Claims

1. Process for preparing a poly(meth)acrylic acid, wherein a process stream from (meth)acrolein synthesis containing between 8 and 50% by weight of (meth)acrylic acid, based on the weight of the process stream, is subjected to free-radical polymerization in the presence of water formed in the oxidation reaction of the meth(acrolein) synthesis.

2. Process according to Claim 1, wherein the resulting poly(meth)acrylic acid which is at least partially dissolved in water originating at least partially in the oxidation reaction of (meth)acrolein synthesis is subjected to further processing and/or functionalization, wherein a functionalized poly(meth)acrylic acid is formed.

3. Process according to Claim 2, wherein the functionalization is an at least partial polymer-analogous esterification.

4. Process according to at least one of Claims 1 to 3, wherein

   a. the process stream contains one or more compounds selected from formaldehyde, acetic acid, maleic acid, maleic anhydride, terephthalic acid, formic acid, benzoic acid, (meth)acrolein, allyl alcohol, protoanemonine or structural isomers thereof, terephthaladehyde, lactic acid, lactide, diformulfuran, hydroxycinnamic acid or structural isomers thereof or dihydropyrancarbaldehyde and optionally condensation and addition products, or esters of these components, and/or
   b. the process stream contains process stabilizers selected from hydroquinones, phenothiazines, N-oxide-containing compounds, preferably 4-hydroxy-2,2,6,6-tetramethylpiperidine-1-oxyl, and/or a combination thereof.

5. Process according to at least one of Claims 1 to 4, wherein the process stream is subjected to free-radical polymerization in the presence of chain transfer agents, free-radical initiators, preferably aqueous persulfate solutions, more preferably solutions of sodium, potassium or ammonium persulfates, such as $Na_2S_2O_8$; and/or reducing agents, preferably $NaHSO_3$ solutions, azo initiators or organic peroxide initiators, preferably tert-butyl hydroperoxide, or a combination of at least one iron compound with an H_2O_2 solution and, optionally reducing agent at temperatures of between 20 to 150°C, preferably in a temperature range from 80 to 120°C.

6. Process according to at least one of Claims 1 to 5, wherein the process stream contains

8% to 40% by weight	(meth)acrylic acid,
0.01% to 20% by weight	formaldehyde and
0.1% to 10% by weight	each acetic acid and/or formic acid.

7. Process according to at least one of Claims 1 to 6, wherein the process stream has the following composition:

(meth)acrylic acid	8 to 35	% by weight
formaldehyde	0.01 to 5.0	% by weight
acetic acid	0 to 5.0	% by weight
maleic anhydride	0 to 3.0	% by weight
formic acid	0 to 5.0	% by weight
benzoic acid	0 to 2.0	% by weight
(meth)acrolein	0 to 2.0	% by weight
allyl alcohol	0 to 0.5	% by weight
hydroquinone	0 to 600	ppm by weight
protoanemonine or structural isomers thereof	0 to 1000	ppm by weight
water	balance.	

8. Process according to at least one of Claims 1 to 7, wherein the process stream contains aldehydes, preferably formaldehyde or hydrates thereof, and/or is subjected to a pretreatment, preferably with urea.

9. Process according to at least one of Claims 1 to 8, wherein the poly(meth)acrylic acid obtained is esterified in the presence of the secondary components or conversion products thereof and these secondary components or conversion products thereof are at least partly thermally removed in the esterification.

10. Process according to Claim 9, wherein the poly(meth)acrylic acid obtained is esterified with (methoxy)polyethylene glycol and/or with alcohols having alkylene ether functionality in their structure.

11. Process according to Claim 9 or 10, wherein the esterification is conducted with exclusion of a catalyst and/or within a temperature range from 120 to 250°C, preferably from 140 to 180°C.

12. Process according to at least one of Claims 1 to 11, wherein the poly(meth)acrylic acid and/or the functionalized poly(meth)acrylic acid are/is present at least partly in solution and/or formulated and/or isolated, preferably by drying, spray-drying or precipitation.