SUMMARY

The disclosure provides a method for uniformly distributing a process liquid within a process vessel, comprising;

a) providing a process liquid to a fouling-resistant liquid distributor comprising a liquid distribution head, installed within a process vessel having a cross- sectional area;

b) causing rotational movement of the fouling-resistant liquid distributor; and

c) uniformly distributing the process liquid over the cross-sectional area within the process vessel.

In an aspect, there is provided a method for uniformly distributing a process liquid within a process vessel, while suppressing the formation of condensation polymer, comprising:

a. providing a process liquid to at least one fouling-resistant liquid distributor comprising a liquid distribution head, installed within a process vessel having a cross-sectional area;

b. causing rotational movement of the fouling-resistant liquid distributor; and

c. uniformly distributing the process liquid over the cross-sectional area within the process vessel;

said process vessel is a (meth)acrylic monomer process vessel;

said process liquid comprising one or more polymerization inhibitors;

~~the~~ said method further comprising at least one of:

simultaneously self-rinsing the at least one fouling-resistant liquid distributor with a portion of the process liquid during step (c), and

providing the process liquid during step (c) to a plurality of the fouling-resistant liquid distributors, wherein each of the fouling-resistant liquid distributors simultaneously rinses each other with a portion of the process liquid during step (c).

The method of the disclosure further comprises simultaneously self-rinsing the at least one fouling-resistant liquid distributor with a portion of the process liquid during step (c) and/or providing the process liquid during step (c) to a plurality of the fouling-resistant liquid distributors, wherein each of the fouling-resistant liquid distributors simultaneously rinse each other with a portion of the process liquid during step (c).

The simultaneously self-rinsing of the fouling-resistant liquid distributor with a portion of the process liquid during uniform distribution has never been disclosed nor suggested in prior art.

Another embodiment of the disclosure, the rotational movement in step (b) is achieved by supplying at least one of a motive fluid and the process liquid to the liquid distribution head.

Yet another embodiment, the process vessel is a (meth)acrylic monomer process vessel and the process liquid comprises one or more polymerization inhibitors.

The disclosure also provides a system for uniformly distributing a process liquid within a process vessel comprising a supply of process fluid, a stationary conduit, and a liquid distribution head attached to the conduit, preferably to an end of the stationary conduit. The liquid distribution head is motive, powered by a fluid, preferably

by the process fluid, and comprises at least one process liquid delivery port, preferably a plurality of liquid delivery ports. The at least one process liquid delivery port is configured to provide a +10° or greater angle of liquid coverage when the liquid distribution head is moving.

In another aspect, there is provided a system for uniformly distributing a process liquid comprising one or more polymerization inhibitors within a process vessel for producing (meth)acrylic monomers, while suppressing the formation of condensation polymer, according to the method as defined above, comprising:

a. a supply of process fluid,

b. a stationary conduit, and

c. a liquid distribution head attached to said conduit, wherein said liquid distribution head is motive, powered by a fluid, and comprises at least one process liquid delivery port, ~~and~~

d. a plurality of liquid distributors simultaneously rinsing each other with the process liquid, and

wherein the at least one process liquid delivery port is configured to provide a +10° or greater angle of liquid coverage of the process fluid when the liquid distribution head is moving.

Yet another aspect of the present disclosure provides a process vessel comprising the said system.

Yet another embodiment of the present disclosure provides a simple and cost effective method for uniformly distributing liquid over the internal cross-section of (meth)acrylic monomer vapor-liquid contacting vessels, without accumulating condensation polymer on the distribution equipment.

Yet another embodiment of the present disclosure provides a method for collateral wetting of process-facing surfaces within the vapor space of (meth)acrylic monomer process vessels, such as quench vessels, absorbers, contact condensers, scrubbers, heat exchangers, distillation columns, reactors, and storage tanks to further reduce the potential for polymer accumulation within process vessels.

In another aspect, there is provided the use of the process vessel as defined above, for producing (meth)acrylic monomers.

CLAIMS

1. A method for uniformly distributing a process liquid within a process vessel, while suppressing the formation of condensation polymer, comprising:

a. providing a process liquid to at least one fouling-resistant liquid distributor comprising a liquid distribution head, installed within a process vessel having a cross-sectional area;

b. causing rotational movement of the fouling-resistant liquid distributor; and

c. uniformly distributing the process liquid over the cross-sectional area within the process vessel;

said process vessel is a (meth)acrylic monomer process vessel;

said process liquid comprising one or more polymerization inhibitors;

~~the~~ said method further comprising at least one of:

simultaneously self-rinsing the at least one fouling-resistant liquid distributor with a portion of the process liquid during step (c), and

providing the process liquid during step (c) to a plurality of the fouling-resistant liquid distributors, wherein each of the fouling-resistant liquid distributors simultaneously rinses each other with a portion of the process liquid during step (c).

2. The method of claim 1, wherein said at least one fouling-resistant liquid distributor comprises:

a. a stationary conduit, and

b. a motive fluid-powered liquid distribution head attached to said conduit,

wherein at least one of said stationary conduit and said liquid distribution head comprises at least one process liquid delivery port.

3. The method of claims 1 or 2, wherein causing the rotational movement in step (b) is achieved by supplying at least one of motive fluid and the process liquid to the liquid distribution head.

4. The method of any one of claims 1 to 3 further comprising collaterally-wetting process-facing surfaces within the process vessel with a portion of the process liquid.

5. The method of Claim 4, wherein the wetting liquid rate resulting from collaterally-wetting the process-facing surfaces of the process vessel interior is less than 0.5 m^3/m^2-hr.

~~6. The method of any one of claims 1 to 5, wherein the process vessel is a (meth)acrylic monomer process vessel.~~

~~7.~~6. The method of ~~claim 6~~any one of claims 1 to 5, wherein the (meth)acrylic monomer process vessel is used in a process to produce one or more compounds selected from the group consisting of acrolein, acrylic acid, methyl acrylate, ethyl acrylate, butyl acrylate, 2-ethylhexyl acrylate, 2-octyl acrylate, 2-(dimethylamino) ethyl acrylate, methacrolein, methacrylic acid, methyl methacrylate, ethyl methacrylate, butyl methacrylate, and 2-(dimethylamino) ethyl methacrylate.

~~8.~~7. The method of any one of claims 1 to ~~7~~6, wherein the process vessel is a vapor-liquid contacting vessel selected from the group consisting of a quench vessel, an absorption tower, a contact condenser, a fractionating condenser, a dehydration tower, a finishing column, a scrubber, a distillation column, and a storage tank.

~~9.~~8. The method of any one of claims 1 to ~~7~~6, wherein the process vessel is an integrated process vessel comprising two or more successive process sections selected from the group consisting of a quench section, an absorption section, a partial condensation section, a scrubbing section, a packed section, a contact condensation section, a trayed section, a stripping section, and a rectification section.

~~10.~~9. The method of any one of claims 1 to ~~9~~8, wherein the process vessel comprises one or more internal components selected from the group consisting of trays, tray supports, structured packing, random packing, feed distributors, demister pads,

stationary spray nozzles, baffles, liquid distribution troughs, and side draw collection trays.

~~11. The method of any one of claims 1 to 10, wherein the process liquid comprises one or more polymerization inhibitors.~~

~~12.~~10. A system for uniformly distributing a process liquid comprising one or more polymerization inhibitors within a process vessel for producing (meth)acrylic monomers, while suppressing the formation of condensation polymer, according to the method of any one of the preceding claims, comprising:

a. a supply of process fluid,

b. a stationary conduit, and

c. a liquid distribution head attached to said conduit, wherein said liquid distribution head is motive, powered by a fluid, and comprises at least one process liquid delivery port, ~~and~~

d. a plurality of liquid distributors simultaneously rinsing each other with the process liquid, and

wherein the at least one process liquid delivery port is configured to provide a +10° or greater angle of liquid coverage of the process fluid when the liquid distribution head is moving.

~~13.~~11. A process vessel comprising a system according to claim ~~12~~10.

~~14.~~12. Use of the process vessel of claim ~~13~~11, for producing (meth)acrylic monomers.

~~15.~~13. Use of the process vessel of claim ~~14~~12, wherein the (meth)acrylic monomers are selected from the group consisting of acrolein, acrylic acid, methyl acrylate, ethyl acrylate, butyl acrylate, 2-ethylhexyl acrylate, 2-octyl acrylate, 2-(dimethylamino) ethyl acrylate, methacrolein, methacrylic acid, methyl methacrylate, ethyl methacrylate, butyl methacrylate, and 2-(dimethylamino) ethyl methacrylate.