**We claim:**

1. A process for producing acetic acid, comprising the steps of:

reacting carbon monoxide with at least one reactant in a eductor-based reactor containing a reaction medium to produce a reaction solution comprising acetic acid, wherein the at least one reactant is selected from the group consisting of methanol, methyl acetate, methyl formate, dimethyl ether and mixtures thereof, and wherein the reaction medium comprises water, acetic acid, methyl acetate, methyl iodide, and a catalyst; wherein the eductor-based reactor comprises one or more eductor mixers;

withdrawing the reaction solution at a first flow rate from the eductor-based reactor;

separating a portion of the reaction solution to form a pump around stream;

optionally passing a portion of the pump around stream through one or more steam generators to produce an exiting process stream and steam;

optionally passing a portion of the pump around stream through one or more heat exchangers to produce an outflow; and

feeding a portion of one of more of the following: the pump around stream, the exit process stream, or the outflow to at least one of the one or more eductor mixers to provide mixing of the reaction medium in the eductor-based reactor.

2. (Amended) The process of claim 1, further comprising the step of:

feeding a portion of the reaction solution forward to a flasher to produce a crude product and a catalyst recycle stream, wherein the pump around stream is separated prior to the introduction to the flasher.

3. The process of claim 2, wherein the flow rate of the pump around stream is at least 1.2 times greater than the flow rate of the remaining portion of the reaction solution forwarded to the
flasher.

4. The process of claims 1 through 3, wherein the exiting process stream has a temperature that is less than the temperature of the reaction solution withdrawn from the eductor-based reactor.



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5. The process of claims 1 through 4, wherein 20% to 100% of the reaction solution withdrawn from the eductor-based reactor is separated as the pump around stream.

6. The process of claims 1 through 5, wherein at least 50% of the reaction solution withdrawn from the eductor-based reactor is separated as the pump around stream.

7. The process of claims 1 through 6, wherein the one or more eductor mixers each have a discharge to motive ratio of at least 2:1.

8. The process of claims 1 through 7, wherein the eductor-based reactor contains no moving parts within the reactor for mixing.



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**The invention claimed is:**

1. A process for producing acetic acid, comprising the steps of:

reacting carbon monoxide with at least one reactant in a eductor-based reactor containing a liquid reaction medium to produce a reaction solution comprising acetic acid, wherein the at least one reactant is selected from the group consisting of methanol, methyl acetate, methyl formate, dimethyl ether and mixtures thereof, and wherein the liquid reaction medium comprises water, acetic acid, methyl acetate, methyl iodide, and a catalyst, wherein the eductor-based reactor comprises one or more eductor mixers;

separating a portion of the reaction solution to form a pump around stream; and

feeding a portion of the pump around stream to at least one of the one or more eductor mixers to provide mixing of the reaction medium in the eductor-based reactor.

2. The process of claim 1, further comprising the step of:

feeding the remaining portion of the reaction solution withdrawn from the reactor but not separated to form the pump around stream forward to a flasher to produce a crude product and a catalyst recycle stream, wherein the pump around stream is separated prior to the introduction to the flasher.

3. The process of claim 2, wherein the flow rate of the pump around stream is at least 1.2 times greater than the flow rate of the remaining portion of the reaction solution forwarded to the flasher.

4. The process of claim 1, further comprising the step of:

passing a portion of the pump around stream through one or more steam generators to produce an exiting process stream and steam.

5. The process of claim 4, further comprising the step of: feeding a portion of the exiting process stream to at least one of the one or more eductor mixers to provide mixing of the reaction medium in the eductor-based reactor.

6. The process of claim 4, wherein the exiting process stream has a temperature that is less than the temperature of the reaction solution withdrawn from the eductor-based reactor.

7. The process of claim 1, further comprising the step of:

passing a portion of the pump around stream through one or more heat exchangers to produce an outflow.

8. The process of claim 7, further comprising the step of:

feeding a portion of the outflow to at least one of the one or more eductor mixers to provide mixing of the reaction medium in the eductor-based reactor.

9. The process of claim 1, wherein 20% to 100% of the reaction solution withdrawn from the eductor-based reactor is separated as the pump around stream.

10. The process of claim 1, wherein at least 50% of the reaction solution withdrawn from the eductor-based reactor is separated as the pump around stream.

11. The process of claim 1, wherein the one or more eductor mixers each have a discharge to motive flow rate ratio of at least 2:1.

12. A process for producing acetic acid, comprising the steps of:

reacting carbon monoxide with at least one reactant in a reactor containing a liquid reaction medium to produce a reaction solution comprising acetic acid, wherein the at least one reactant is selected from the group consisting of methanol, methyl acetate, methyl formate, dimethyl ether and mixtures thereof, and wherein the liquid reaction medium comprises water, acetic acid, methyl acetate, methyl iodide, and a catalyst;

withdrawing the reaction solution at a first flow rate from the reactor;

separating a portion of the reaction solution to form a pump around stream;

separating a remaining portion of the reaction solution withdrawn from the reactor but not separated to form the pump around stream and forwarding the remaining portion to a flasher, wherein the flow rate of the pump around stream is at least 1.2 times greater than the flow rate of the remaining portion of the reaction solution forwarded to the flasher;

passing a portion of the pump around stream through one or more steam generators to produce an exiting process stream and steam; and

feeding a portion of the exiting process stream to the reactor.

13. The process of claim 12, wherein the reactor is an eductor-based reactor, and wherein the eductor-based reactor comprises one or more eductor mixers.

14. The process of claim 13, further comprising the step of:

feeding a portion of the exiting process stream to at least one of the one or more eductor mixers to provide mixing of the reaction medium in the eductor-based reactor.

15. The process of claim 12, further comprising the step of:

passing a portion of the exiting process stream through one or more heat exchangers to produce an outflow.

16. The process of claim 12, further comprising the step of:

introducing the remaining portion of the reaction solution to the flasher to produce a crude product and a catalyst recycle stream, wherein the pump around stream is separated prior to the introduction to the flasher.

17. A process for producing acetic acid, comprising the steps of:

reacting carbon monoxide with at least one reactant in a reactor containing a liquid reaction medium to produce a reaction solution comprising acetic acid, wherein the at least one reactant is selected from the group consisting of methanol, methyl acetate, methyl formate, dimethyl ether and mixtures thereof, and wherein the liquid reaction medium comprises water, acetic acid, methyl acetate, methyl iodide, and a catalyst;

withdrawing the reaction solution at a first flow rate from the reactor;

separating a portion of the reaction solution to form a pump around stream;

separating a remaining portion of the reaction solution withdrawn from the reactor but not separated to form the pump around stream and forwarding the remaining portion to a flasher, wherein the flow rate of the pump around stream is at least 1.2 times greater than the flow rate of the remaining portion of the reaction solution forwarded to the flasher;

passing a portion of the pump around stream through one or more heat exchangers to produce an outflow; and

feeding a portion of the outflow to the reactor.

18. The process of claim 17, wherein the reactor is an eductor-based reactor, and wherein the eductor-based reactor comprises one or more eductor mixers.

19. The process of claim 18, further comprising the step of:

feeding a portion of the outflow to at least one of the one or more eductor mixers to provide mixing of the reaction medium in the eductor-based reactor.

20. The process of claim 17, further comprising the step of:

passing a portion of the pump around stream through one or more steam generators to produce an exiting process stream and steam.

21. The process of claim 17, further comprising the step of:

introducing the remaining portion of the reaction solution to the flasher to produce a crude product and a catalyst recycle stream, wherein the pump around stream is separated prior to the introduction to the flasher.

22. The process of claim 1, wherein the catalyst is a homogeneous catalyst.