

Production of Maleic Anhydride

Background

Maleic anhydride is a versatile chemical intermediate used to make unsaturated polyester resins, lube oil additives, alkyd resins, and a variety of other products. In 1995, global production of maleic anhydride was estimated at 1.8 billion pounds, with an estimated value of \$700 million. Over the last five years, world consumption has increased at an average annual rate of 5.8%, with the fastest growth occurring in Asia, where it is used as an intermediate for production of 1,4-butanediol [1]. The goal of this project is to design a grass roots facility that is capable of producing 40 million pounds of maleic anhydride per year from n-butane.

Process Description

For the overall process. Pure butane, Stream 2, and compressed air, Stream 3, are mixed and fed to PFR, an adiabatic reactor, where butane reacts with oxygen to form maleic anhydride. The reaction is exothermic, therefore, one could consider either a PFR or a packed bed reactor with heat removal to stay close to isothermal. The reactor effluent is cooled and sent to an absorber, where it is contacted with water, Stream 7, to remove the light gases and all of the maleic anhydride reacts to form maleic acid. The vapor effluent, which consists of non-condensables, Stream 8, must be sent to an after-burner to remove any carbon monoxide prior to venting to the atmosphere. This is not shown here. The liquid effluent, Stream 9, is then cooled and sent to CSTR at 101 kPa and 120°C. The vapor effluent from CSTR Stream 11, is sent to waste treatment. Stream 12, the liquid

effluent, is sent to CSTR where maleic acid is broken down to maleic anhydride and water. The reactor effluent is then sent to distillation column, where maleic anhydride and water are separated. The distillate, Stream 14, is sent to waste treatment. Stream 15, the bottoms, consists of 99.99-wt.% maleic anhydride.

Results-

In PFR we get 100% conversion of butane and 41% conversion of oxygen.

In first CSTR we get 99.99% conversion of maleic anhydride into maleic acid.

In second CSTR we get 99.99% conversion of maleic acid into maleic anhydride.

Finally we get 99.99 % pure distillate of maleic anhydride in stream 15.

References

1. <http://www-cmrc.sri.com/CIN/JulyAugust96/Article08.html>
2. Slindard, W., A. Baylis, U.S. Patent # 4,052,417 "Vapor Phase Oxidation of Butane Producing Maleic Anhydride and Acetic Acid."

