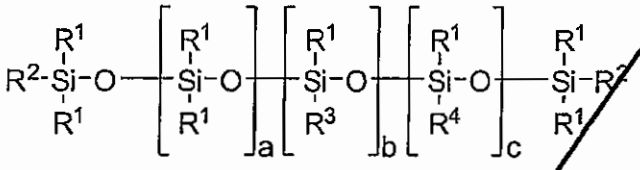
Claims:

1. Composite membrane having a separating membrane layer and a support membrane which have one or more separating membrane layers, characterized in that at least one separating membrane layer is produced by curing laterally modified silicone acrylates of the general Formula I



Formula I

wherein:

a = 25–500,
b = 1–25,
c = 0–20,

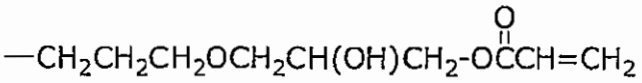
R^1 = independent of one another identical or different alkyl or aryl radicals having 1 to 30 carbon atoms which optionally bear ether and/or ester and/or epoxy and/or alcohol functions,

R^2 = independent of one another identical or different radicals from the group: R^1, R^3 and R^4,

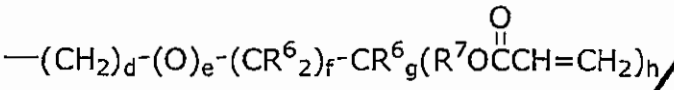
R^3 = independent of one another identical or different organic radicals which bear one or more acrylate groups,

R^4 = identical or different polyether radicals.

2. Composite membrane according to Claim 1, characterized in that, as substituent R^3, use is preferably made of radicals of general Formula II or III,



Formula II



Formula III

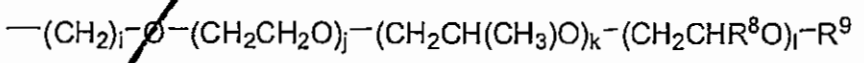
d = 0 to 12, e = 0 or 1, f = 0–12, g = 0–2, h = 1–3,

wherein: g + h = 3,

R^6 = independent of one another identical or different alkyl or aryl radicals having 1 to 30 carbon atoms or H,

R^7 = identical or different divalent hydrocarbon radicals, preferably $-CR^6_2-$, in particular $-CH_2-$.

3. Composite membrane according to either of Claims 1 or 2, characterized in that, as radical R^1 in Formula I, use is made of identical or different polyether radicals of the general Formula IV



Formula IV

i = 0–12, preferably 3–7, in particular 3,

j = 0–50, k = 0–50, l = 0–50,

R^8 = identical or different alkyl or aryl radicals having 2-30 carbon atoms, preferably ethyl and phenyl,

R^9 = identical or different alkyl or aryl radicals having 2-30 carbon atoms, or H or alkanoyl radicals, preferably methyl, H or acetyl.

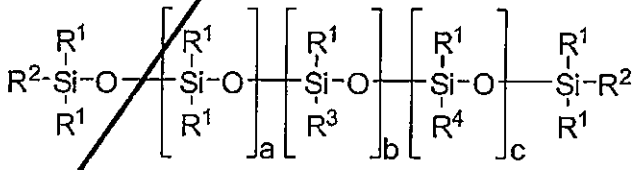
4. Composite membrane according to at least one of Claims 1 to 3, characterized in that this is composed of a plurality of layers of different silicone acrylates.

5. Composite membrane according to Claim 4, characterized in that this is composed of a mixture of different silicone acrylates.

6. Composite membrane according to Claim 5, characterized in that two different silicone acrylates are used, wherein as component a) terminally α,ω-modified silicone acrylates are used and as component b) laterally modified silicone acrylates according to the Formula I are used.

7. Composite membrane according to Claims 4 or 6, characterized in that it contains at least one of the following components:

a) one or more silicone acrylates having a silicon content of on average > 29% by weight of the general Formula I



Formula I

wherein, for the component a:

a = 25–500,
b = 0–15,
c = 0–20,
with the proviso that when b = 0, $R^2 = R^3$,

b) one or more silicone acrylates having a silicon content of < 27.5% by weight of the general Formula I

wherein, for the component b:

a = 1–24,
b = 3-10,
c = 0–20,
with the proviso that when b = 0, $R^2 = R^3$.

8. Composite silicone membranes according to Claim 7, characterized in that the components a) and b) are present in the mixture in a mass ratio of 10 to 1 to 1 to 10.

9. Composite membrane according to any one of Claims 1 to 8, characterized in that the silicone acrylates are cured using a photo-initiator by electromagnetic radiation having a wavelength which is less than 800 nm and/or by electron beams.

10. Composite membrane according to any one of Claims 1 to 9, characterized in that the support membrane is a solvent persistent porous three-dimensional support structure selected from the group of nonwovens or micro-filtration membranes or ultrafiltration membranes or separators.

11. Composite membrane according to any one of Claims 1 to 10, characterized in that the porous support material is selected from the group of the following materials: polyacrylonitrile (PAN), polyimide (PI), polyether ether ketone (PEEK), polyvinylidene fluoride (PVDF), polyamide (PA), polyamide-imide (PAI), polyethersulfone (PES), polybenzimidazole (PBI), sulphonated polyether ketone (SPEEK), polyethylen (PE), polypropylen (PP), or inorganic porous materials and/or ceramic membranes or polymer ceramic membranes produced using aluminium oxide, titanium dioxide, zirconium dioxide, silicon oxide and/or titanium

nitrite, and also mixtures, modifications or composites of the named various support membrane materials.

12. Use of the composite membrane according to any one of Claims 1 to 11 for retaining dissolved molecules having a molecular weight of less than 2000 g/mol with a retain fraction rate of at least 90% by weight.

13. Use according to Claim 12 for retaining or separating off homogeneous catalyst systems from reaction mixtures, for separating triglycerides from solvents having a molecular weight of less than 200 g/mol, for separating off oligomers from monomer solutions, or for separating off (pharmaceutical) active ingredients or precursors thereof from reaction mixtures or solutions.

14. Use according to Claim 13 characterized in that hydrocarbons with 1 to 8 carbon atoms, its isomers or mixtures or else CO_2 are used as solvent.

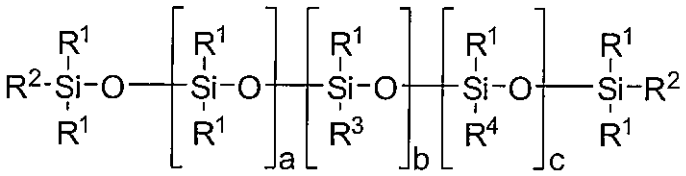
15. Use according to any one of Claims 12 to 14, characterized in that molecular weight fractions of less than 1000 g/mol are separated off from solutions in n-heptane at 30°C, 30 bar pressure.

16. Process for producing a composite membrane according to at least one of Claims 1 to 11, characterized in that a support membrane is coated with at least one silicone acrylate of the Formula I and/or mixtures of various silicone acrylates, and is subsequently cured by electromagnetic radiation and/or electron beam radiation.

Claims:

1. Composite membrane having a separating membrane layer and a support membrane which have one or more separating membrane layers, characterized in that at least one separating membrane layer is produced by curing a mixture of different silicone acrylates
characterized in that the mixture contains at least the following components:

a) one or more silicone acrylates having a silicon content of on average > 29% by weight of the general Formula I



Formula I

wherein, for the component a:

a = 25–500,
b = 0–15,
c = 0–20,
with the proviso that when b = 0, $R^2 = R^3$,
and

b) one or more silicone acrylates having a silicon content of < 27.5% by weight of the general Formula I

wherein, for the component b:

a = 1–24,
b = 3-25,
c = 0–20.

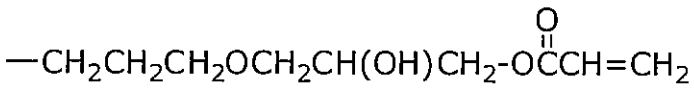
R^1 = independent of one another identical or different alkyl or aryl radicals having 1 to 30 carbon atoms which optionally bear ether and/or ester and/or epoxy and/or alcohol functions,

R^2 = independent of one another identical or different radicals from the group consisting of R^1, R^3 and R^4,

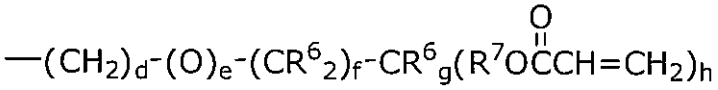
R^3 = independent of one another identical or different organic radicals which bear one or more acrylate groups,

R^4 = identical or different polyether radicals.

2. Composite membrane according to Claim 1, characterized in that, as substituent R^3, use is made of radicals of general Formula II or III,



Formula II



Formula III

d = 0 to 12, e = 0 or 1, f = 0–12, g = 0–2, h = 1–3,

wherein: g + h = 3,

R^6 = independent of one another identical or different alkyl or aryl radicals having 1 to 30 carbon atoms or H,

R^7 = identical or different divalent hydrocarbon radicals.

3. Composite membrane according to either of Claims 1 or 2, characterized in that, as radical R^4 in Formula I, use is made of identical or different polyether radicals of the general Formula IV

$$—(CH_2)_i–O–(CH_2CH_2O)_j–(CH_2CH(CH_3)O)_k–(CH_2CHR^8O)_l–R^9$$

Formula IV

i = 0–12,

j = 0–50,

R^8 = identical or different alkyl or aryl radicals having 2-30 carbon atoms, preferably ethyl and phenyl,

R^9 = identical or different alkyl or aryl radicals having 2-30 carbon atoms, or H or alkanoyl radicals, preferably methyl, H or acetyl.

4. Composite membrane according to at least one of Claims 1 to 3, characterized in that this is composed of a plurality of layers of different silicone acrylates.

5. Composite membrane according to any one of Claims 1 to 4, characterized in that two different silicone acrylates are used, wherein as first component a) terminally α,ω-modified silicone acrylates are used and as second component b) laterally modified silicone acrylates according to the Formula I are used.

6. Composite silicone membranes according to any one of Claims 1 to 5, characterized in that the components a) and b) are present in the mixture in a mass ratio of 10 to 1 to 1 to 10.

7. Composite membrane according to any one of Claims 1 to 6, characterized in that the silicone acrylates are cured using a photo-initiator by electromagnetic radiation having a wavelength which is less than 800 nm and/or by electron beams.

8. Composite membrane according to any one of Claims 1 to 7, characterized in that the support membrane is a solvent persistent three-dimensional support structure selected from the group of fibrous webs, tissues or micro-filtration membranes or ultrafiltration membranes or separators.

9. Composite membrane according to of Claim 8, characterized in that the support structure is selected from the group of the following materials: polyacrylonitrile (PAN), polyimide (PI), polyether ether ketone (PEEK), polyvinylidene fluoride (PVDF), polyamide (PA), polyamide-imide (PAI), polyethersulfone (PES), polybenzimidazole (PBI) sulphonated polyether ketons (SPEEK), Polyethylen (PE), Polypropylen (PP), or inorganic porous materials and/or ceramic membranes or polymer ceramic membranes produced using aluminium oxide, titanium dioxide, zirconium dioxide, silicon oxide and/or titanium nitrite, and also mixtures and/or modifications or composites of the named various support membrane materials.

10. Use of the composite membrane according to any one of Claims 1 to 9 for retaining dissolved molecules having a molecular weight of less than 2000 g/mol with a retain fraction rate of at least 90% by weight.

11. Use according to Claim 10 for retaining or separating of homogeneous catalyst systems from reaction mixtures, for separating triglycerides from solvents having a molecular weight of less than 200 g/mol, for separating off oligomers from monomer solutions, or for separating off (pharmaceutical) active ingredients or precursors thereof from reaction mixtures or solutions.

12. Use according to Claim 11 characterized in that hydrocarbons with 1 to 8 carbon atoms, its isomers or mixtures or CO_2 are used as solvent.

13. Use according to any one of Claims 10 to 12, characterized in that molecular weight fractions of less than 1000 g/mol are separated off from solutions in n-heptane at 30°C, 30 bar pressure.

14. Process for producing composite membrane having the separating membrane layer and the support membrane according to at least one of Claims 1 to 9, comprising:
coating the support membrane with the mixtures of different silicone acrylates; and
subsequently curing by electromagnetic radiation and/or electron beam radiation.