York (1975)
- 5-Nelson W.L; petroleum Refinery Engineering, 4th Edition, Mc Graw_Hill, NewYork (1958).
- 6-Gary H.J and Handwerk G.H, petroleum Refining Technology and Economics, 2nd Edition, Marcel Dekker, New York (1948).
- 7-Kohl A.L and Riesenfeld F.C, Gas purification, 3rd Edition, Gulf publishing CO., London (1979).



Production of Acetaldehyde

STUDENT NAME

1- MUSTAFA SAADI M O H. & 2-MOHAMMAD SAAD HUSSAIN

SUPERVISED NAME

DR. NABILAH ADEL MOHAMMED

Abstract

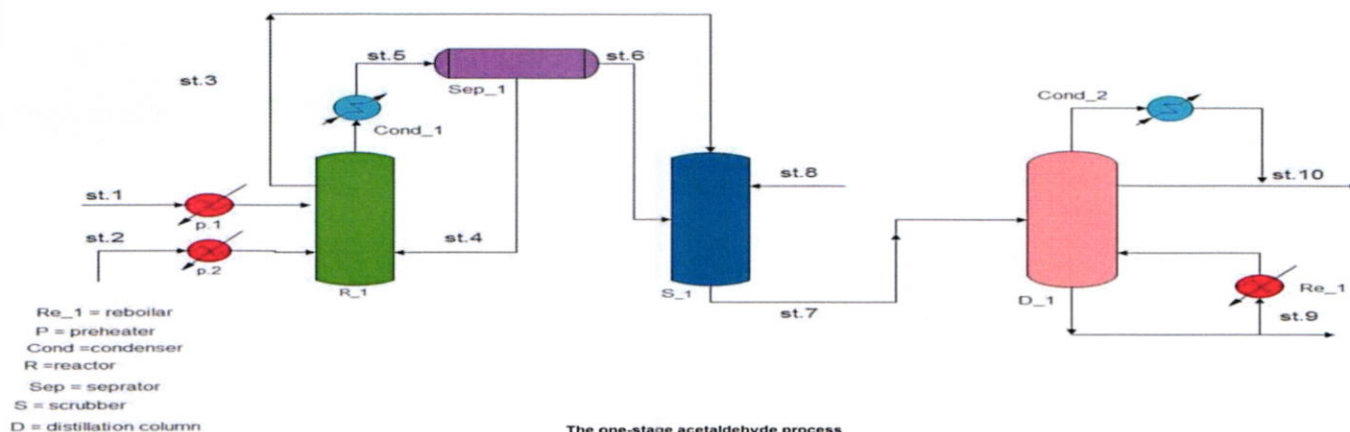
The object of this project is to produce (acetaldehyde) by using the available, inexpensive and suitable raw materials. The first time that material was produced in 1774 by Scheele during reaction of black manganese dioxide and sulfuric acid with alcohol. This material is important in industrial, is used in produce acetic acid, acetic anhydride, intermediate in the synthesis, a fruit and fish preservative. Although presence of several methods used for produce acetaldehyde from (Ethanol, methanol, acetylene, Lower hydrocarbons, Carbon monoxide and hydrogen, ethylene), but is produced mainly in process from ethylene using ($C_2H_4 + O_2$) as raw materials at production capacity (5 ton/hr).

Uses

Traditionally, acetaldehyde was mainly used as a precursor to acetic acid. The predominant use of acetaldehyde is as an intermediate in the synthesis of other chemicals. Acetaldehyde is used in the production of perfumes, polyester resins, and basic dyes. It is also used as a fruit and fish preservative, as a flavoring agent, and as a denaturant for alcohol, in fuel compositions, for hardening gelatin, and as a solvent in the rubber, tanning, and paper industries.

Production methods

- 1) Ethanol from fermentation of carbohydrate or from hydration of ethylene
- 2) Acetylene
- 3) Ethylene
- 4) Lower hydrocarbons
- 5) Carbon monoxide and hydrogen
- 6) Methanol



References

- 1-Air toxic – chemical and physical properties. (www.the science and safety behind your product/product)
- 2-Ullmanns; Encyclopedia of chemical industries." 2005 wiley – vch verlage GmbH & co. KGaA, Weinheim; 4th edn"
- 3-Kirk – Othmer; Encyclopedia of chemical technology. " 4th edn ; John Wiley and co. 2004"
- 4- Coulson and Richardson; chemical Engineering " Vol 6 R.S. Sinnott. Co; 4th edn ; 1985
- 5-Perry, R.H. and Chilton, C.H., "Chemical Engineers Handbook" McGraw Hill, Inc., New York, 1984.
- 6- M.S. Matar, M.J. Mirbach, H.A. Tavim, catalyst in petrochemical processes ~ Kluwer academic publishers , Dordrecht , 1989.



Production of pyridine

Students Name

1- Ali Emad Khadim
2- Hassanen Abd Al- Zahra
3- Abdalla Ali Hussein

Supervised by

Lec. Luma Hussein

Object of project:

To Manufacture Production of pyridine, Production capacity ton/day

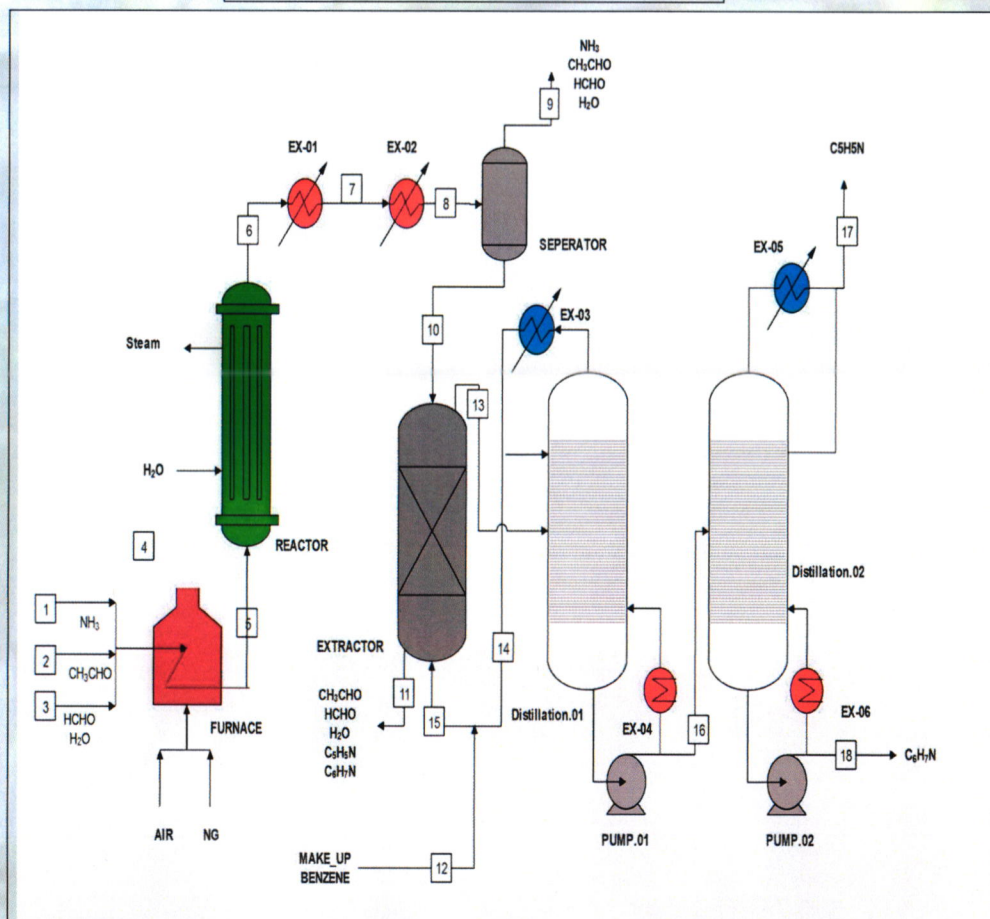
Abstract:

Pyridine is a basic heterocyclic organic compound with chemical formula C_5H_5N . It is structurally related to benzene, with one methane group ($=CH-$) replaced by nitrogen atom. The Pyridine ring occurs in many important compounds, including azines and vitamins niacin and Pyridoxal. It is a colorless, highly flammable, weakly alkaline, water-soluble liquid with a distinctive.

Pyridine is produced usually 99.9% purity for use as solvent, extraction, Pharmaceuticals and other industrial purpose. Pyridine is produced by two processes first, is separation from tar and second is from aldehydes (acetaldehyde and formaldehyde with ammonia).

References

- 1- Kirk _ Othmer, Encyclopedia of chemical Technology, 4th Edition, Vol., John Wiley, New york (1998).
- 2- Ulman; Encyclopedia of Industrial Chemistry 2nd Edition, John Wiley, New York (2005).
- 3- Mcketta and John J., Encyclopedia of Chemical processing and Design, 2nd Edition, vol. Marcel Dekker..
- 4- Faith, Keyes and Ckark; Industrial Chemical 4th Edition.
- 5- Coulson J.M and richardson J.F, chemical engineering design vol.6 4th edition, butterworth Heinemann, oxford
- 6- Gallant W.R, physical Properties of Hydrocarbon.



Uses

- 1_Pyridine is an excellent solvent for paint and rubber preparation.
- 2_Use for dehydrochlorination reaction.
- 3_Use for extraction of antibiotics.
- 4_Large amounts of pyridine are used as starting material for pharmaceuticals and agrochemicals.
- 5_Use directly in the denaturation of alcohol.
- 6_Approximately 20% of pyridine goes into the production of pipyridine which is commercially significant in the preparation of chemicals used.
- 7_Pyridine is also used as an intermediate in the preparation of drugs and dyes.
- 8_Used as an intermediate in the preparation of polycarbonate resins.
- 9_Used as flavoring agent in the preparation of food.
- 10_Used as raw material for production of vinylpyridines.
- 11_Used as raw material for production of pyridinium chlorochromate.
- 12_Used as raw material for production of N-alkylpyridinium salts.

Production Methods :-

- 1-separation from tar.
- 2-synthesis from aldehydes (acetaldehyde and formaldehyde) with ammonia

Selection of production method

Synthesis from aldehydes (acetaldehydes and formaldehydes) with ammonia



University of Technology
Chemical Engineering Department



Branch : gas and oil Refinery

The Project Name Production of maleic anhydride

The Students Name: Ahmed Kadhem Ouda
Salih Hassan Abd

The Name of Supervisor: Dr. Salah Salman

Abstract

The dominant end use of maleic anhydride (MA) is to the production of unsaturated polyester resins. These resins, which have high structural strength and good dielectric properties, have a variety of applications in automobile bodies, building panels, molded boats, chemical storage tanks, lightweight pipe, , furniture, radar domes, luggage, and bathtubs. Other end products are formic acid, agricultural chemicals ,alkyd resins, lubricants, copolymers, plastics, surface active agents, and more

Uses

- 1- Around 50% of world maleic anhydride output is used in the manufacture of unsaturated polyester resins.
- 2- The production of 1,4-butanediol (BDO) is also having an impact on the maleic anhydride market.
- 3- Another market for maleic anhydride is lubricating oil additives, which are used in gasoline and diesel engine crankcase oils as dispersants and corrosion inhibitors.
- 4- There are a number of smaller applications for maleic anhydride. The food industry uses maleic anhydride in artificial sweeteners and flavour enhancements.

Production Methods: 1- Oxidation of benzene
2-Dehydration of aqueous maleic acid solution 3- Oxidation of butane

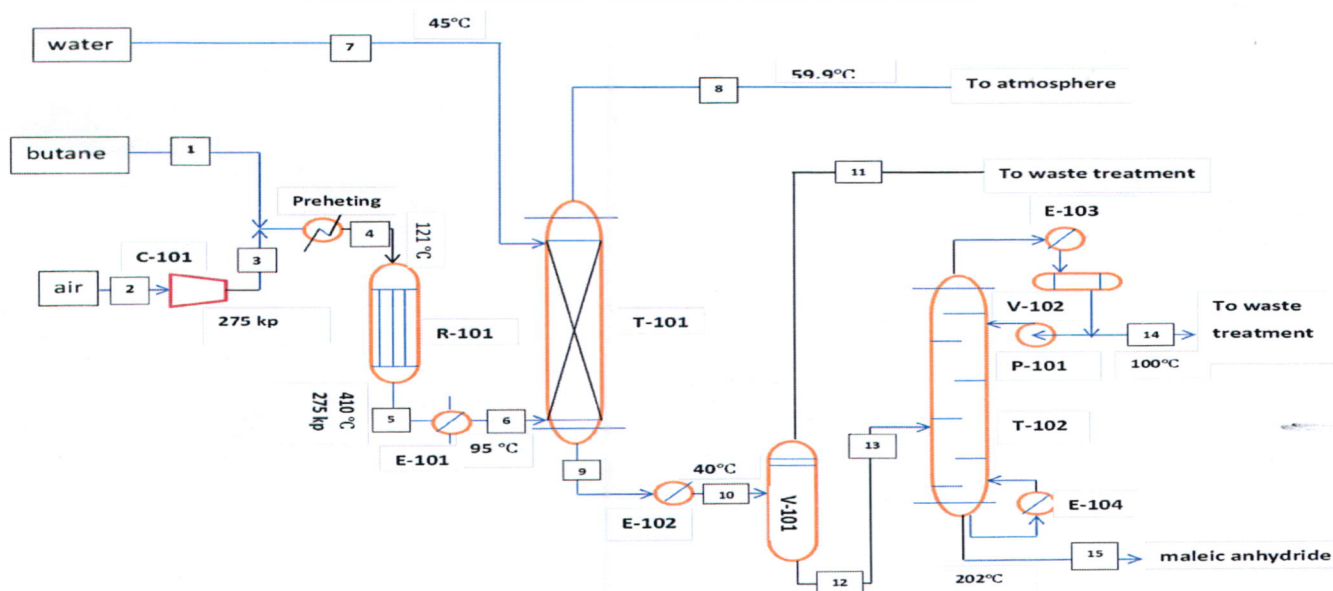


Figure 1: PFD for maleic anhydride production

References:

- coulson and richardson;"chemical engineering"vol6-R.S.sinnott co. ;4th edu,1985
perry;"chemical engineer's handbook";6th edu – pergamon press co .1986



University Of Technology Chemical Engineering Department

Branch : gas and oil Refinery

The Project Name : **Production of ethyl benzene**



The Students Name :

Thamer Hattem

Adnan Abdulhussien

Dhulfqaar Amer

The Name Of Supervisor :

Dr.Eman Taha

Uses :

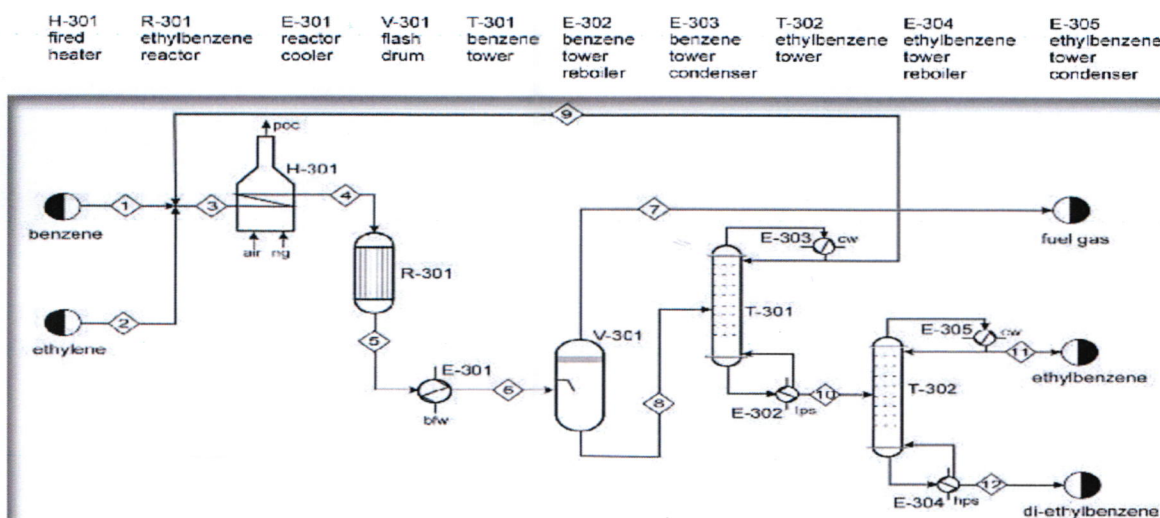
- 1) Large amounts of ethylbenzene production is consumed for manufacturing of styrene.
- 2) Used as a solvent in inks, rubber, adhesives, varnished and paints.
- 3) Used to produce acetophenon.
- 4) Used to produce diethylbenzene.

Abstract :

Ethylbenzene also called (ethylbenzol and phenietane) is an organic compound with the formula ($C_6H_5C_2H_5$) it is a highly flammable, colorless liquid with an aromatic odor similar to that of gasoline. This mono cyclic aromatic hydrocarbon is important in the petrochemical industry as an intermediate in the production of styrene the precursor to polystyrene a common plastic material. In 2012 more than 99% of ethylbenzene produced was consumed in the production of styrene . Ethylbenzene is also used to make other chemicals, in fuel and as a solvent in inks, rubber, varnishes and paints. Most of ethylbenzene is produced by alkylation of benzene with ethylene in the liquid or vapor phase over a catalyst such $AlCl_3$, zeolite. Ethylbenzene was first produced in a commercial seal in the 1930 by Dow chemical in the United State and by BASF in the Germany.

Manufacturing processes:

Ethyl benzene is manufactured by the following processes
1-Liquid phase alkylation of benzene over ($AlCl_3$ process)
2- vapor phase alkylation of benzene over (zeolite process)



References:-

- [1]: Ullmann; Encyclopedia of industrial chemistry second Edition, John Wiley; New York (2005)
- [2]: Coulson J.M and Richardson J.F, chemical engineering design vol.6. fourth Edition, Butterworth Heinemann, Oxford (2005)
- [3] , Mcketta and john J. ,Encyclopedia of Chemical processing and design , 2nd Edition , VOL Marcel Dekker , New York . (1988)



Ethylene Glycol Production

Objective

This Project aims to design factory to produce Ethylene glycol which used in industry. The production capacity is 120000 ton/year according to the Nisso petrochemical.

Abstract

Glycols are diols, compounds containing two hydroxyl groups attached to separate carbon atoms in an aliphatic chain. Although glycols may contain heteroatoms. Ethylene glycol is one of the most important ethylene-derived industrial chemical worldwide. All known ethylene glycol is now produced via the hydration of ethylene oxide, which also produces small quantities of di, tri, and higher glycols as by-pro.

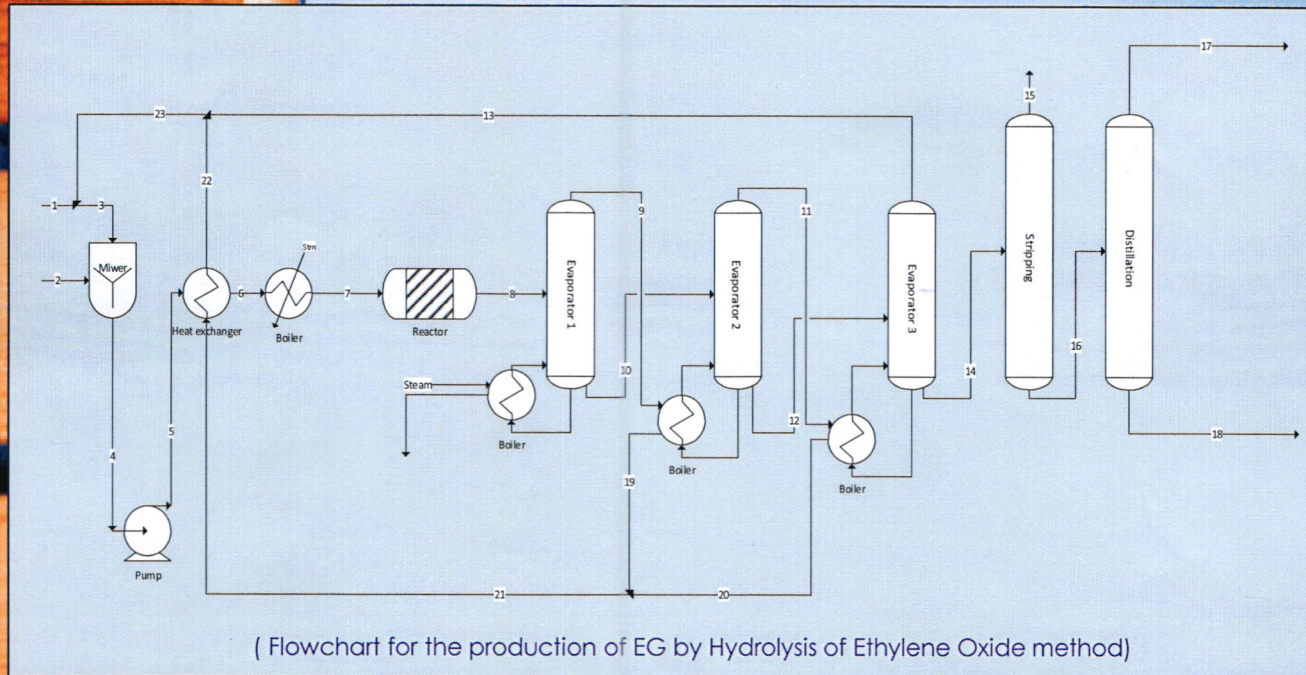
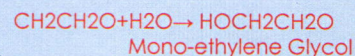
Uses of Ethylene glycol

- 1- Ethylene glycol is a perfect anti freezing agent in motor vehicles, solar energy units, heat pumps, water heating systems.
- 2- Ethylene glycol is also used in the production of some vaccines but it is not itself present in these injections. It is used as a minor (1–2%) ingredient in shoe polish and in some inks and dyes.
- 3- Ethylene glycols are used as a reactant in the manufacture of polyester resins.
- 4- Ethylene glycols including mono ethylene glycol (MEG), diethylene glycol (DEG), and tri-ethylene glycol (TEG) are versatile chemical intermediates used to produce a variety of products for commercial and industrial use, for example: Adhesives and coatings.

Production Methods

- 1- Hydrolysis of Ethylene Oxide
- 2- DuPont formaldehyde process.
- 3- Halcon Acetoxylatin Process.
- 4- Union Carbide Syngas Process.
- 5- Union Carbide-Ube Syngas Process.
- 6- Ethylene carbonate process.

Process Selection:
Hydrolysis of Ethylene Oxide



References

- 1- Encyclopedia of chemical processing and design, volume 21, edited by John J. Mcketta New York: Marcel Dekker, (1976).
- 2- Siegfried Rebsdatt; Dieter Mayer, "Ethylene Glycol", "Ullmann's Encyclopedia of Industrial Chemistry Weinheim: Wiley-VCH, (2005).
- 3- Kirk Othmer Encyclopedia of Chemical Technology (R), New York, Inter science Pub.
- 4- Jacqueline I. Kroschwitz (executive editor); Mary Howe-Grant (editor), Encyclopedia of Chemical Technology, 4th Edition, New York: Wiley, (1991).

Design by

Ahmed Haider
Haider Mohammed

Supervisor

Dr. Zaidoon M. Shakoor



University of Technology
Department of Chemical Engineering
Branch of oil and gas Refinery
Alkylation of Pentene C_5^+

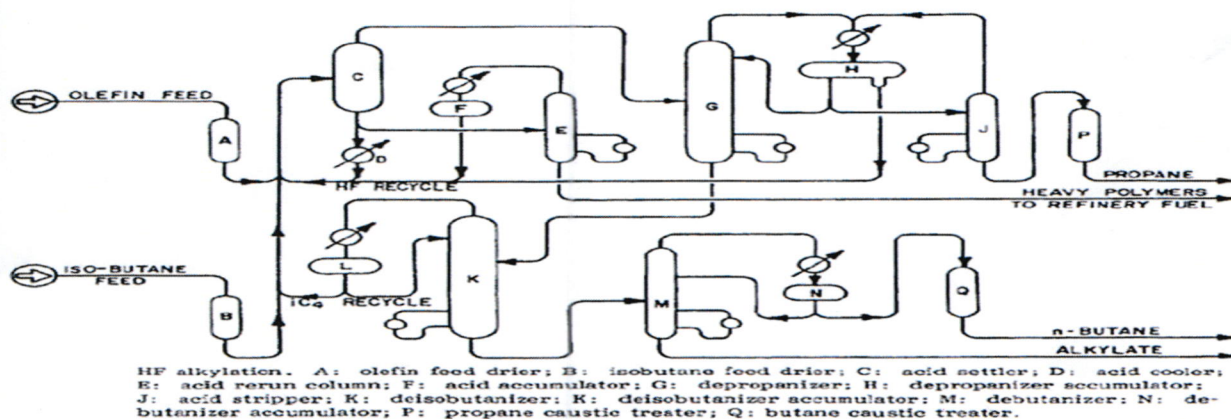


Figure 2 Phillips hydrofluoric acid alkylation unit.

Abstract:

The addition of an alkyl group to any compound is an alkylation, but in petroleum refining terminology. The term alkylation is used for the reaction of low molecular weight olefin with an isoparaffin to form higher-molecular weight isoparaffin. The processes of commercial importance involving low temperature alkylation are connected in the presence of either hydrofluoric acid or sulfuric acid as catalyst. The first process, using hydrofluoric acid, was selected for its many advantages. By proper choice of operation conditions, most of the product can be made to fall within the gasoline boiling range. This study is divided into four chapters. The first chapter presents introduction to the subject, i.e., alkylation reaction, catalyst, feed stocks and products, process variables, and process description. The second chapter includes methods of production. The third and fourth chapters cover material and energy balance respectively. The fifth chapter deals with equipment design, a condenser. The study is finalized with conclusions.



Methods of Alkylation of Pentene C_5^+

1. Alkylation on Solid Acids "zeolites"
2. Sulfuric Acid Alkylation
3. HF Alkylation.

Uses:

Alkylate is a key component in reformulated gasoline. Alkylation processes are becoming important due to growing demand for high octane gasoline and requirement of low RVP, low Sulphur, and low toxics. Alkylate is an ideal blend stock to meet these requirements. Alkylation of C_5^+ cut from FCC and significantly reduces RVP of finished gasoline pool. Cs alkylate: Maylene alkylation has two fold advantages: it increases the volume of alkylate available while decreasing Reid vapor pressure and olefin content of gasoline blend stocks.

Reference:

- 1- J.H. Gary & G.E. Handwerk petroleum Refinery, Marcel Dekker Inc N.Y. & Basel.
- 2- W.A. Gruse and D.R. Stevens "Chemical Technology of petroleum" 3rd. (Mc Graw-Hill book company, New York, 1960) pp. 153-163.
- 3- R.E. Payne, petrol, refiner 37(9), 316-329 (1958).
- 4- R.J. Hengstebeck, "petroleum processing" (Mc Graw-Hill book company, New York, 1984), pp. 27-63.
- 5- C.L. Thoms catalytic process and person catalysts (Mc Graw-Hill book company, New York, 1970), p.p 87-96.
- 6- Coulson & Richardson, Chemical Engineering, vol. 6.
- 7- Nelson, petroleum refinery Engineering Mc Graw-Hill Book Company.

Supervised by: Dr. Khalid Hamid Rasheed

Student: Mohammed Ali, Mohammed Aziz, Mustafa Khirallah





University of Technology
Chemical Engineering Department
Branch : oil and gas refinery



Project Name:-Drying Oil Production Process

Student Name

Mays Mufeed Majeed

Zainb Laith Thiab

Supervisor By

Dr-Salah Salman Ibrahim

Abstract

Drying oils are additives to paints and varnishes to aid in the drying process when these products are applied to surfaces. Drying oil is modeled as 1-tetradecane ($C_{14}H_{28}$).

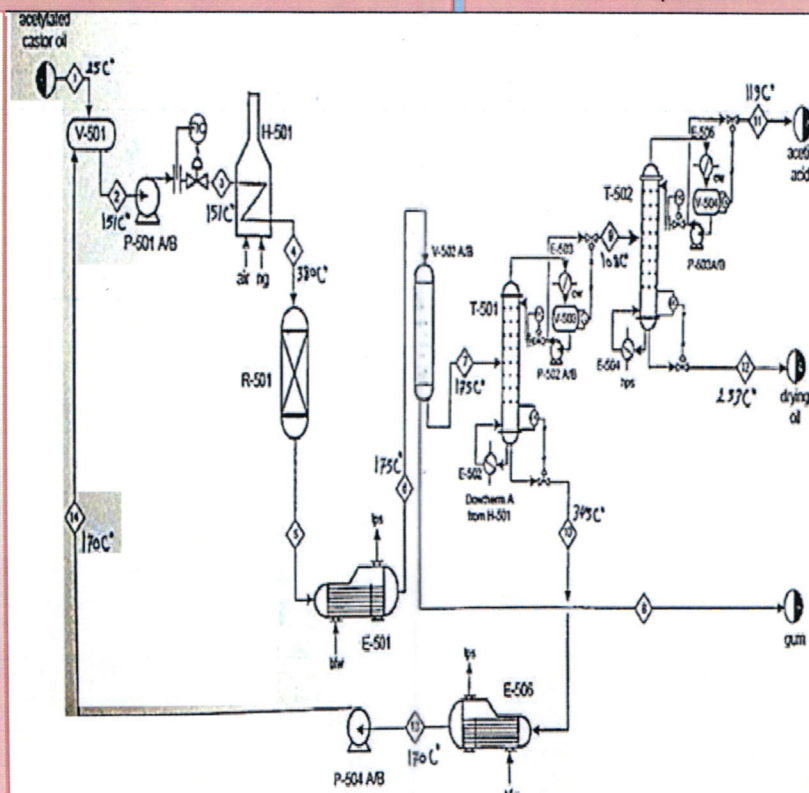
The goal of project is the facility manufactures drying oil(DO) from acetylated castor oil(ACO). Both of these compounds are mixtures. However, for simulation purposes, acetylated castor oil is modeled as palmitic (hexadecanoic) acid ($C_{15}H_{31}COOH$) and drying oil is modeled as 1-tetradecene ($C_{14}H_{28}$). In an undesired side reaction, a gum can be formed, which is modeled as 1-octacosene ($C_{28}H_{56}$)

Uses

These oils are added to some types of paint and coloring agents and dyes, and various as well as inks in all forms and types, as well as pastes industrial and coatings, and packaging and dyes varnish, dye shoes and leather fabrics, as well as add to the types of resins and polymeric plastic used to make surfaces and packaging and that of the most important benefits of using these oils are the work of layers and surfaces of thin and transparent and solid on different products for the purpose of preserving it from damage and distortions, humidity and dust. As well as achieving a speed of drought and durability and aesthetic quality of the surfaces and different products

Production method

Drying oil can be obtained by one industrial method from acetylated castor oil



References:

- 1- dol2-"Drying oil production" ch E455-Fall-2002-Major-1-(10/25/02) www.gg.uwyo.edu/content/lecture/energy/
- 2- Perry;"chemical Engineer's hand book";6th edu "pergamon press co.1986"
- 3- coulson and Richardson;"Chemical Engineering" vol6 "R.S.sinnott co.4th edu;1985"



University of Technology
Department of Chemical Engineering

Branch: Oil and Gas Refining

Design of plastic bottle recycling
(Poly Ethyethylene Terephthalate "PET")



The Student Name: 1- Kwakib Kadhim 2- Fatima Header 3- Lena Harach

Supervised by: Dr. Ruyadh Saddek

Abstract

The purpose of this project is to recycling piastic bottles (PET) by using available and inexpensive raw materials . The product capacity ; (1578.28 Kg/h)

This compound is an important industrial, and the most important uses are :(fibers, films, barrier film, soft drying bottles).

Although presence of several methods used for production, but this compound is produce mainly in such process (PET- Recycling Unit). And using the following raw materials (PET used as raw materials). This material gas been prepared first time in American households in 1970 –and the importance of this material gradually increased after entering in many application.

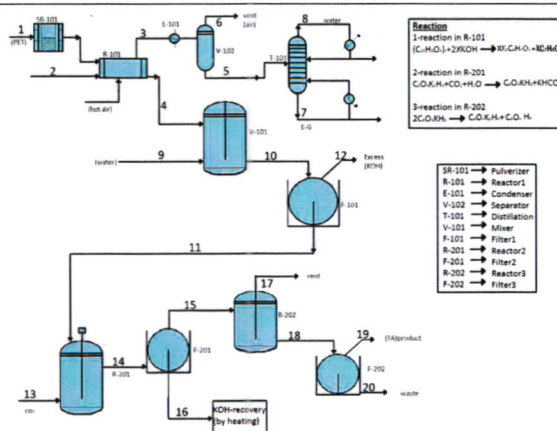
Uses of PET

PET is used as a raw material for making packaging materials such as bottles and containers for packaging a wide range of food products and other consumer goods. Examples include soft drinks, alcoholic beverages, detergents, cosmetics, pharmaceutical products and edible oils. PET is one of the most common consumer plastics used. Polyethylene terephthalate also can be used as main material in making paper.

Production methods

1- Mitsubishi Process (MHI)

2- Polyethylene Terephthalate Recycling Facility



Reference:

- 1- Pet bottle recycling – Wikipedia, the free encyclopedia polyethylera terephalate- Wikipedia, the free encyclopedia www.en.wikipedia.org/wiki/PET
- 2- www.dx.doi.org/recyclability/Ethylera_terephthalate.
- 3- Pet-pdyethylena terephthalate Relycling facility www.napcor.com/report.html
- 4- Development of chemical Recycling process for post-consumer PET Bottles by mathonolysis in supercritical methanol. www.mitsubishi_haery_industries.technical_review_vol40/2003.jan/.



University of Technology

Chemical Engineering Department



Branch: oil & gas refinery Engineering

The Students Name: Sirin Balasim & Tabarek Abd-Alhussin

The Name of Supervisor: Talib mohamed

Toluene Production

Abstract of Project:

The purpose of this project is to produce (Toluene) by using available and inexpensive raw materials. the product capacity; 130000 ton/year.

This compound is an important industrial material, and the most important uses are: (to produce benzene and xylene as solvents and used for an action booster in gasoline, and also used for paints. Although presence of several methods used for production, but this compound is produced mainly in such process (catalytic reforming and BTX) and using the following raw materials (Naphtha and BTX)

This material has been prepared first time in 1837 and the importance of this material gradually increased after entering in many applications.

Uses:

1. The largest use for toluene is in the production of benzene.
2. Toluene is a common solvent
3. Toluene is used as an octane booster or enhancer gasoline
4. The fourth ranked application involves its disproportionation a mixture of benzene and xylene. When oxidized it yields benzaldehyde and benzoic acid, two intermediates in chemistry.

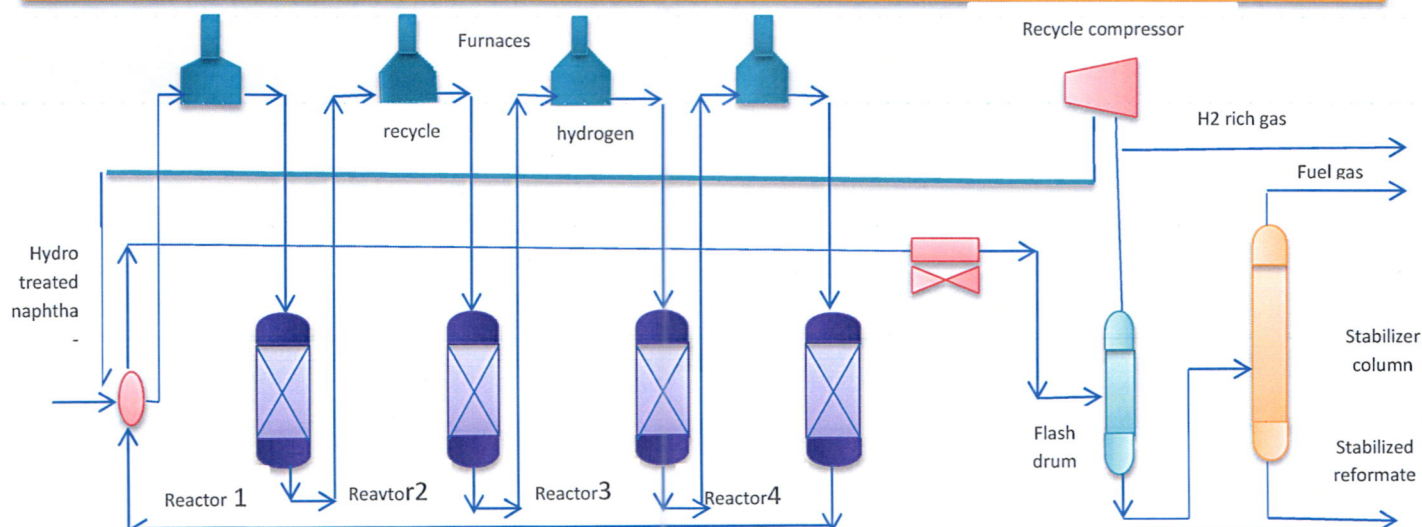
Production Methods

1. Toluene from petroleum fraction

1.1. Hydro treating 1.2. Catalytic reforming 1.3. Secondary hydrogenation

2. Toluene production from coal

3. Toluene production from styrene (Main the method of catalytic reforming)



Reference

1. Toluene-wikipedia, the free encyclopedia www.en.wikipedia.org/wiki/toluene
2. Faith, Keys; "Industrial chemicals"; 4th ed; 1976 McGraw Hill Co.
3. Data and information from "Aldaura refinery"



University of Technology

Chemical Engineering



Branch: oil and gas refining

The Project Name:

Production of Sodium Benzoate

The Students Name: Mostafa Hamid Abbas & Adwaa Hamid Abbas

The Name of Supervisor : Dr.Riyadh S-ALMuktar

Abstract of Project:

The purpose of this project is to produce (sodium benzoate) by using available and inexpensive raw materials. The product capacity: 75 ton/year. This compound is an important industrial material, and the most important uses are: (is most widely used in acidic foods such as salad dressings (vinegar) carbonated drinks, used as preservative in medicines and cosmetic, used in industry in paper, sodium benzoate has found considerable application as a corrosion inhibitor). Although presence of several methods used for production, but this compound is produced mainly in such process (reaction between the benzoic acid solution and sodium hydroxide solution) and using the following raw materials (benzoic acid and sodium hydroxide).

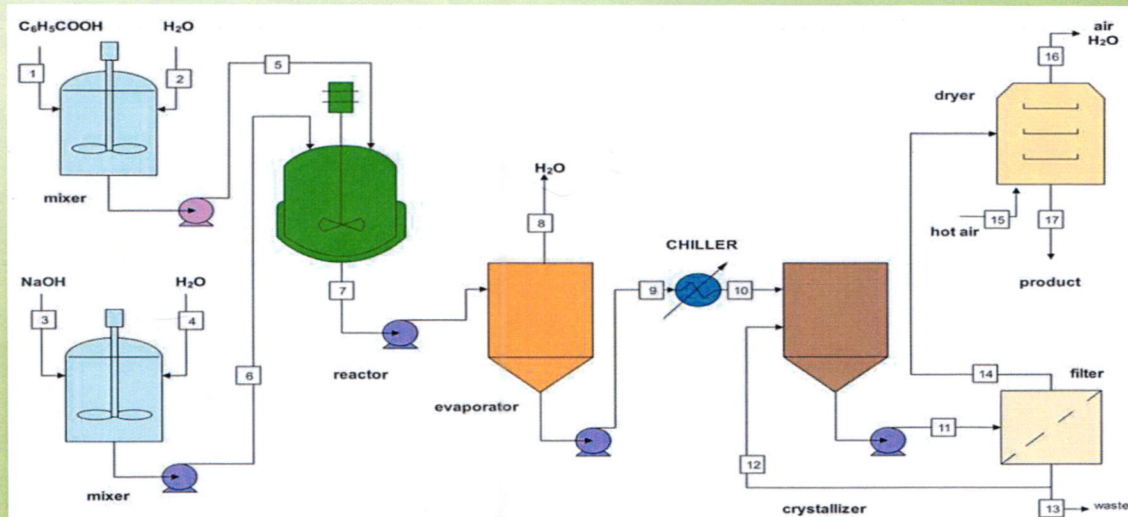
Uses:

Sodium benzoate is most widely used in acidic foods such as salad dressings (vinegar) carbonated drinks, and used as preservative in medicines and cosmetic, used as a treatment for urea cycle disorders due to its ability to bind amino acids, sodium benzoate has found considerable application as a corrosion inhibitor, used in industry in paper, and used extensively in pharmaceutical preparation, used to treat hyper ammonia. **Sodium benzoate is used in fireworks and serves as fuel to the whistle mixture; it is the powder responsible for the whistling noise when ignited**

Production Methods:

1-reaction between the benzoic acid solution and sodium hydroxide solution. 2-method of direct oxidation of toluene in the sodium hydroxide solution. 3-the addition of water to the benzoic esters.

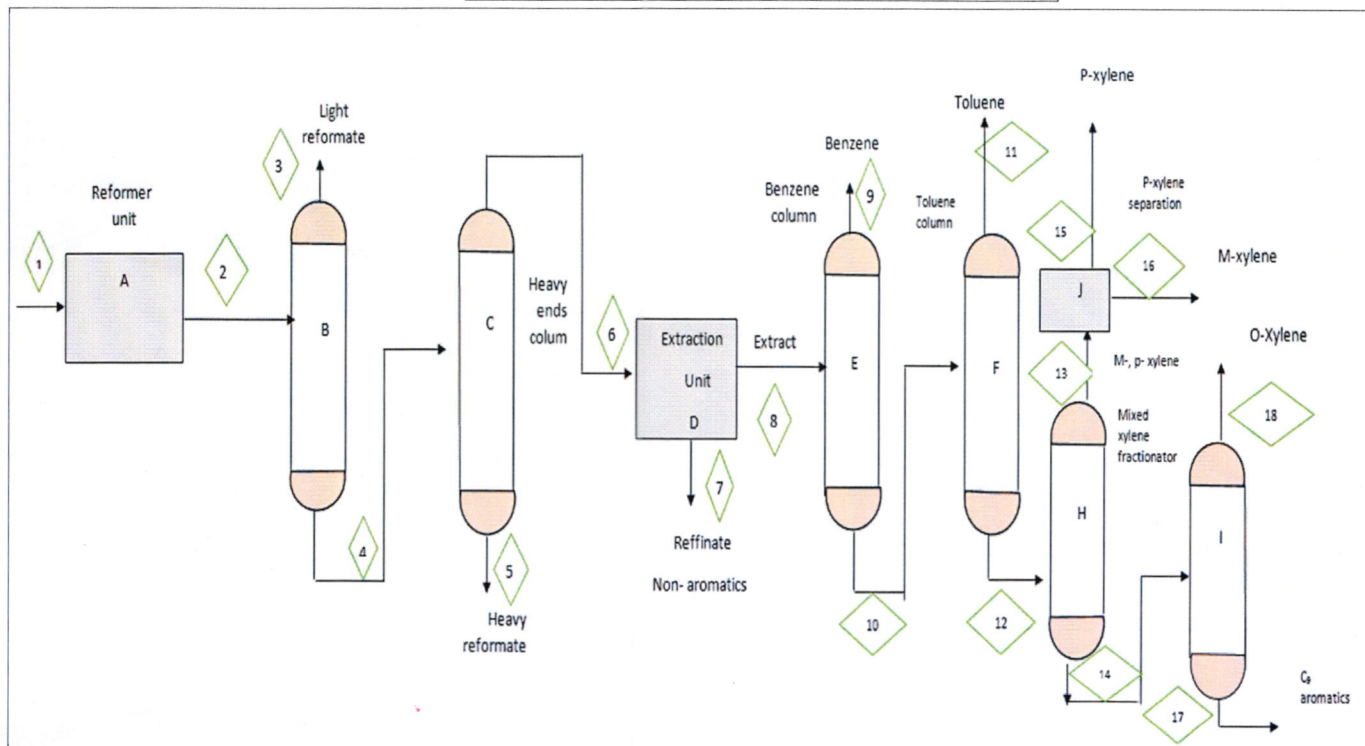
Plot the desired Flow sheet:



Reference: 1-sodium benzoate -wikipedia, the free encyclopedia. 2-<http://doc.ccc-group.com/spec/80090.pdf>. 3-kirk-othmer, encyclopedia of chemical engineers hand book, 7th edition, mc graw-hill, newyork (1997)



Production of xylene



Abstract:

Xylene is an aromatic hydrocarbon mixture consisting of benzene ring with two methyl groups at various substituted positions.

•xylene is

•the three xylene isomers are o- xylene, m-xylene, para-xylene which differ in the position of two methyl groups on the ring

•chemical formula C₈H₁₀

• The goal of this project is to construct a plant to produce: to product xylene with capacity 317000 ton/year .the plant contain: reformer unit, distillation, extraction, separation

Uses:

- 1- Xylene used as antiknock agents in gasoline and as an intermediate in synthetic reaction
- 2- used as the solvent in chemical industry for chemical and petrochemical
- 3- to product compounds: terephthalic acid, dimethyl, terephthalate
- 4-to synthesize plasticizers and polyester fibers, photographic films
- 5-in product of polymer
- 4-to synthesize plasticizers and polyester fibers, photographic films
- 5-in product of polymer

Production Methods:

1- Catalytic Reforming,^(a) Besides the nature of the raw materials, process engineering parameters also significantly determine the composition of the reformate and its content of C₈ aromatics . The design of the catalytic reformer, its mode of operation, and the catalyst used are also very important

2- Separation of the C₈ Aromatics Fraction^(b) :- The reformates used to produce C₈ aromatics can be processed such that C₈ and heavier aromatics are produced in the following approximate proportions:

Benzene
P-Xylene
O-Xylene
C₉+ aromatics

Besides the aromatics, naphtha fractions and gaseous products (hydrogen, fuel gases, etc.) are formed. This optimized result involves the following operations:

- 1) Toluene is dealkylated to benzene.
- 2) m-Xylene is isomerized to o- and p-xylenes.
- 3) Ethylbenzene is transalkylated to xylenes.

If the toluene is subjected to **transalkylation** instead of thermal **dealkylation**, the yield of xylenes can be further increased at the expense of benzene. The structure of a modern aromatics complex, which produces o- and p-xylene in the highest possible yield, is based on a combination of a series of these processes. The ethylbenzene is mainly converted to xylenes because obtaining ethylbenzene from reformate is energy intensive. The main source of ethylbenzene, which is almost exclusively dehydrogenated to styrene, is therefore now the more economical alkylation of benzene with ethylene. Distillative removal of ethylbenzene, which for styrene production must be toluene-free, from reformates can take place after removal of Toluene from the sump of the toluene column.

Reference

- 1-Xylene –Introduction &production of xylene
"www.teach – material .com/making- supplies"
- 2- Xylene – Wikipedia; the free encyclopedia
"www.en.wikipedia. Org /wiki/xylene."
- 3- Ullmans; encyclopedia of chemical industries
"2005 wiley – vch.verlag GmbH&co.kGaA, weinheim; 4th edn "
- 4-kirk-othmer; encyclopedia of chemical technology
"4th end; john willey and son co.2004"
- 5-coulson and Richardson; chemical engineering "vol 6 R.s.sinnott.co; 4th edn; 1985"
- 6- Perry; chemical engineer "hand book" 6th end program press co.1986
- 7-data from "Al- Dora refinery
"www.Mrc.oil gor.lg/ company – Dora –refinery

By: sally muwaffaq - saja hathim

Supervisor: Dr. Talib Mohammed



University of Technology

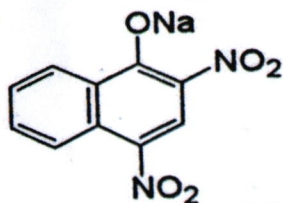
Department of Chemical Engineering

Branch of Oil & Gas Refinery

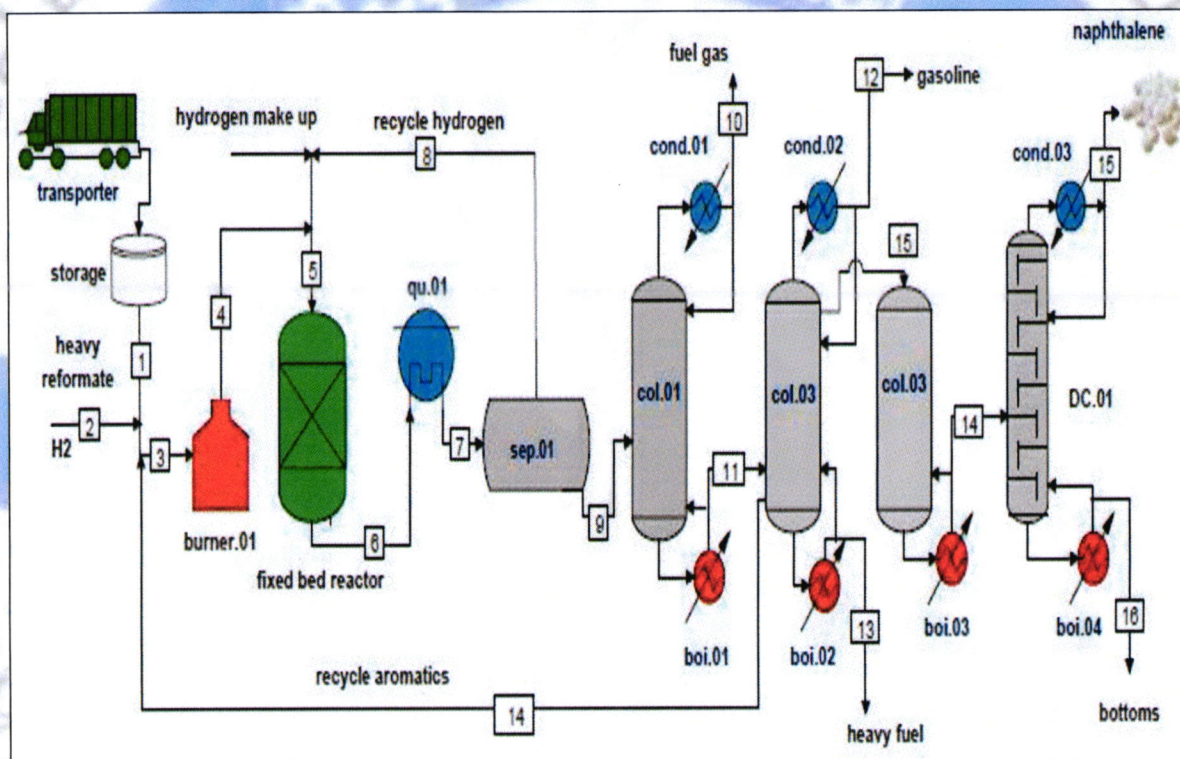


Abstract

Naphthalene was first isolated from coal tar in 1819 by Alexander Garden; it represents about 10% of this complex mixture of aromatics. The industrial importance of naphthalene dates from the latter half of the last century, owing mainly to the ease with which it can be converted into sulfonic acids and thence also to the naphthols, for use as dyestuffs intermediates. However, the first synthetic naphthalene-based dye was a nitro-derivative, Martius Yellow (Acid Yellow24), which was patented in 1864 by Carl Alexander Martius.



Project for Production of Naphthalene from petroleum



Uses of Naphthalene

1. As a chemical intermediate

Naphthalene is used mainly as a precursor to other chemicals.

2. As a solvent for chemical

Molten naphthalene provides an excellent solubilizing medium for poorly soluble aromatic compounds.

3. Wetting agent and surfactant

Alkyl naphthalene sulfonates (ANS) are used in many industrial applications as nondetergent wetting agents.

4. As a fumigant

Naphthalene has been used as a household fumigant. It was once the primary ingredient in mothballs

Students Name

- Mustafa Thammar
- Wissam Hassan

Supervised By

• Lec. Basheer Ahmed

References

- Kirk Othmer Encyclopedia of Chemical Technology (R), New York, Interscience Pub
- Ullmann's Encyclopedia of Industrial chemistry
- Chemical Engineering, Volume 6, Third Edition, "Chemical Engineering Design" R.K. Sinnott

Production Methods

- Manufacturing of Naphthalene from coal tar
- Manufacturing of Naphthalene from petroleum



University of Technology
Chemical Engineering Department



Branch : gas and oil Refinery

The Project Name
Extraction of BTX from catalytic reformat

The Students Name: Ahmed Radhi Adnan
Ahmed Abdulkadhim Kraidi

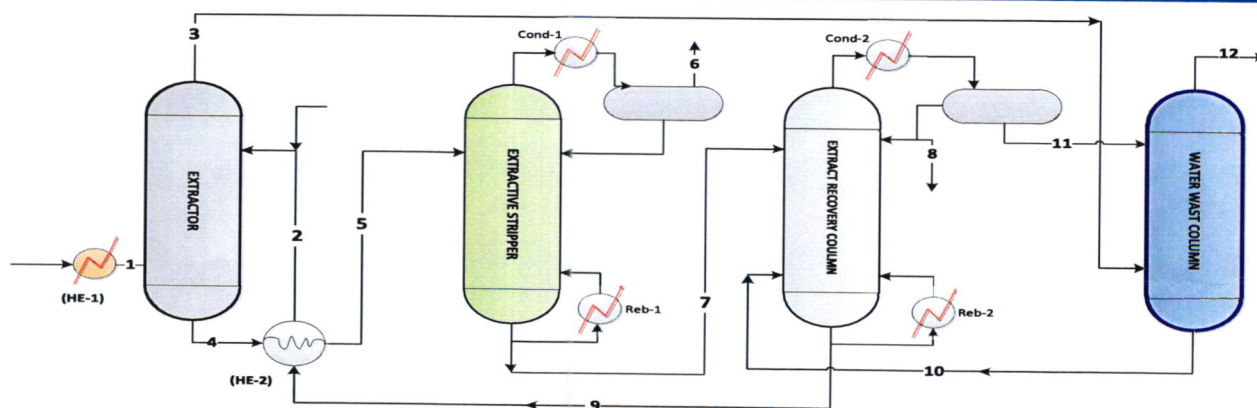
The Name of Supervisor: Dr. Iman Jawad Taha

Abstract of Project: You work in a facility that produces about 637.667 ton/day of reformat which is produced from catalytic reforming of naphtha that is contains on paraffins, BTX and heavy aromatic. BTX are extracted from reformat by sulfolane process .

In this process uses sulfolane ($C_4H_8SO_2$) As solvent where consisting two layers (raffinate & extract) in extraction column. BTX are separated from extract layer in distillation column whereas the solvent is recycled back to the extractor.

Uses: benzene as a source for the production of many petrochemicals and hydrocarbon materials. Other chemicals derived from benzene are styrene, phenol, and cyclohexane About 85-90% of toluene produced annually is blended directly into the gasoline pool as a component of reformat and of pyrolysis gasoline. The remainder is blended into gasoline to increase octane number of premium fuels The majority of xylenes, which are mostly produced by catalytic reforming or petroleum fractions, are used in motor gasoline

Production Methods: 1- Sulfolane Process
2-Morphylan process 3- hybrid process



Reference:

coulson and richardson; "chemical engineering" vol6-R.S.sinnott co. ;4th edu,1985
perry; "chemical engineer's handbook"; 6th edu – pergamon press co .1986



University of technology

Department of Chemical engineering

Branch : Refinery of Gas & Oil



Name of project :

Production of ethanolamine

Name of supervisor : Tagreed Lutfy

Students names: Ayat Hussain , Baraa Najah , Hajar thaer

Abstract

The purpose of this project is to product 'Ethanolamine' by using available and inexpensive raw materials.

The product capacity: 10000 ton/year

This compound is an important industrial material, and the most important uses are: (Surfactants, Corrosion Inhibitors, Gas purification).

Although presence of several methods used for production, but this compound is produced mainly in such process: Production from aqueous ammonia and using the following raw material: (Ethylene oxide, NH_3 , H_2O).

This material has been prepared first time in 1860 by 'Wurtz'.

And the importance of this material gradually increased after entering in many applications.

Uses

1. Surfactants
2. Corrosion inhibitors
3. Gas purification (gas treating)
4. Intermediates
5. Cosmetics
6. Other uses :
 - a) Cement
 - b) Pharmaceuticals
 - c) Printing inks
 - d) Textiles and textile additives
 - e) Wood treating

Production

1. Ethanol amines from aqueous ammonia
2. Ethanol amines from anhydrous ammonia.

References

1. Ethanolamine's: A Techno-commercial profile. www.clamical weekly-August 24, 2004-product focus
3. Ethanolamine-Wikipedia, The free encyclopedia; 8/21/2015. www.en.wikipedia.org/wiki/Ethanolamine's
5. Ullmann-Encyclopedia of industrial-chemistry; Ethanolamine's. 2005 Wiley-VCH Verlag GmbH & CO. KGaA, Weinheim; 4th edn
6. Kirk-othnary- Encyclopedia of chemical technology; Ethanolamine's. 4th edn; joh willey and son CO. 5th edn

