Claims

1. A process for the preparation of a pure copolymer comprising at least the steps of:

A) filtering a first organic medium comprising:

i) at least one copolymer comprising a fraction of cyclic copolymers having a molecular weight of 2,000 g/mol or less and

ii) an organic diluent

through a semipermeable ultrafiltration membrane to produce

- a retentate comprising at least one copolymer comprising a fraction of cyclic copolymers having a molecular weight of 2,000 g/mol or less which is lower than in the copolymer employed in the organic medium before filtration and an organic diluent
- a permeate comprising cyclic copolymers having a molecular weight of 2,000 g/mol or less and an organic diluent and

B) contacting a second organic medium comprising

i) the copolymer of or obtainable from the retentate and

ii) an organic diluent

with an aqueous medium comprising at least one LCST compound having a cloud point of 0 to 100°C and removing at least partially the organic diluent to obtain the pure copolymer.

2. The process according to claim 1, wherein the copolymer is a halogenated copolymer.

3. The process according to claim 1 or 2, wherein the aqueous medium further contains non-LCST compounds, whereby the non-LCST compounds are selected from the group consisting of ionic or non-ionic surfactants, emulsifiers, and antiagglomerants.

4. The process according to anyone of claims 1 to 3, wherein the aqueous medium comprises 20,000 ppm or less of non-LCST compounds described in claim 2, with respect to the amount of copolymer present in the organic medium.

5. The process according to anyone of claims 1 to 4, wherein the aqueous medium comprises 500 ppm or less of dispersants, emulsifiers or anti-agglomerants other than LCST compounds.

6. The process according to anyone of claims 1 to 5, wherein the at least one LCST compound is selected from the group consisting of:

poly(N-isopropylacrylamide), poly(N-isopropylacrylamide-co-N,N-dimethylacrylamide, poly(N-isopropylacrylamide)-alt-2-hydroxyethylmethacrylate, poly(N-vinylcaprolactam), poly(N,N-diethylacrylamide), poly[2-(dimethylamino)ethyl methacrylate], poly(2-oxazoline) glycopolymers, Poly(3-ethyl-N-vinyl-2-pyrrolidone), hydroxylbutyl chitosan, polyoxyethylene (20) sorbitan monostearate, polyoxyethylene (20) sorbitan monolaurate, polyoxyethylene (20) sorbitan monooleate, methyl cellulose, hydroxypropyl cellulose,

hydroxyethyl methylcellulose, hydroxypropyl methylcellulose, poly(ethylene glycol) methacrylates with 2 to 6 ethylene glycol units, polyethyleneglycol-co-polypropylene glycols, compounds of formula (I)

(I) $HO-[-CH_2-CH_2-O]_x-[-CH(CH_3)-CH_2-O]_y-[-CH_2-CH_2-O]_z-H$

with y = 3 to 10 and x and z = 1 to 8, whereby y+x+z is from 5 to 18,

polyethyleneglycol-co-polypropylene glycol, ethoxylated iso-$C_{13}H_{27}$-alcohols, polyethylene glycol with 4 to 50 ethyleneglycol units, polypropylene glycol with 4 to 30 propyleneglycol units, polyethylene glycol monomethyl, dimethyl, monoethyl and diethyl ether with 4 to 50 ethyleneglycol units, polypropylene glycol monomethyl, dimethyl, monoethyl and diethyl ether with 4 to 50 propyleneglycol units.

7. The process according to anyone of claims 1 to 6, wherein the amount of LCST compound(s) present in the aqueous medium is of from 1 to 20,000 ppm with respect to the amount of copolymer in the second organic medium.

8. The process according to anyone of claims 1 to 7, wherein the amount of LCST compound(s) present in the aqueous medium is of from 1 to 5,000 ppm with respect to the amount of copolymer in the second organic medium.

9. The process according to anyone of claims 1 to 7, wherein the LCST compounds exhibit a molecular weight of at least 1,500 g/mol.

10. Copolymer products comprising

I) 96.0 wt.-% or more of a copolymer having a fraction of cyclic copolymers having a molecular weight of 2,000 g/mol or less in the range of from 20 to 2,000ppm of the total weight of the copolymer

II) 0 to 3.0 wt.-% of salts of mono- or multivalent metal ions and

III) 1 ppm to 5,000 ppm of at least one LCST compound.

11. Copolymers comprising

I) 100 parts by weight of a copolymer having a fraction of cyclic copolymers having a molecular weight of 2,000 g/mol or less in the range of from 20 to 2,000 of the total weight of the copolymer

II) 0.0001 to 0.5 parts by weight of a least one LCST compound and

III) no or from 0.0001 to 3.0 parts by weight of salts of mono- or multivalent metal ions and

IV) no or from 0.005 to 0.3 parts by weight of antioxidants

V) from 0.005 to 1.5 parts by weight of volatiles having a boiling point at standard pressure of 200°C or less.

12. Copolymer products according to claim 11, further comprising

VI) from 0.05 to 2.5 parts by weight of stabilizers.

13. Copolymer products comprising 97.5 wt.-% or more of a coplymer having a fraction of cyclic copolymers having a molecular weight of 2000 g/mol or less in the range of from 20 to 2,000 ppm of the total weight of the copolymer and having an ash content measured according to ASTM D5667 of 0.25 wt.-% or less and further comprising 1 ppm to 5,000 ppm of a least one LCST compound.

14. Copolymer products according to anyone of claims 9 to 13 wherein the copolymer comprises repeating units derived from at least one isoolefin and at least one multiolefin.

15. Copolymer products according to anyone of claims 9 to 14, whereby the copolymer comprises repeating units derived from at least one isoolefin and at least one multiolefin whereby the repeating units derived from the multiolefin are at least partially halogenated.

16. Copolymer products according to claim 15 wherein the copolymer consists of repeating units derived from isobutylene and isoprene.

17. Copolymer products according to anyone of claims 9 to 16, wherein the copolymers have a multiolefin content of 0.1 mol-% or more.

18. Copolymer products according to anyone of claims 10 to 17, wherein the copolymers have a weight average molecular weight in the range of from 10 to 2,000 kg/mol.

19. Blends or compounds obtainable by blending or compounding the copolymer products according to anyone of claims 9 to 18.

20. Blends or compounds comprising copolymer products according to anyone of claims 9 to 19, whereby the blends comprise a ratio of copolymer to carboxylic acid salts of mono- and multivalent metal ions of at least 250:1.

21. Innerliners, bladders, tubes, air cushions, pneumatic springs, air bellows, accumulator bags, hoses, conveyor belts and pharmaceutical closures and containers, automobile suspension bumpers, auto exhaust hangers, body mounts, shoe soles, tire sidewalls and tread compounds, belts, hoses, shoe soles, gaskets, o-rings, wires/cables, membranes, rollers, bladders (e.g. curing bladders), inner liners of tires, tire treads, shock absorbers, machinery mountings, balloons, balls, golf balls, protective clothing, medical tubing, storage tank linings, electrical insulation, bearings, pharmaceutical stoppers, adhesives, a container, such as a bottle, tote, storage tank, a container closure or lid; a seal or sealant, such as a gasket or caulking; a material handling apparatus, such as an auger or conveyor belt; a cooling tower; power belts, a metal working apparatus, or any apparatus in contact with metal working fluids; an engine component, such as fuel lines, fuel filters, fuel storage tanks, gaskets, seals, etc.; a membrane, for fluid filtration or tank sealing, appliances, baby products, bathroom fixtures, bathroom safety, flooring, food storage, garden, kitchen fixtures, kitchen products, office products, pet products, sealants and grouts, spas, water filtration and storage, equipment, food preparation surfaces and equipments, shopping carts, surface applications, storage containers, footwear, protective wear, sporting gear, carts, dental equipment, door knobs, clothing, telephones, toys, catheterized fluids in hospitals,

surfaces of vessels and pipes, coatings, food processing, biomedical devices, filters, additives, computers, ship hulls, shower walls, tubing, pacemakers, implants, wound dressing, medical textiles, ice machines, water coolers, fruit juice dispensers, soft drink machines, piping, storage vessels, metering systems, valves, fittings, attachments, filter housings, linings, and barrier coatings made from or comprising (halogenated) copolymer products according to anyone of claims 9 to 18 or the blends and compounds of claims 19 and 20.