CLAIMS

1. A process for epoxidizing 1,4 isoprene moieties of halobutyl rubber comprising unsaturated allylic halide moieties and unsaturated 1,4-isoprene moities, the process comprising reacting an unsaturated halobutyl rubber with hydrogen peroxide in the presence of a polymer support having a sulfonic acid group, to epoxidize only the unsaturated 1,4-isoprene moieties of the halobutyl rubber without affecting the allylic halide moieties of the halobutyl rubber to produce epoxidized halobutyl rubber comprising allylic halide groups and oxirane functional groups in the polymer backbone.

2. The process according to claim 1, wherein:
the unsaturated halobutyl rubber is in an organic phase,
both the hydrogen peroxide and the polymer support are together in an aqueous phase, and
the reacting comprises mixing the organic phase and the aqueous phase for reaction of the unsaturated halobutyl rubber with the hydrogen peroxide in the presence of the polymer support.

3. The process according to claim 1, wherein the organic phase comprises at least one solvent selected from aliphatic hydrocarbon, cyclic hydrocarbon, alicyclic hydrocarbon, aromatic hydrocarbon, halo derivatives of aliphatic, cyclic, alicyclic or aromatic hydrocarbons, ethers, glycol ethers, alkyl esters and combinations thereof.

4. The process according to claim 1, wherein the polymer support is a styrene polymer.

5. The process according to claim 1, wherein the polymer support is a styrene-divinylbenzene copolymer.

6. The process according to claim 1, wherein the polymer support is a fluorocarbon resin.

7. The process according to claim 1, wherein the process is carried out at a temperature of about 25° C. to about 100° C.

8. The process according to claim 1, wherein the process comprises reacting the unsaturated halobutyl rubber with about 1 to about 50 molar equivalents of hydrogen peroxide relative to the number of the double bonds of the unsaturated polymer to be epoxidized.

9. The process according to claim 1, wherein the process comprises reacting the unsaturated halobutyl rubber with hydrogen peroxide in the presence of a polymer support having about 0.00001

to 15 molar equivalents of the sulfonic acid groups relative to the number of the double bonds of the unsaturated polymer to be epoxidized.

10. The process according to claim 1, further comprising pretreating the unsaturated halobutyl rubber to remove foreign materials prior to reacting the unsaturated halobutyl rubber with the hydrogen peroxide and the sulfonic acid group.

11. The process according to claim 10, wherein the pretreating comprises centrifugation.

12. The process according to claim 2, further comprising separating the organic phase and the aqueous phase.

13. The process according to claim 12, further comprising washing the organic phase with an alkaline solution to maintain the pH in an alkaline region.

14. The process according to claim 13, further comprising removing organic solvent from the organic phase.

15. The process according to claim 14, further comprising removing the organic solvent by applying steam or by ethanol coagulation.

16. The process according to claim 1, wherein the unsaturated halobutyl rubber, hydrogen peroxide, and polymer support are mixed together to produce a reaction mixture and the process further comprises adding a stabilizing agent to the reaction mixture.

17. The process according to claim 13, further comprising adding a stabilizing agent subsequent to washing the organic phase with an alkaline solution.

18. The process of claim 17, wherein the stabilizing agent is sterically hindered phenol, sterically hindered amine (HALS), amine derivative, dihydroquinoline derivative, or mixtures thereof.

19. The process according to claim 1, wherein:

the polymer support is at least one of a styrene polymer, a styrene-divinylbenzene copolymer, and a fluorocarbon resin;

the unsaturated halobutyl rubber is in an organic phase, and both the hydrogen peroxide and the polymer support are in an aqueous phase; and

the process further comprises:

pretreating the unsaturated halobutyl rubber to remove foreign materials;

reacting the unsaturated butyl rubber with about 1 to about 50 molar equivalents of hydrogen peroxide relative to the number of the double bonds of the unsaturated polymer to be epoxidized, in the presence of a polymer support having about 0.00001 to 15 molar equivalents of the sulfonic acid groups relative to the number of the double bonds of the unsaturated polymer to be epoxidized, wherein the reacting comprises mixing the organic phase containing the unsaturated halobutyl rubber with the aqueous phase containing the hydrogen peroxide and polymer support;

separating the resultant aqueous phase from the resultant organic phase containing organic solvent and the epoxidized polymer;

washing the organic phase with an alkaline solution to maintain a pH of the organic phase in an alkaline region;

adding a stabilizing agent to the washed organic phase, wherein the stabilizing agent is sterically hindered phenol, sterically hindered amine (HALS), amine derivative, dihydroquinoline derivative, or mixtures thereof; and evaporating the organic solvent from the organic phase.

20. The process according to claim 2, comprising one of:

adding the organic phase into the aqueous phase, or

adding the aqueous phase into the organic phase,

to react the unsaturated halobutyl rubber with the hydrogen peroxide in the presence of the polymer support.