

Description

The present invention relates to the production of hydrogen peroxide by the oxidation of methyl benzyl alcohol.

Description of the Prior Art

Hydrogen peroxide is an important chemical of commerce which is produced in very large quantities for use in a number of industrial applications. The predominant process used commercially for the production of hydrogen peroxide involves the oxidation of anthrahydroquinone, extraction of hydrogen peroxide and reduction of the resulting anthraquinone to anthrahydroquinone which is reused. This process requires very high capital expenditures in that use of a working solvent with efficient recycle of various process components is a necessity.

Substantial efforts have been directed to processes which involve direct combination of hydrogen and oxygen but thus far such processes have not found widespread success.

Hydrogen peroxide has been formed by the oxidation of secondary alcohols. At one time the production of hydrogen peroxide by oxidation of isopropanol was practiced commercially. Other secondary alcohols which have been mentioned as possible starting materials for hydrogen peroxide production include methyl benzyl alcohol and cyclohexanol. See, for example, U.S. Patents 2,871,102-4 of Shell Development.

Hydrogen peroxide has also been formed by oxidation of very high boiling secondary alcohols such as diaryl methanol, the product hydrogen peroxide being stripped from the reaction mixture during oxidation; see U.S. Patent 4,303,632.

In certain commercial technologies, there are produced substantial quantities of various secondary alcohols. For example, in the coproduction of propylene oxide and styrene monomer by hydroperoxide epoxidation, methyl benzyl alcohol is formed and ultimately converted by dehydration to styrene monomer. See U.S. Patent 3,351,635.

The present invention provides a process where commercial streams containing methyl benzyl alcohol can be employed effectively and efficiently for hydrogen peroxide production.

Summary of the Invention

In accordance with the present invention there is provided an improved process for the production of hydrogen peroxide by oxidation of methyl benzyl alcohol. In particular, the process of this invention involves the production of hydrogen peroxide by molecular oxygen oxidation of methyl benzyl alcohol in the liquid phase wherein the concentration of water in the

liquid reaction mixture is maintained below 4% by weight, preferably below 2% by weight, and most preferably below 1% by weight of the reaction mixture. Acetophenone is a coproduct.

Brief Description of the Drawing

The accompanying drawing illustrates in schematic form a suitable embodiment of the invention.

Detailed Description of the Invention

In accordance with the teachings of the prior art, the oxidation of secondary alcohols to produce hydrogen peroxide has been carried out either with water being added to the alcohol feed and/or under conditions of reflux whereby condensibles including water were returned to the reaction mixture and allowed to build up in concentration therein. See U.S. Patent 2,871,104 to Rust.

The surprising discovery has now been made, however, that, unlike other systems, in the oxidation of methyl benzyl alcohol to produce hydrogen peroxide and acetophenone, the presence of even low concentrations of water in the reaction mixture has a profound and adverse effect on the oxidation reaction. In fact, it has been found that the desired oxidation of methyl benzyl alcohol essentially ceases if the water content of the reaction mixture is permitted to rise to certain levels.

In accordance with the present invention, methyl benzyl alcohol is oxidized in the liquid phase with molecular oxygen at elevated temperatures and pressure with the concentration of water in the reaction mixture maintained below 4% by weight, preferably below 2% by weight, and most preferably below 1% by weight. In this way high reaction rates and selectivities to hydrogen peroxide can be achieved.

In an especially preferred embodiment of the invention, hydrogen peroxide production can be integrated with the production of propylene oxide and styrene monomer by epoxidation with ethyl benzene hydroperoxide. In this embodiment, feed to the methyl benzyl alcohol oxidation comprises a methyl benzyl alcohol/acetophenone process stream from the propylene oxide and styrene monomer process as will be hereinafter described.

The oxidant which is used in the present invention is molecular oxygen. Air is a convenient source of the oxygen although pure oxygen, oxygen-enriched air, oxygen diluted with various inerts such as argon, carbon dioxide, and the like can also be used.

The conditions of temperature and pressure are such as to maintain the reaction mixture in the liquid phase. Elevated temperatures ranging from about 100-250°C, preferably 120-180°C are employed to achieve reasonable reaction rates.

It is important to provide substantial partial pres-

benzene stream in amount of 230.6 parts is recovered in line 130, and recycled, to H₂O₂ extraction 119 and ethyl benzene back extraction 124. About 3.1 parts water is also removed (not shown) in Unit 128. The bottoms stream 129 is about 204.5 parts, comprised of 59% methyl benzyl alcohol, and 41% acetophenone.

The combined streams in lines 110 and 129 in amount of 500 parts and comprised of 74% methyl benzyl alcohol, and 26% acetophenone is dehydrated in zone 112. About 95% conversion of methyl benzyl alcohol to styrene is experienced in 112, resulting in a product stream in line 131 of 500 parts comprised of 4% methyl benzyl alcohol, 26% acetophenone, 60% styrene, and 10% water. Styrene separation unit 132 separates 300 parts styrene in line 133 and 51 parts water (not shown). The other product exits line 134 and is 149 parts, comprised of 12% methyl benzyl alcohol, and 88% acetophenone. This is diluted with 163.5 parts ethyl benzene in line 137 and sent to acetophenone hydrogenation unit 135.

About 90% of the acetophenone fed to hydrogenation is converted by reaction with 2.1 parts hydrogen from line 136. The product stream in amount of 314.5 parts, is recycled back to propylene oxide/styrene monomer refining section 103, and is comprised of 52% ethyl benzene, 43% methyl benzyl alcohol, and 5% acetophenone.

The compound referred to throughout this specification as methyl benzyl alcohol is sometimes otherwise known as 1-phenyl ethanol, α -phenyl ethanol or methyl phenyl carbinol.

Claims

1. A process for the production of hydrogen peroxide by reacting methyl benzyl alcohol with molecular oxygen in the liquid phase characterised in that the concentration of water in the liquid phase is maintained below 4% by weight during the reaction.
2. A process according to claim 1 wherein the concentration of water in the liquid phase is maintained below 2% by weight during the reaction.
3. A process according to claim 1 wherein the concentration of water in the liquid phase is maintained below 1% by weight during the reaction.

Patentansprüche

1. Verfahren zur Herstellung von Wasserstoffperoxid durch die Umsetzung von Methylbenzylalkohol mit molekularem Sauerstoff in flüssiger Phase, dadurch gekennzeichnet, daß die Wasser-

konzentration in der flüssigen Phase während der Umsetzung unter 4 Gew.% gehalten wird.

2. Verfahren nach Anspruch 1, bei dem die Wasserkonzentration in der flüssigen Phase während der Umsetzung unter 2 Gew.% gehalten wird.
3. Verfahren nach Anspruch 1, bei dem die Wasserkonzentration in der flüssigen Phase während der Umsetzung unter 1 Gew.% gehalten wird.

Revendications

1. Procédé pour la production d'eau oxygénée par la réaction d'alcool méthyl benzylique avec de l'oxygène moléculaire en phase liquide, caractérisé en ce que la concentration de l'eau dans la phase liquide est maintenue en-dessous de 4% en poids pendant la réaction.
2. Procédé suivant la revendication 1, dans lequel la concentration d'eau dans la phase liquide est maintenue en-dessous de 2% en poids pendant la réaction.
3. Procédé suivant la revendication 1, dans lequel la concentration d'eau dans la phase liquide est maintenue en-dessous de 1% en poids pendant la réaction.



benzene stream in amount of 230.6 parts is recovered in line 130, and recycled, to H₂O₂ extraction 119 and ethyl benzene back extraction 124. About 3.1 parts water is also removed (not shown) in Unit 128. The bottoms stream 129 is about 204.5 parts, comprised of 59% methyl benzyl alcohol, and 41% acetophenone.

The combined streams in lines 110 and 129 in amount of 500 parts and comprised of 74% methyl benzyl alcohol, and 26% acetophenone is dehydrated in zone 112. About 95% conversion of methyl benzyl alcohol to styrene is experienced in 112, resulting in a product stream in line 131 of 500 parts comprised of 4% methyl benzyl alcohol, 26% acetophenone, 60% styrene, and 10% water. Styrene separation unit 132 separates 300 parts styrene in line 133 and 51 parts water (not shown). The other product exits line 134 and is 149 parts, comprised of 12% methyl benzyl alcohol, and 88% acetophenone. This is diluted with 163.5 parts ethyl benzene in line 137 and sent to acetophenone hydrogenation unit 135.

About 90% of the acetophenone fed to hydrogenation is converted by reaction with 2.1 parts hydrogen from line 136. The product stream in amount of 314.5 parts, is recycled back to propylene oxide/styrene monomer refining section 103, and is comprised of 52% ethyl benzene, 43% methyl benzyl alcohol, and 5% acetophenone.

The compound referred to throughout this specification as methyl benzyl alcohol is sometimes otherwise known as 1-phenyl ethanol, α -phenyl ethanol or methyl phenyl carbinol.

Claims

1. A process for the production of hydrogen peroxide by reacting methyl benzyl alcohol with molecular oxygen in the liquid phase characterised in that the concentration of water in the liquid phase is maintained below 4% by weight during the reaction.
2. A process according to claim 1 wherein the concentration of water in the liquid phase is maintained below 2% by weight during the reaction.
3. A process according to claim 1 wherein the concentration of water in the liquid phase is maintained below 1% by weight during the reaction.

Patentansprüche

1. Verfahren zur Herstellung von Wasserstoffperoxid durch die Umsetzung von Methylbenzylalkohol mit molekularem Sauerstoff in flüssiger Phase, dadurch gekennzeichnet, daß die Wasser-

konzentration in der flüssigen Phase während der Umsetzung unter 4 Gew.% gehalten wird.

2. Verfahren nach Anspruch 1, bei dem die Wasserkonzentration in der flüssigen Phase während der Umsetzung unter 2 Gew.% gehalten wird.
3. Verfahren nach Anspruch 1, bei dem die Wasserkonzentration in der flüssigen Phase während der Umsetzung unter 1 Gew.% gehalten wird.

Revendications

1. Procédé pour la production d'eau oxygénée par la réaction d'alcool méthyl benzylique avec de l'oxygène moléculaire en phase liquide, caractérisé en ce que la concentration de l'eau dans la phase liquide est maintenue en-dessous de 4% en poids pendant la réaction.
2. Procédé suivant la revendication 1, dans lequel la concentration d'eau dans la phase liquide est maintenue en-dessous de 2% en poids pendant la réaction.
3. Procédé suivant la revendication 1, dans lequel la concentration d'eau dans la phase liquide est maintenue en-dessous de 1% en poids pendant la réaction.