HYDROALKYLATION PROCESS

PRIORITY CLAIM

[0001] This application claims priority to U.S. Provisional Application Serial No. 61/603,510 filed February 27, 2012 and European Application No. 12162355.7 filed March 30, 2012.~~, the disclosures of which are fully incorporated herein by their reference.~~

FIELD

[0002] The present invention relates to a hydroalkylation process useful for making phenol.

BACKGROUND

[0003] Phenol is an important product in the chemical industry and is useful in, for example, the production of phenolic resins, bisphenol A, ε-caprolactam, adipic acid, and plasticizers.

[0004] Currently, the most common route for the production of phenol is the Hock process via cumene. This is a three-step process in which the first step involves alkylation of benzene with propylene in the presence of an acidic catalyst to produce cumene. The second step is oxidation, preferably aerobic oxidation, of the cumene to the corresponding cumene hydroperoxide. The third step is the cleavage of the cumene hydroperoxide generally in the presence of a sulfuric acid catalyst into equimolar amounts of phenol and acetone.

[0005] It is also known that phenol and cyclohexanone can be co-produced by a process in which cyclohexylbenzene is oxidized to obtain cyclohexylbenzene hydroperoxide and the hydroperoxide is decomposed in the presence of an acid catalyst to the desired phenol and cyclohexanone. Although various methods are available for the production of cyclohexylbenzene, a preferred route is disclosed in U.S. Patent No. 6,037,513, in which the cyclohexylbenzene is produced by hydroalkylating benzene in the presence of a bifunctional catalyst comprising a molecular sieve of the MCM-22 family and at least one hydrogenation metal selected from palladium, ruthenium, nickel, cobalt and mixtures thereof. The '513 patent also discloses that the resultant cyclohexylbenzene can be oxidized to the corresponding hydroperoxide and then decomposed to the desired phenol and cyclohexanone co-product.

[0006] Although the process of the '513 patent is very selective in the conversion of benzene to cyclohexylbenzene, one inevitable by-product of the process is cyclohexane resulting from competing hydrogenation of the benzene feed and the cyclohexene intermediate. Not only does the cyclohexane by-product represent a significant loss of