

Integrated process for simultaneously preparing alkali metal methoxides

The present invention relates in a first aspect to an integrated process for simultaneously preparing n mixtures $P(i)$ comprising alkali metal methoxide and methanol, with one rectification column D , the process comprising preparing one or more alkali metal methoxides in n reactive distillation column $K(i)$ under reactive distillation conditions from n streams $H(i)$ and n streams $G(i)$ comprising methanol, thereby obtaining n vapor top streams $W(i)$ comprising methanol and water; and obtaining n bottoms streams $P(i)$ comprising alkali metal methoxide $A(i)OMe$ and methanol; the process further comprising feeding at least a part of a first vapor stream $W(1)$ into the lower part of the rectification column D at a position $I(1)$; and at least partially condensing at least a part of a second vapor stream $W(2)$, obtaining an at least partially condensed stream $W_C(2)$, and feeding at least a part of the stream $W_C(2)$ into the rectification column at a position $I(2)$.

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A second aspect of the invention is directed to a chemical production unit for carrying out the process according to the first aspect; and a third aspect of the invention is related to the use of a chemical production unit according to the second aspect or of a process according to the first aspect for simultaneously producing n mixtures $P(i)$ comprising alkali metal methoxide and methanol.

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State of the art

In the prior art, processes are described wherein a mixture comprising an alkali metal alkoxide and methanol is prepared in a reactive distillation column from a methanol stream and an aqueous stream which comprises a dissolved alkali metal hydroxide. According to these processes, the methanol stream fed into the reactive distillation column is prepared by separating methanol from water in a rectification column upstream of the reactive distillation column and using the respectively obtained methanol to the reactive distillation column. In this respect, reference is made, for example, to US 2002/0183566 A1, US 2008/0296786 A1, or WO 2013/168113 A1. However, according to the teaching of these prior art documents, only one specific mixture comprising alkali metal methoxide and methanol could be produced.

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WO 2021/148174 A1 refers to a process for simultaneously preparing two mixtures comprising sodium metal alkoxide and potassium metal alkoxide as well as methanol, wherein a single rectification column D is employed for generating a methanol stream which is then used as a methanol source for two parallel downstream reactive distillation columns in which the two different mixtures comprising alkali metal alkoxide and methanol are simultaneously prepared.

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WO 2022/263032 A1 also discloses a process for simultaneously preparing two mixtures comprising alkali metal alkoxide and methanol in separate reactive distillation columns with one rectification column for methanol. Therein, serial connected compressors are required for a multiple
5 step compression of a vapor phase comprising methanol, initially taken from the rectification column, wherein the resulting multiple compressed phase is then used for providing energy to an intermediate reboiler and a bottom reboiler of the rectification column.

WO 2022/117803 A1 discloses a process for simultaneously preparing two or more mixtures
10 comprising alkali metal alkoxide and methanol, wherein a single rectification column D is employed for generating a methanol stream which is then used, after a suitable dividing into two or more substreams, as a methanol source for two or more parallel downstream reactive distillation columns in which two or more different mixtures comprising alkali metal methoxide and methanol are simultaneously prepared. Therein, a part stream of a vapor phase comprising methanol
15 and taken at the top of the rectification column D, is compressed and used as heating medium for an intermediate reboiler of the rectification column D, thus covering the energy demand of said intermediate reboiler.

However, there is still a need for improvement, both in terms of energy demand and in terms of
20 apparatus costs.

Therefore, it was an object of the present invention to provide an economically advantageous process for simultaneously preparing two or more mixtures comprising alkali metal hydroxide and methanol. It was a further object of the present invention to provide a process for preparing
25 two or more mixtures comprising alkali metal hydroxide and methanol which allows for a reduction of the demand of external energy.

Surprisingly, it was found that these objects can be solved by a process according to which a single rectification column is used, at least one reboiler thereof being provided with energy from
30 stream(s) prepared from a vapor phase comprising methanol taken from the rectification column, using at least one compression unit. This in combination with at feeding at least a part of a first vapor stream W(1) into the lower part of the rectification column D at a position I(1); and at least partially condensing at least a part of a second vapor stream W(2), obtaining an at least partially condensed stream W_c(2), and feeding at least a part of the stream W_c(2) into the recti-
35 fication column at a position I(2). This combined approach allows a significant reduction of demand of external energy (steam) required for the rectification column.

- Thus, a first aspect of the invention relates to an integrated process for simultaneously preparing n mixtures $P(i)$ comprising alkali metal methoxide and methanol, comprising providing n reactive distillation columns $K(i)$;
- providing n aqueous liquid streams $H(i)$, a given stream $H(i)$ comprising a dissolved alkali metal hydroxide $A(i)OH$, wherein n is an integer with $n \geq 2$ and $i = 1 \dots n$; and
- 5 providing a rectification column D comprising at least one reboiler $V(1a)$;
- wherein the process comprises preparing the one or more alkali metal methoxides in the n reactive distillation column $K(i)$ under reactive distillation conditions from the n streams $H(i)$ and n streams $G(i)$ comprising methanol, thereby obtaining n vapor top streams $W(i)$ comprising methanol and water; and obtaining n bottoms streams $P(i)$ comprising alkali metal methoxide
- 10 $A(i)OMe$ and methanol;
- the process further comprising
- (a) obtaining a vapor phase V comprising methanol at the top of the rectification column D , said vapor phase V having a pressure p_V and a temperature T_V ;
 - 15 (b) preparing at least two streams from the vapor phase V , comprising a vapor stream G having a pressure p_G and a temperature T_G with $0.95 \leq p_G/p_V \leq 1.05$, and further comprising a stream $T(1a)$, said stream $T(1a)$ having a pressure $p_{T(1a)}$ and a temperature $T_{T(1a)}$ with $p_{T(1a)} > p_V$;
 - (c) preparing the n streams $G(i)$ from the vapor stream G , each of the streams $G(i)$ having a pressure $p_{G(i)}$ and a temperature $T_{G(i)}$ with $p_{G(i)} > p_G$ for each stream $G(i)$; and feeding each stream $G(i)$ into the respective reactive distillation column $K(i)$;
 - 20 (d) passing at least a part of the stream $T(1a)$ as a heating medium through the reboiler $V(1a)$ of the rectification column D , obtaining a, preferably at least partially condensed, stream $T_C(1a)$ having a temperature $T_{T_C(1a)}$ with $T_{T_C(1a)} < T_{T(1a)}$;
 - 25 (e) feeding at least a part of the stream $T_C(1a)$ into the rectification column D ;
 - (f) feeding at least a part of a first vapor stream $W(1)$ into the lower part of the rectification column D at a position $I(1)$;
 - (g) at least partially condensing at least a part of a second vapor stream $W(2)$, obtaining an at least partially condensed stream $W_C(2)$, and feeding at least a part of the stream $W_C(2)$
 - 30 into the rectification column D at a position $I(2)$.

Feeding of at least a part of the stream $T_C(1a)$ into the rectification column D according to (e) is preferably done as explained in more detail herein below.

- 35 In some preferred embodiments, the process further comprises for at least one reactive distillation column $K(i)$, preferably for n reactive distillation columns $K(i)$, feeding the stream $G(i)$ into the lower part of the reactive distillation column $K(i)$ and feeding the aqueous liquid stream $H(i)$ into the upper part of the reactive distillation column $K(i)$.

In some preferred embodiments of the process, a stream H(1) comprises dissolved sodium hydroxide and a stream H(2) comprises dissolved potassium hydroxide, wherein sodium methoxide is prepared in the reactive distillation column K(1) from which the stream W(1) is obtained
5 and potassium methoxide is prepared in the reactive distillation column K(2) from which the stream W(2) is obtained.

In some preferred embodiments of the process n is 2 ($n = 2$).

10 In some preferred embodiments, the process further comprises
(h) feeding a stream M comprising methanol into the rectification column D at a position I(M).

Alternative(s) B

15 As indicated above, at least a part of a second vapor stream W(2) is at least partially condensed in (g), thereby obtaining an at least partially condensed stream $W_C(2)$, and at least a part of the stream $W_C(2)$ is fed into the rectification column at a position I(2). Here regarding the alternative B and herein below also regarding alternatives C, D, "at least partially condensed" regarding vapor stream W(2) means that at least 2 weight-% of stream W(2) are condensed and form $W_C(2)$.
20 Furthermore, in (h) a stream M comprising methanol is fed into the rectification column D at a position I(M).

In some preferred embodiments of the process, (g) comprises passing the vapor stream W(2) having a temperature $T_{W(2)}$ through at least one heat exchanger E, obtaining an at least partially
25 condensed stream $W_C(2)$ having a temperature $T_{WC(2)}$ with $T_{WC(2)} < T_{W(2)}$, and feeding at least a part of the at least partially condensed stream $W_C(2)$ into the the rectification column D at the position I(2); and wherein (h) comprises passing the stream M having a temperature T_{M1} through one or more of said at least one of heat exchangers E, obtaining a stream M having a temperature T_{M2} with $T_{M2} > T_{M1}$, and feeding the stream M having the temperature T_{M2} into the
30 upper part of the rectification column D at the position I(M), wherein preferably, I(M) is above I(2) and I(2) is above I(1).

In some preferred alternative embodiments of the process, (g) comprises
(g.1) passing the vapor stream W(2) having a temperature $T_{W(2)}$ through a heat exchanger
35 E(1a), obtaining a partially condensed stream $W_C(2)$ having a temperature $T_{WC(2)}$ with $T_{WC(2)} < T_{W(2)}$;
(g.2) feeding at least a part of the at least partially condensed stream $W_C(2)$ into the lower part of the rectification column D at the position I(2);

and wherein (h) comprises

(h.1) passing the stream M having the temperature T_{M1} through the heat exchanger E(1a), obtaining the stream M having the temperature T_{M2} ;

(h.2) feeding the stream M having the temperature T_{M2} into the upper part of the rectification column D at the position I(M),

wherein preferably, I(M) is above I(2) and I(2) is above I(1).

In some preferred alternative embodiments of the process, (g) comprises

(g.1') passing the vapor stream W(2) having a temperature $T_{W(2)}$ through a heat exchanger E(1a), obtaining a partially condensed stream $W_{C1(2)}$ having a temperature $T_{WC1(2)}$ with $T_{WC1(2)} < T_{W(2)}$;

(g.2') passing the stream $W_{C1(2)}$ having the temperature $T_{WC1(2)}$ through a heat exchanger E(1b), obtaining a, preferably completely condensed, stream $W_{C2(2)}$ having a temperature $T_{WC2(2)}$ with $T_{WC2(2)} < T_{WC1(2)}$;

(g.3') feeding at least a part of the stream $W_{C2(2)}$ into the lower part of the rectification column D at the position I(2);

and wherein (h) comprises

(h.1) passing the stream M having the temperature T_{M1} through the heat exchanger E(1a), obtaining the stream M having the temperature T_{M2} ;

(h.2) feeding at least a part of the stream M having the temperature T_{M2} into the upper part of the rectification column D at the position I(M),

wherein preferably, I(M) is above I(2) and I(2) is above I(1).

The preferred alternative embodiments of the process allows to heat up stream M and get after

E(1b) a complete liquid stream. That means, only a small pipe and a small nozzle for feeding the condensed stream into D is necessary.

In these preferred and alternative preferred embodiments, the methanol concentration in stream W(1) $c_{MeOH}(1)$ is preferably higher than the MeOH concentration in W(2) $c_{MeOH}(2)$ with $c_{MeOH}(1) >$

$c_{MeOH}(2)$. W(1) is fed into rectification column D at a position I(1), wherein the MeOH concentration at that position I(1) within the rectification column D $c_{MeOH}(D1)$ is preferably about equal to $c_{MeOH}(1)$ with $0.95 \leq c_{MeOH}(1)/c_{MeOH}(D1) \leq 1.05$.

At least partially condensed stream $W_C(2)$ has a methanol concentration $c_{MeOH}(2')$ equal to the

methanol concentration in W(2) and lower than the methanol concentration in W(1). $W_C(2)$ is preferably fed into rectification column D at a position I(2), wherein the MeOH concentration at that position I(2) within the rectification column D $c_{MeOH}(D2)$ is preferably about equal to $c_{MeOH}(2')$ with $0.95 \leq c_{MeOH}(2')/c_{MeOH}(D2) \leq 1.05$. This preferred feeding manner enables a most efficient

processing of rectification column D. The same applies with respect to $W_{C2}(2)$. Heat emitted from stream $W_{C1}(2)$ in heat exchanger E(1b) is taken up by a cooling medium such as water or ambient air.

- 5 I(M) is in the upper half of rectification column D, preferably in its upper third. Preferably, there is at least one, more preferably there are at least 2, theoretical stages between I(M) and the head of the rectification column D. I(2), which is above I(1), and I(1) are both in the lower half of rectification column D, preferably both in its lower third, wherein more preferably I(2) is preferably at least one, more preferably at least 5, theoretical stages above I(1).

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Alternative C

- As indicated above, at least a part of a second vapor stream W(2) is at least partially condensed in (g), thereby obtaining an at least partially condensed stream $W_C(2)$, and at least a part of the stream $W_C(2)$ is fed into the rectification column at a position I(2). Furthermore, in (h) a stream M comprising methanol is fed into the rectification column D at a position I(M).

- In some preferred alternative embodiments of the process, (g) and (h) comprise passing the vapor stream W(2) having a temperature $T_{W(2)}$ through at least one heat exchanger E(2), obtaining an at least partially, preferably essentially completely, condensed stream $W_C(2)$ having a temperature $T_{WC(2)}$ with $T_{WC(2)} < T_{W(2)}$; and admixing the stream M, prior to feeding it into the rectification column D at the position I(M), with at least a part of the stream $W_C(2)$, wherein I(M) = I(2), wherein preferably, I(M) is above I(1).

- 25 These preferred alternative embodiments allow to use only one nozzle to feed both streams in the column D.

- In these preferred alternative embodiments, the methanol concentration in stream W(1) $c_{MeOH}(1)$ is preferably higher than the MeOH concentration in W(2) $c_{MeOH}(2)$ with $c_{MeOH}(1) > c_{MeOH}(2)$. W(1) is fed into rectification column D at a position I(1), wherein the MeOH concentration at that position I(1) within the rectification column D $c_{MeOH}(D1)$ is preferably about equal to $c_{MeOH}(1)$ with $0.95 \leq c_{MeOH}(1)/c_{MeOH}(D1) \leq 1.05$.

- At least partially condensed stream $W_C(2)$ has a methanol concentration $c_{MeOH}(2')$ equal to the methanol concentration in W(2) and lower than the methanol concentration in W(1). The mixture of $W_C(2)$ and M having a methanol concentration $c_{MeOH}(\text{mixture})$ is preferably fed into rectification column D at a position I(M), wherein the MeOH concentration at that position I(M) within the rectification column D $c_{MeOH}(DM)$ is preferably about equal to $c_{MeOH}(\text{mixture})$ with $0.95 \leq$

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$c_{\text{MeOH}}(\text{mixture})/c_{\text{MeOH}}(\text{D2}) \leq 1.05$. This preferred feeding manner enables a most efficient processing of rectification column D. Heat emitted from stream W(2) in heat exchanger E(2) is taken up by a cooling medium such as water or ambient air.

- 5 I(M), where the mixture of stream M and at least a part of the stream W_C(2) is fed into the rectification column D is in its lower half. Preferably, there is at least one, more preferably there are at least 2, theoretical stages between I(1) and I(M). I(1) is in the lower half of rectification column D, preferably in its lower third.

10 *Alternative D*

As indicated above, at least a part of a second vapor stream W(2) is at least partially condensed in (g), thereby obtaining an at least partially condensed stream W_C(2), and at least a part of the stream W_C(2) is fed into the rectification column at a position I(2). Furthermore, in (h) a stream
15 M comprising methanol is fed into the rectification column D at a position I(M).

- In some preferred alternative embodiments of the process, (g) and (h) comprise admixing the vapor stream W(2) having a temperature $T_{W(2)}$ with the stream M having a temperature T_{M1} with $T_{W(2)} > T_{M1}$, thereby at least partially condensing the stream W(2), and feeding the stream ob-
20 tained from mixing into the rectification column D at the position I(M), wherein $I(M) = I(2)$, wherein preferably, I(M) is above I(1).

These preferred alternative embodiments allow to use only one nozzle to feed both streams in the column D.

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In these preferred alternative embodiments, the methanol concentration in stream W(1) $c_{\text{MeOH}}(1)$ is preferably higher than the MeOH concentration in W(2) $c_{\text{MeOH}}(2)$ with $c_{\text{MeOH}}(1) > c_{\text{MeOH}}(2)$. W(1) is fed into rectification column D at a position I(1), wherein the MeOH concentration at that position I(1) within the rectification column D $c_{\text{MeOH}}(\text{D1})$ is preferably about equal to $c_{\text{MeOH}}(1)$ with
30 $0.95 \leq c_{\text{MeOH}}(1)/c_{\text{MeOH}}(\text{D1}) \leq 1.05$.

- The mixture of W(2) and M having a methanol concentration $c_{\text{MeOH}}(\text{mixture})$ is preferably fed into rectification column D at a position I(M), wherein the MeOH concentration at that position I(M) within the rectification column D $c_{\text{MeOH}}(\text{DM})$ is preferably about equal to $c_{\text{MeOH}}(\text{mixture})$ with
35 $0.95 \leq c_{\text{MeOH}}(\text{mixture})/c_{\text{MeOH}}(\text{DM}) \leq 1.05$. This preferred feeding manner enables a most efficient processing of rectification column D.

I(M), where the mixture of stream M and stream W(2) is fed into the rectification column D is in its lower half. Preferably, there is at least one, more preferably there are at least 2, theoretical stages between I(1) and I(M). I(1) is in the lower half of rectification column D, preferably in its lower third.

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Parallel compression of T(1a), T(1b)

In some preferred embodiments of the process, the rectification column D comprises at least one reboiler V(1a) and at least one reboiler V(1b) and wherein the at least one reboiler V(1a) is an intermediate reboiler and the at least one reboiler V(1b) is a bottom reboiler;

wherein (b) comprises preparing at least three streams from the vapor phase V, comprising the vapor stream G having a pressure p_G and a temperature T_G with $0.95 \leq p_G/p_V \leq 1.00$, and further comprising two streams T(1a) and T(1b), said stream T(1a) having a pressure $p_{T(1a)}$ and a temperature $T_{T(1a)}$ and said stream T(1b) having a pressure $p_{T(1b)}$ and a temperature $T_{T(1b)}$ with $p_{T(1a)}$

15 $> p_V$, and $p_{T(1b)} > p_V$,

wherein (d) comprises

(d.1) passing at least a part of the stream T(1a) as a heating medium through a reboiler V(1a) of the rectification column D, obtaining a stream $T_{C(1a)}$ having a temperature $T_{T_{C(1a)}}$ with $T_{T_{C(1a)}} < T_{T(1a)}$;

20 (d.2) passing at least a part of the stream T(1b) as a heating medium through a reboiler V(1b) of the distillation column D, obtaining a stream $T_{C(1b)}$ having a temperature $T_{T_{C(1b)}}$ with $T_{T_{C(1b)}} < T_{T(1b)}$; and

wherein (e) comprises

(e.1) feeding at least a part of the stream $T_{C(1a)}$ into the rectification column D;

25 (e.2) feeding at least a part of the stream $T_{C(1b)}$ into the rectification column D.

Feeding of at least a part of the stream $T_{C(1a)}$ into the rectification column D according to (e.1) is preferably done as explained in more detail herein, and also feeding at least a part of the stream $T_{C(1b)}$ into the rectification column D according to (e.2) is preferably done as explained in more detail herein.

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In some preferred embodiments of the process, preparing the at least three streams according to (b) comprises

(b.1) splitting the vapor phase V into at least two vapor streams comprising the stream G and a vapor stream T(1) having a pressure $p_{T(1)}$ and a temperature $T_{T(1)}$ with $0.95 \leq p_{T(1)}/p_V \leq 1.00$;

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(b.2) preparing at least the two streams T(1a) and T(1b) from the vapor stream T(1).

As defined above, a stream M comprising methanol is fed into the rectification column D. This stream M, also referred to as fresh methanol stream M, is fed into D in order provide sufficient methanol for the overall process, in particular to compensate the loss of methanol removed from the process via the mixtures P(i). Generally, there are no specific requirements as far as the methanol content of M is concerned, and the skilled person will be in the position to choose suitable methanol streams M. Preferably, however, it is preferred that the stream M comprises only a low amount of water. Therefore, it is further preferred that from 99 to 100 weight-%, more preferably from 99.5 to 100 weight-%, more preferably from 99.9 to 100 weight-% of the stream M consist of methanol and optionally water, wherein the amount of water comprised in the stream M is preferably at most 2000 weight-ppm, more preferably at most 1500 weight-ppm, more preferably at most 1000 weight-ppm, such as at most 750 weight-ppm or at most 500 weight-ppm or at most 250 weight-ppm. As far as the temperature of the stream M is concerned at which the stream M is fed into D, it is preferred that the temperature is in the range of from ambient temperature up to the boiling point of methanol at the column pressure of D, especially in view of alternatives B and C; more preferably the temperature is ambient temperature. Regarding alternative D, it is preferred that M has ambient temperature (in the range of from 10 to 40 °C).

In some preferred embodiments of the process, the rectification column D is operated at a pressure at the top of D in the range of from 0.5 to 10 bar(abs), preferably in the range of from 0.75 to 6 bar(abs), more preferably in the range of from 1 to 5 bar(abs), more preferably in the range of from 1 to 3 bar(abs).

In some preferred embodiments of the process, the rectification column D is operated at a temperature at the top of D in the range of from 45 to 137 °C, preferably in the range of 49 to 118, more preferably in the range of from 64 to 111 °C, more preferably in the range of from 64 to 95°C. As to the rectification column D, it is preferred that it has from 20 to 100, more preferably from 30 to 80, more preferably from 40 to 60 theoretical stages. Conceivable preferred ranges are, for example, from 40 to 50 or from 45 to 55 or from 50 to 60.

30 *Rectification column D without top vapor recompression*

In some embodiments of the process, the rectification column is operated without top vapor recompression.

35 *Rectification column D with top vapor recompression*

In some preferred embodiments of the process, the rectification column D is operated at a reflux ratio of at least 0.5:1, preferably in the range of from 0.55:1 to 1.4:1, or preferably in the range

of from 0.6:1 to 1.4:1. In some preferred embodiments of the process, the rectification column D is operated with top vapor recompression. Preferably, realizing the reflux ratio comprises preparing from the vapor phase V a further vapor stream T(2), passing said stream T(2) through a condenser V(2), obtaining a liquid stream T(3) and a waste gas stream T(2w), and feeding the liquid stream T(3) into the top of the rectification column D. The waste gas stream T(2w) preferably essentially consists of oxygen, nitrogen, carbon dioxide and methanol, wherein the amount of methanol in T(2w) is preferably in the range of from 2 to 80 weight-%, preferably in the range of from 10 to 30 weight-% based on the total weight of T(2w).

10 *Recirculation of $T_c(1a)$ into D*

In some preferred embodiments of the process, at least a part of $T_c(1a)$ is fed to a first condensate drum CD(1), wherein from said first condensate drum CD(1), a gas stream T(1g) and a liquid stream T(1l) are removed, said gas stream T(1g) being fed into the condenser V(2) together with T(2) and said liquid stream T(1l) being combined with the liquid streams T(2l) and (T2gl) in depressurized form, obtaining a combined liquid stream which is fed as the stream T(3) into the top of the rectification column D. In "depressurized form" regarding the liquid streams T(1l), T(2l) and (T2gl) means that these streams and respectively the combined liquid stream therefrom have a pressure p_{cs} about equal to the pressure at the top of rectification column D as described above, i.e. $0.95 \leq p_{cs}/p_{tD} \leq 1.05$.

In particular in view of overall energy consumption topics, the rectification column D is operated with top vapor recompression. Reference is made, for example, to the schematic overview in Figure 1 showing a process according to the present invention with reflux. When the rectification column is operated with top vapor recompression, it is also preferred that realizing the reflux ratio comprises using 2 condensers, V(2) and V(3), as described below in that

- (i) in addition to the at least two streams G and T(1a), which are prepared from the vapor phase V, preparing a further stream T(2) from the vapor phase V and passing said stream T(2) through the condenser V(2), obtaining a liquid stream T(2l) and a gas stream T(2g); passing the gas stream T(2g) through the condenser V(3), obtaining a liquid stream T(2gl) and a waste gas stream T(2w); and combining the liquid streams T(2l) and (T2gl) in depressurized form in a second condensate drum CD(2);
- (ii) feeding $T_c(1a)$, at least partially, to a first condensate drum CD(1), wherein from said first condensate drum CD(1), a gas stream T(1g) and a liquid stream T(1l) are removed, said gas stream T(1g) being fed into the condenser V(2) together with T(2) and said liquid stream T(1l) being combined with the liquid streams T(2l) and (T2gl) in depressurized form in the second condensate drum CD(2), obtaining a combined liquid stream which is fed as the stream T(3) into the top of the rectification column D.

Certainly, as far as step (i) above is concerned, the skilled person may also realize, if need be, said reflux ratio by using more than the 2 condensers V(2) and V(3) or by using only one condenser V(2).

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Vapor phase V

In some preferred embodiments of the process, the vapor phase V has a pressure p_v , in the range of from 0.5 to 10 bar(abs), preferably in the range of from 0.75 to 6 bar(abs), more preferably in the range of from 1 to 5 bar(abs), more preferably in the range of from 1 to 3 bar(abs). Preferably, the vapor phase V has a temperature T_v in the range of from 45 to 137 °C, preferably in the range of 49 to 118, more preferably in the range of from 64 to 111 °C, more preferably in the range of from 64 to 95°C .

15 *Stream taken from rectification column D for heating purpose regarding V(1a)*

In some preferred embodiments of the process, a stream T(Di) is taken from the rectification column D and passed for heating purpose through reboiler V(1a) of the rectification column D, obtaining a heated stream $T_h(Di)$ having a temperature $T_{Th(Di)}$ with $T_{Th(Di)} > T_{T(Di)}$, wherein heated stream $T_h(Di)$ is reintroduced into rectification column D. In some preferred embodiments, V(1a) is an intermediate reboiler of the rectification column D and the stream T(Di) is preferably taken at an intermediate position from rectification column D.

Stream T(1a)

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In some preferred embodiments of the process, stream T(1a) has a pressure $p_{T(1a)}$, which is adjusted so that $T_{condT(1a)} \geq T_{boilT(Di)} + 3 \text{ K}$, wherein $T_{condT(1a)}$ is the condensation temperature of stream T(1a) at a pressure $p_{T(1a)}$ and $T_{boilT(Di)}$ is the boiling temperature of stream T(Di) at a pressure $p_{T(Di)}$. Stream T(1a) preferably has a condensation temperature $T_{condT(1a)}$ which is in the range of from 3 to 30 K, preferably in the range of from 4 and 25 K, more preferably in the range of from 5 and 20 K, higher than $T_{boilT(Di)}$.

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Stream taken from rectification column D for heating purpose regarding V(1b)

35 In some preferred embodiments of the process, a stream T(Db) is taken from the rectification column D and passed for heating purpose through reboiler V(1b) of the rectification column D, obtaining a heated stream $T_h(Db)$ having a temperature $T_{Th(Db)}$ with $T_{Th(Db)} > T_{T(Db)}$, wherein

heated stream $T_h(\text{Db})$ is reintroduced into rectification column D. In some preferred embodiments, V(1b) is an intermediate reboiler of the rectification column D and the stream $T(\text{Db})$ is preferably taken at a bottom position from rectification column D.

- 5 Heated stream $T_h(\text{Di})$ preferably comprises two phases, i.e. a gaseous and a liquid part. Analogously, heated stream $T_h(\text{Db})$ preferably comprises two phases, i.e. a gaseous and a liquid part.

Stream T(1b)

- 10 Stream T(1b) preferably has a pressure $p_{T(1b)}$, which is adjusted so that $T_{\text{cond}T(1b)}$ is $\geq T_{\text{boil}T(\text{Db})} + 3 \text{ K}$, wherein $T_{\text{cond}T(1b)}$ is the condensation temperature of stream T(1b) at a pressure $p_{T(1b)}$ and $T_{\text{boil}T(\text{Db})}$ is the boiling temperature of stream T(Db) at a pressure $p_{T(\text{Db})}$. Preferably, stream T(1b) has a condensation temperature $T_{\text{cond}T(1b)}$ which is in the range of from 3 to 30 K, preferably in the range of from 4 and 25 K, more preferably in the range of from 5 and 20 K, higher than
- 15 $T_{\text{boil}T(\text{Db})}$.

K(i), K(1), K(2)

- In some preferred embodiments, the process further comprises for at least one reactive distillation column K(i), preferably for n reactive distillation columns K(i), feeding the stream G(i) into the lower part of the reactive distillation column K(i) and feeding the aqueous liquid stream H(i) into the upper part of the reactive distillation column K(i).
- 20

Further streams

- 25 In some preferred embodiments of the process, prior to preparing the n streams G(i) from the vapor stream G according to (c), the stream G is passed through a compressor C_G , thereby obtaining a compressed stream G_c having a pressure p_{G_c} and a temperature T_{G_c} with $p_{G_c} > p_G$.
- 30 In some preferred embodiments of the process, prior to be fed into the reactive distillation column K(i), each of the n streams G(i) is passed through a compressor $C(i)$, thereby obtaining n compressed streams $G_c(i)$ having a pressure $p_{G_c(i)}$ and a temperature $T_{G_c(i)}$ with $p_{G_c(i)} > p_G$.
- In some preferred embodiments of the process, a stream H(1) comprises dissolved sodium hydroxide and a stream H(2) comprises dissolved potassium hydroxide, wherein sodium methoxide is prepared in the reactive distillation column K(1) from which the stream W(1) is obtained and potassium methoxide is prepared in the reactive distillation column K(2) from which the stream W(2) is obtained.
- 35

In some preferred embodiments of the process n is 2 ($n = 2$).

Preferably, the stream H(1) comprises dissolved sodium hydroxide and the stream H(2) comprises dissolved potassium hydroxide, wherein sodium methoxide is prepared in the reactive distillation column K(1) from which the stream W(1) is obtained and potassium methoxide is prepared in the reactive distillation column K(2) from which the stream W(2) is obtained.

In some preferred embodiments of the process, the stream W(1) comprises methanol and water at a molar methanol-to-water ratio $r(1)$ and wherein the stream W(2) comprises methanol and water at a molar methanol-to-water ratio $r(2)$ with $r(2) < r(1)$.

With respect to the stream G, it is preferred that said stream G comprises methanol and water, wherein more preferably from 99.95 to 100 weight-% of G consist of methanol and water, and wherein the water content of G is at most 200 weight-ppm, more preferably at most 150 weight-ppm, more preferably at most 100 weight-ppm, wherein more preferably, said water content is in the range of from 5 to 100 weight-ppm, more preferably in the range of from 10 to 100 weight-ppm, more preferably in the range of from 15 to 100 weight-ppm. According to (c), n streams G(i) are prepared from the vapor stream G, each of the streams G(i) having a pressure $p_{G(i)}$ and a temperature $T_{G(i)}$ with $p_{G(i)} > p_G$ and $T_{G(i)} > T_G$ for each stream G(i), and feeding each stream G(i) into the respective reactive distillation column K(i), wherein for preparing the n streams G(i), the at least one compression unit C_G is employed. Preferably, the stream G is divided into the two streams G(1) and G(2), wherein the stream G has a mass flow rate $f(G)$, the stream G(1) has a mass flow rate $f(G(1))$ and the stream G(2) has a mass flow rate $f(G(2))$, wherein $f(G) = f(G(1)) + f(G(2))$. Generally, the stream G can be divided by any conceivable method. Preferably (c) comprises passing the stream G into a stream dividing device S, said device more preferably comprising a pipe junction. In context, it is noted that the term "the stream is divided into two streams" refers to a method according to which the streams obtained from said dividing have the same chemical composition as the stream G. As far as the ratios $f(G(1))/f(G)$ and $f(G(2))/f(G)$ are concerned, the present invention allows for a flexible adjusting of said ratios in that the individual flow rates $f(G(1))$ and $f(G(2))$ can be chosen depending on the desired amount of A(1)OMe, preferably sodium methoxide, to be obtained relative to the desired amount of A(2)OMe, preferably potassium methoxide, to be obtained.

Prior to dividing according to (c), the stream G can be passed through the at least one compression unit C_G , thereby realizing a pressure increase of G. Preferably, the pressure is suitably increased so that the pressure of the streams after dividing is adapted to the desired pressure when the streams are fed into the reactive distillation columns K(i) and ultimately, via the streams W(i), back into D. Preferably, said pressure increase is in the range of from 0.1 to 0.8

bar, more preferably in the range of from 0.15 to 0.6 bar, more preferably in the range of from 0.2 to 0.4 bar. According to this embodiment of the present invention, it is preferred that the dividing according to (c) comprises passing the compressed stream G into a stream dividing device S, said device preferably comprising a pipe junction and at least one control device allowing for adjusting the ratio $f(G(1))/f(G(2))$, wherein said at least one control device is located downstream of said pipe junction. At least one of these control devices is located either in the stream G(1) or in the stream G(2) or in both streams G(1) and G(2), and it is preferred that the at least one control device preferably is a control valve. Afterwards, the compressed stream G is fed into the dividing device S and consequently, the resulting streams G(1) and G(2) are fed into the reactive distillation columns K(1) and K(2) respectively. Alternatively, the pressure increase mentioned above is realized not by compressing the stream G prior to, but after dividing. In this alternative embodiment, stream G is fed to a dividing device S and divided in a stream G(1) and a stream G(2). Prior to be fed into the reactive distillation column K(1), the stream G(1) is passed through a compression unit $C_G(1)$, thereby realizing a pressure increase of G(1) in the range of from 0.1 to 0.8 bar, preferably in the range of from 0.15 to 0.6 bar, more preferably in the range of from 0.2 to 0.4 bar. Certainly, said compression of G(1) can be combined with a pre-compression of the stream G prior to dividing; however, it is preferred that this compressing of G(1) is performed with no compression of G being performed prior to dividing. Consequently, in this alternative embodiment, it is also preferred that prior to be fed into the reactive distillation column K(2), the stream G(2) is passed through a compressor $C_G(2)$, thereby realizing a pressure increase of G(2) in the range of from 0.1 to 0.8 bar, preferably in the range of from 0.15 to 0.6 bar, more preferably in the range of from 0.2 to 0.4 bar. Certainly, said compression of G(2) can be combined with a pre-compression of the stream G prior to dividing; however, it is preferred that this compressing of G(2) is performed with no compression of G being performed prior to dividing.

As far as the stream H(1) is concerned, it is preferred that from 99 to 100 weight-%, more preferably from 99.5 to 100 weight-%, more preferably from 99.9 to 100 weight-% of the stream H(1) consist of A(1)OH and water, wherein more preferably from 37.5 to 58 weight-%, more preferably from 40 to 55 weight-%, more preferably from 42.5 to 52 weight-% of the stream H(1) consist of A(1)OH, preferably sodium hydroxide. Preferably the stream H(1) is fed into the reactive distillation column K(1) at a temperature of H(1) in the range of from ambient temperature to its boiling temperature, more preferably in the range of from 50 to 80 °C such as from 50 to 60 °C or from 60 to 70 °C or from 70 to 80 °C. Heating of the stream H(1) to this temperature may be accomplished with any suitable means such as a heat exchanger. It is preferred that the stream H(1) is fed into the top of the reactive distillation column K(1), more preferably to the first theoretical stage from the top.

As to the reactive distillation column K(1), it is preferred that said column has from 5 to 50, more preferably from 10 to 40, more preferably from 15 to 30 theoretical stages, such as from 15 to 20 or from 20 to 25 or from 25 to 30 theoretical stages. Generally, the stream G(1) can be fed at any suitable position into K(1); preferably, G(1) is fed into the reactive distillation column K(1) at a position between the bottoms and the 5th theoretical stage, more preferably between the bottoms and the 3rd theoretical stage, more preferably between the bottoms and the 2nd theoretical stage of the reactive distillation column K(1). Preferably, the reactive distillation column K(1) is operated at a pressure at the top in the range of from 0.5 to 10 bar(abs), more preferably in the range of from 1 to 6 bar(abs), more preferably in the range of from 1 to 5 bar(abs). Suitable preferred ranges are, for example, from 1 to 3 bar(abs) or from 2 to 4 bar(abs) or from 3 to 5 bar(abs). While it is generally possible to operate the reactive distillation column K(1) with reflux, it is preferred that the reactive distillation column K(1) is operated at a reflux ratio of 0:1.

As far as the stream W(1) is concerned which is obtained from the top of K(1), it is preferred that from 99 to 100 weight-%, more preferably from 99.5 to 100 weight-%, more preferably from 99.9 to 100 weight-% of W(1) consist of methanol and water. More preferably, from 1 to 10 weight-%, more preferably from 2 to 8 weight-%, more preferably from 4 to 7 weight-%, more preferably from 5 to 6 weight-% of the stream W(1) consist of water.

As far as the mixture P(1) is concerned, it is preferred that from 99 to 100 weight-%, more preferably from 99.5 to 100 weight-%, more preferably from 99.9 to 100 weight-% of the stream P(1) consist of A(1)OMe, preferably sodium methoxide, and methanol. More preferably, from 10 to 50 weight-%, more preferably from 20 to 40 weight-%, more preferably from 25 to 35 weight-% of the stream P(1) consist of A(1)OMe, preferably sodium methoxide. More preferably, at most 5000 weight-ppm, more preferably at most 2000 weight-ppm, more preferably at most 1000 weight-ppm of the stream P(1) consist of water. Conceivable maximum water contents may include, for example, 750 weight-ppm or 500 weight-ppm or 250 weight-ppm. Preferably, the concentration of A(1)OMe, preferably sodium methoxide in the stream P(1) are realized by the skilled person by operating the reactive distillation column K(1) at a respective reboiler duty.

According to the present invention, it is preferred that the top of the reactive distillation column K(1) is equipped with a suitable droplet separating device D(1), preferably a demister. Thus, the process preferably comprises separating droplets comprising A(1)OH, preferably sodium hydroxide, from the vapor stream in the top of K(1). It is further preferred that, in particular for cleaning purposes, said demister is suitably treated with a suitable stream M(1). A preferred treating may comprise, preferably consist of at least temporarily spraying the demister with the stream M(1). Regarding the chemical composition of M(1), it is especially preferred that M(1) comprises methanol, wherein it is more preferred that M(1) is branched from a condensed top

stream removed from the rectification column D, for example one of the streams described above, or being a fresh methanol stream, for example a stream branched from the stream M described above.

- 5 As far as the stream H(2) is concerned, it is preferred that from 99 to 100 weight-%, more preferably from 99.5 to 100 weight-%, more preferably from 99.9 to 100 weight-% of the stream H(2) consist of A(2)OH, preferably potassium hydroxide, and water, wherein more preferably 30 to 55 weight-%, more preferably from 40 to 52.5 weight-%, more preferably from 45 to 50 weight-% of the stream H(2) consist of A(2)OH, preferably potassium hydroxide. Preferably the
10 stream H(2) is fed into the reactive distillation column K(2) at a temperature of H(2) in the range of from ambient temperature to its boiling temperature, more preferably in the range of from 50 to 80 °C such as from 50 to 60 °C or from 60 to 70 °C or from 70 to 80 °C. Heating of the stream H(2) to this temperature may be accomplished with any suitable means such as a heat exchanger. It is preferred that the stream H(2) is fed into the top of the reactive distillation column
15 K(2), more preferably to the first theoretical stage from the top.

- As to the reactive distillation column K(2), it is preferred that said column has from 5 to 50, more preferably from 10 to 40, more preferably from 15 to 30 theoretical stages, such as from 15 to 20 or from 20 to 25 or from 25 to 30 theoretical stages. Generally, the stream G(2) can be fed at
20 any suitable position into K(2); preferably, G(2) is fed into the reactive distillation column K(2) at a position between the bottoms and the 5th theoretical stage, more preferably between the bottoms and the 3rd theoretical stage, more preferably between the bottoms and the 2nd theoretical stage of the reactive distillation column K(2). Preferably, the reactive distillation column K(2) is operated at a pressure at the top in the range of from 0.5 to 10 bar(abs), more preferably in the
25 range of from 1 to 6 bar(abs), more preferably in the range of from 1 to 5 bar(abs). Suitable preferred ranges are, for example, from 1 to 3 bar(abs) or from 2 to 4 bar(abs) or from 3 to 5 bar(abs). While it is generally possible to operate the reactive distillation column K(2) with reflux, it is preferred that the reactive distillation column K(2) is operated at a reflux ratio of 0:1.

- 30 As far as the stream W(2) is concerned which is obtained from the top of K(2), it is preferred that from 99 to 100 weight-%, more preferably from 99.5 to 100 weight-%, more preferably from 99.9 to 100 weight-% of W(2) consist of methanol and water. More preferably, from 1 to 15 weight-%, more preferably from 2 to 12 weight-%, more preferably from 6 to 10 weight-% of the stream W(2) consist of water.

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As far as the mixture P(2) is concerned, it is preferred that from 99 to 100 weight-%, more preferably from 99.5 to 100 weight-%, more preferably from 99.9 to 100 weight-% of the stream P(2) consist of A(2)OMe, preferably potassium methoxide, and methanol. More preferably, from 10

to 50 weight-%, more preferably from 20 to 40 weight-%, more preferably from 25 to 35 weight-% of the stream P(2) consist of A(2)OMe, preferably potassium methoxide. More preferably, at most 5000 weight-ppm, more preferably at most 2000 weight-ppm, more preferably at most 1000 weight-ppm of the stream P(2) consist of water. Conceivable maximum water contents
5 may include, for example, 750 weight-ppm or 500 weight-ppm or 250 weight-ppm. Preferably, the concentration of A(2)OM, preferably potassium methoxide in the stream P(2) are realized by the skilled person by operating the reactive distillation column K(2) at a respective reboiler duty.

According to the present invention, it is preferred that the top of the reactive distillation column
10 K(2) is equipped with a suitable droplet separating device D(2), preferably a demister. Thus, the process preferably comprises separating droplets comprising A(2)OH, preferably potassium hydroxide, from the vapor stream in the top of K(2). It is further preferred that, in particular for cleaning purposes, said demister is suitably treated with a suitable stream M(2). A preferred treating may comprise, preferably consist of at least temporarily spraying the demister with the
15 stream M(2). Regarding the chemical composition of M(2), it is especially preferred that M(2) comprises methanol, wherein it is more preferred that M(2) is branched from a condensed top stream removed from the rectification column D, for example one of the streams described above, or being a fresh methanol stream, for example a stream branched from the stream M described above.

20

In the above, it was described that according to the present invention, the stream G, prior to dividing, is preferably passed through a compression unit C_G. According to the present invention, it is also possible that either in addition to at least one of the above alternatives or, preferably as the sole respective compression, prior to being fed into the rectification column D, the stream
25 W(1) is passed through a compression unit C_G(1), thereby realizing a pressure increase of W(1) preferably in the range of from 0.1 to 0.8 bar, more preferably in the range of from 0.15 to 0.6 bar, more preferably in the range of from 0.2 to 0.4 bar, and prior to being fed into the rectification column D, the stream W(2) is passed through a compression unit C_G(2), thereby realizing a pressure increase of W(2) in the range of from 0.1 to 0.8 bar, more preferably in the range of
30 from 0.15 to 0.6 bar, more preferably in the range of from 0.2 to 0.4 bar. According to this embodiment of the present invention, it is also possible to suitably combine the streams W(1) and W(2), prior to being passed through a compressor, in a combining device to obtain a respective combined stream W, and pass said combined stream W, prior to being fed into D, through a compressor, thereby realizing a pressure increase of W(1) preferably in the range of from 0.1 to
35 0.8 bar, more preferably in the range of from 0.15 to 0.6 bar, more preferably in the range of from 0.2 to 0.4 bar. Said combining device preferably comprises a pipe junction and at least one control device, preferably a control valve.

As far as the integrated process of the present invention is concerned, it is noted that for simultaneously preparing, in addition to the 2 mixtures P(1) and P(2) as described above in detail, a 3rd mixture P(3) etc. can be obtained, the skilled person, based on his general knowledge, will be in the position to derive from said details above in a straight-forward manner also any detail adjusting the overall process. . According to the present invention, it is also conceivable that from at least one of the streams P(i), A(i)OMe is at least partially separated from methanol, more preferably obtaining solid, more preferably crystalline A(i)OMe. Thus, solid, preferably crystalline sodium methoxide and solid, preferably crystalline potassium methoxide, can be obtained.

2nd aspect - Chemical production unit

A second aspect of the invention relates to a chemical production unit for carrying out the process according to the first aspect of the invention, comprising

- 15 - a rectification column D comprising
 - in its lower part, inlet means for feeding streams W(i) or one or more combined stream thereof into D;
 - in its upper part, outlet means for removing a vapor stream V or divided streams thereof, comprising at least a gaseous stream G and at a stream T(1a), from the top of D;
 - 20 -- at least one reboiler V(1a);
- optionally a stream dividing device S_o for dividing V or substreams of V into (further) sub streams thereof;
- 25 - a first compressor C_T(1) for compressing T(1a) or a part thereof;
- means for passing compressed sub streams of T(1) from C_T(1) as heating medium through reboiler V(1a);
- a stream dividing device S for dividing the stream G into n streams G(i);
- means for passing the stream G to said stream dividing device S;
- 30 - n reactive distillation columns K(i), n≥2 and i=1...n; said reactive distillation columns K(i) being arranged in parallel, each reactive distillation column K(i) comprising
 - in its upper part, preferably in its top, inlet means for feeding a stream H(i) into K(i);
 - in its lower part, inlet means for feeding a stream G(i) into K(i);
 - outlet means for removing a stream W(i) from the top of K(i);
 - 35 -- a bottom reboiler;
 - outlet means for removing a bottoms stream from K(i);
 - a stream dividing means for separating a stream P(i) from the bottoms stream removed from K(i);

- means for passing the streams $G(i)$ to the reactive distillation columns $K(i)$;
- means for exchanging heat and/or for combining at least one of the streams $W(i)$ with a methanol stream M and means for feeding resulting stream(s) into D ;
- means for passing at least another one of the streams $W(i)$ to the rectification column D ;
- one or more compressors $C(i)$ for compressing either the stream G and/or the streams $G(i)$ and/or the streams $W(i)$.

Means for exchanging heat are preferably one or more heat exchanger(s), means for combining at least one of the streams $W(i)$ with a methanol stream M are preferably one or more mixing device(s).

- 15 In some preferred embodiments, the means for passing at least another one of the streams $W(i)$ to the rectification column D are combined with means for feeding said at least another one of the streams $W(i)$ into D . Preferably, these means for feeding said at least another one of the streams $W(i)$ into D are differently located than the means for feeding stream(s) resulting from exchanging heat and/or from combining at least one of the streams $W(i)$ with a methanol stream
- 20 M into D . Preferably, each of the means for feeding stream(s) resulting from exchanging heat and/or from combining at least one of the streams $W(i)$ with a methanol stream M into D are located at a position of D which is above the position of the means for feeding the at least another one of the streams $W(i)$ into D .
- 25 In some preferred embodiments, the means for passing at least another one of the streams $W(i)$ into the rectification column D are located at a position $I(1)$ of the rectification column D .

In some preferred embodiments, the chemical production unit further comprises at least one heat exchanger E as means for exchanging heat from a stream $W(2)$ with a methanol stream M and means for feeding a stream M having a temperature T_{M2} with $T_{M2} > T_{M1}$, into the rectification column D at a position $I(M)$ as well as means for feeding a partially condensed stream $W_{C(2)}$ obtained from the heat exchanger E having a temperature $T_{WC(2)}$ with $T_{WC(2)} < T_{W(2)}$ into the rectification column D at a position $I(2)$, which is different from $I(1)$. Preferably, $I(M) \neq I(1) \neq I(2)$.

- 35 In some preferred embodiments, the chemical production unit further comprises a heat exchanger $E(1a)$ as means for exchanging heat from a stream $W(2)$ with a methanol stream M and means for feeding a stream M having a temperature T_{M2} with $T_{M2} > T_{M1}$, into the rectification column D at a position $I(M)$. Preferably, the chemical production unit further comprises at least

another heat exchanger E(1b), through which a partially condensed stream $W_{C1}(2)$ obtained from the heat exchanger E(1a) having a temperature $T_{WC(2)}$ with $T_{WC(2)} < T_{W(2)}$ is passed, thereby obtaining a completely condensed stream $W_{C2}(2)$ having a temperature $T_{WC2(2)}$ with $T_{WC2(2)} < T_{WC1(2)}$. The chemical production unit preferably comprises means for feeding $W_{C2}(2)$ into the
5 rectification column D at a position I(2). Preferably, $I(M) \neq I(1) \neq I(2)$.

In some preferred embodiments, the chemical production unit further comprises a heat exchanger E(2), through which a stream W(2) having a temperature $T_{W(2)}$ is passed, wherein a heat transfer takes place with a cooling medium. The chemical production unit preferably further
10 comprises a mixing device, in which a condensed stream $W_C(2)$ having a temperature $T_{WC(2)}$ with $T_{WC(2)} < T_{W(2)}$ coming from E(2) is mixed with the stream M. Preferably, the chemical production unit further comprises means for feeding the admixed stream into the rectification column D at a position I(M). Preferably, $I(M) \neq I(1)$.

15 In some preferred embodiments, the chemical production unit further comprises at least one mixing device, in which a stream W(2) having a temperature $T_{W(2)}$ is combined with the stream M having a temperature T_{M1} with $T_{W(2)} > T_{M1}$, resulting in an at least partial condensation of the stream W(2). The chemical production unit further preferably comprises means for feeding the admixed stream into the rectification column D at a position I(M). Preferably, $I(M) \neq I(1)$.

20 In some preferred embodiments, the chemical product unit comprises an intermediate reboiler V(1a) and a bottom reboiler V(1b) and further a second compressor $C_T(2)$ for compressing T(1b) and means for passing compressed sub streams of T(1) from $C_T(2)$ as heating medium through bottom reboiler V(1b).

25 All details, embodiments and preferred embodiments as well as alternative (preferred) embodiments described above in the section related to the first aspect of the invention apply also for the second aspect of the invention.

30 In some preferred embodiments, the chemical product unit comprises means for passing condensed sub streams of T(1a) and optionally of T(1b) after passage through reboiler V(1a) and optionally through bottom reboiler V(1b) into D, the means preferably comprising

- at least one condenser, preferably a condenser V(2) and optionally a further condenser V(3) arranged downstream of V(2), having inlet means for receiving condensed stream of
35 T(1a) after passage through intermediate reboiler V(1a) and optionally condensed stream T(1b) after passage through bottom reboiler V(1b), and having outlet means for removing a condensed stream T(3) and for removing a waste gas stream;
- inlet means for feeding the stream T(3) to the top of D.

Preferably, the top of at least one, more preferably of each reactive distillation column $K(i)$ is equipped with a droplet separating device $D(i)$, more preferably a demister, said demister more preferably comprising an inlet means for feeding a stream $M(i)$ comprising methanol into said demister. Preferably each of the reactive distillations columns $K(i)$ comprises, independently from one another, from 5 to 50, more preferably from 10 to 40, more preferably from 15 to 30 theoretical stages. It is preferred that the means for passing the streams $G(i)$ to the reactive distillation columns $K(i)$ are located, independently from one another, at a position between the bottoms and the fifth theoretical stage, more preferably between the bottoms and the third theoretical stage, more preferably between the bottoms and the second theoretical stage of $K(i)$. Preferably, the means for passing the streams $H(i)$ into the reactive distillation columns $K(i)$ are located at the top of $K(i)$, preferably at the uppermost theoretical stage. Preferably at least one, more preferably each reactive distillation columns $K(i)$ does not comprise means for being operated at a reflux ratio of greater than 0:1. Preferably each reactive distillation column $K(i)$ is equipped with trays.

It is preferred that the chemical production unit of the present invention comprises at least one compression unit C_G arranged upstream of $K(i)$ for compressing the stream G before passage into the stream dividing device S . Alternatively, it is preferred that the unit of the present invention comprises n compressors $C(i)$ arranged downstream of $K(i)$ and upstream of D for compressing the streams $W(i)$.

It is preferred that the unit of the present invention further comprises at least one condensate drum (second condensate drum $CD(2)$) for a liquid stream removed from $V(2)$ and optionally from $V(3)$ and further comprising means for passing at least part of the liquid contained in said drum as the stream $T(3)$ to the top of D . According to the present invention, it is preferred that the unit further comprises at least one (first) condensate drum $CD(2)$ for the condensed stream removed from, preferably intermediate, reboiler $V(1a)$ and optional, preferably bottom, reboiler $V(1b)$, the unit more preferably further comprising means for passing at least part of a gas phase obtained in said first condensate drum $CD(1)$ to $V(2)$ and means for passing at least part of a liquid phase obtained in said first condensate drum $CD(1)$ to a second condensate drum $CD(2)$ as defined in the foregoing.

In the context of the present invention, it is also conceivable that suitable reactive distillation columns $K(i)$ are essentially bubble cap tray, valve tray and sieve tray columns. Specifically in the case of valve trays and sieve trays, the trays should be configured so that the raining-through of the liquid is minimized. A person skilled in the art will be familiar with the constructional measures required for this. It is also conceivable that the columns are provided with random

packing elements or structured packings, with structured packings being preferred over random packing elements with a view to uniform distribution of the liquid.

Further, it may be preferred that the unit further comprises means for separating an alkali metal methoxide A(i)OMe from at least one of the streams P(i). Preferably, the number of reactive distillation columns K(i), n, is in the range of from 2 to 10, more preferably in the range of from 2 to 5, more preferably 2 or 3, more preferably 2.

3rd aspect – Use

10

A third aspect of the invention relates to the use of a chemical production unit according to the first aspect of the invention or of a process according to the second aspect of the invention for simultaneously producing n mixtures P(i) comprising alkali metal methoxide and methanol, n being an integer with $n \geq 2$ and $i = 1 \dots n$, wherein

15 either at least 2 of the mixtures P(i) comprise different alkali metal methoxides A(i)OMe, and/or at least 2 of the mixtures P(i) comprise the same alkali metal alkoxide A(i)OMe at different concentrations.

20 All details, embodiments and preferred embodiments as well as alternative (preferred) embodiments described above in the section related to the first aspect of the invention or in the section related to the second aspect of the invention of the invention apply also for the third aspect of the invention.

25 The present invention is further illustrated by the following set of embodiments and combinations of embodiments resulting from the dependencies and back-references as indicated. In particular, it is noted that in each instance where a range of embodiments is mentioned, for example in the context of a term such as "The process of any one of embodiments 1 to 4", every embodiment in this range is meant to be explicitly disclosed for the skilled person, i.e. the wording of this term is to be understood by the skilled person as being synonymous to "The process of
30 any one of embodiments 1, 2, 3 and 4". Further, it is explicitly noted that the following set of embodiments is not the set of claims determining the extent of protection, but represents a suitably structured part of the description directed to general and preferred aspects of the present invention.

35 1. An integrated process for simultaneously preparing n mixtures P(i) comprising alkali metal methoxide and methanol, comprising providing n reactive distillation columns K(i);

- providing n aqueous liquid streams $H(i)$, a given stream $H(i)$ comprising a dissolved alkali metal hydroxide $A(i)OH$, wherein n is an integer with $n \geq 2$ and $i = 1 \dots n$; and providing a rectification column D comprising at least one reboiler $V(1a)$; wherein the process comprises preparing the one or more alkali metal methoxides in the reactive distillation column $K(i)$ under reactive distillation conditions from the n streams $H(i)$ and n streams $G(i)$ comprising methanol, thereby obtaining n vapor top streams $W(i)$ comprising methanol and water; and obtaining n bottoms streams $P(i)$ comprising alkali metal methoxide $A(i)OMe$ and methanol;
- the process further comprising
- (a) obtaining a vapor phase V comprising methanol at the top of the rectification column D , said vapor phase V having a pressure p_V and a temperature T_V ;
 - (b) preparing at least two streams from the vapor phase V , comprising a vapor stream G having a pressure p_G and a temperature T_G with $0.95 \leq p_G/p_V \leq 1.05$, and further comprising a stream $T(1a)$, said stream $T(1a)$ having a pressure $p_{T(1a)}$ and a temperature $T_{T(1a)}$ with $p_{T(1a)} > p_V$;
 - (c) preparing the n streams $G(i)$ from the vapor stream G , each of the streams $G(i)$ having a pressure $p_{G(i)}$ and a temperature $T_{G(i)}$ with $p_{G(i)} > p_G$ for each stream $G(i)$; and feeding each stream $G(i)$ into the respective reactive distillation column $K(i)$;
 - (d) passing at least a part of the stream $T(1a)$ as a heating medium through the reboiler $V(1a)$ of the rectification column D , obtaining a, preferably at least partially condensed, stream $T_C(1a)$ having a temperature $T_{T_C(1a)}$ with $T_{T_C(1a)} < T_{T(1a)}$;
 - (e) feeding at least a part of the stream $T_C(1a)$ into the rectification column D ;
 - (f) feeding at least a part of a first vapor stream $W(1)$ into the lower part of the rectification column D at a position $I(1)$;
 - (g) at least partially condensing at least a part of a second vapor stream $W(2)$, obtaining an at least partially condensed stream $W_C(2)$, and feeding at least a part of the stream $W_C(2)$ into the rectification column D at a position $I(2)$.
2. The process of embodiment 1, further comprising for at least one reactive distillation column $K(i)$, preferably for n reactive distillation columns $K(i)$, feeding the stream $G(i)$ into the lower part of the reactive distillation column $K(i)$ and feeding the aqueous liquid stream $H(i)$ into the upper part of the reactive distillation column $K(i)$.
 3. The process of embodiment 1 or 2, wherein the stream $H(1)$ comprises dissolved sodium hydroxide and the stream $H(2)$ comprises dissolved potassium hydroxide, wherein sodium methoxide is prepared in the reactive distillation column $K(1)$ from which the stream $W(1)$ is obtained and potassium methoxide is prepared in the reactive distillation column $K(2)$ from which the stream $W(2)$ is obtained.

4. The process of any one of embodiments 1 to 3, wherein $n = 2$.
5. The process of any one of embodiments 1 to 4, further comprising
- 5 (h) feeding a stream M comprising methanol into the rectification column D at a position $I(M)$.
6. The process of embodiment 5, wherein (g) comprises passing the vapor stream $W(2)$ having a temperature $T_{W(2)}$ through at least one heat exchanger E, obtaining an at least partially condensed stream $W_C(2)$ having a temperature $T_{WC(2)}$ with $T_{WC(2)} < T_{W(2)}$, and feeding at least a part of the at least partially condensed stream $W_C(2)$ into the rectification column D at the position $I(2)$; and wherein (h) comprises passing the stream M having a temperature T_{M1} through one or more of said at least one of heat exchangers E, obtaining a stream M having a temperature T_{M2} with $T_{M2} > T_{M1}$, and feeding the stream M having the temperature T_{M2} into the upper part of the rectification column D at the position $I(M)$, wherein preferably, $I(M)$ is above $I(2)$ and $I(2)$ is above $I(1)$.
- 10 7. The process of embodiment 6, wherein (g) comprises
- (g.1) passing the vapor stream $W(2)$ having a temperature $T_{W(2)}$ through a heat exchanger
- 20 E(1a), obtaining a partially condensed stream $W_C(2)$ having a temperature $T_{WC(2)}$ with $T_{WC(2)} < T_{W(2)}$;
- (g.2) feeding at least a part of the at least partially condensed stream $W_C(2)$ into the lower part of the rectification column D at the position $I(2)$;
- and wherein (h) comprises
- 25 (h.1) passing the stream M having the temperature T_{M1} through the heat exchanger E(1a), obtaining the stream M having the temperature T_{M2} ;
- (h.2) feeding the stream M having the temperature T_{M2} into the upper part of the rectification column D at the position $I(M)$,
- wherein preferably, $I(M)$ is above $I(2)$ and $I(2)$ is above $I(1)$.
- 30 8. The process of embodiment 6, wherein (g) comprises
- (g.1') passing the vapor stream $W(2)$ having a temperature $T_{W(2)}$ through a heat exchanger E(1a), obtaining a partially condensed stream $W_{C1}(2)$ having a temperature $T_{WC1(2)}$ with $T_{WC1(2)} < T_{W(2)}$;
- 35 (g.2') passing the stream $W_{C1}(2)$ having the temperature $T_{WC1(2)}$ through a heat exchanger E(1b), obtaining a, preferably completely condensed, stream $W_{C2}(2)$ having a temperature $T_{WC2(2)}$ with $T_{WC2(2)} < T_{WC1(2)}$;

- (g.3') feeding at least a part of the stream $W_{C2}(2)$ into the lower part of the rectification column D at the position I(2);
 and wherein (h) comprises
 (h.1) passing the stream M having the temperature T_{M1} through the heat exchanger
 5 E(1a), obtaining the stream M having the temperature T_{M2} ;
 (h.2) feeding at least a part of the stream M having the temperature T_{M2} into the upper part of the rectification column D at the position I(M),
 wherein preferably, I(M) is above I(2) and I(2) is above I(1).
- 10 9. The process of embodiment 5, wherein (g) and (h) comprise passing the vapor stream $W(2)$ having a temperature $T_{W(2)}$ through at least one heat exchanger E(2), obtaining an at least partially, preferably essentially completely, condensed stream $W_C(2)$ having a temperature $T_{WC(2)}$ with $T_{WC(2)} < T_{W(2)}$; and admixing the stream M, prior to feeding it into the rectification column D at the position I(M), with at least a part of the stream $W_C(2)$, wherein
 15 I(M) = I(2), wherein preferably, I(M) is above I(1).
10. The process of embodiment 5, wherein (g) and (h) comprise admixing the vapor stream $W(2)$ having a temperature $T_{W(2)}$ with the stream M having a temperature T_{M1} with
 20 $T_{W(2)} > T_{M1}$, thereby at least partially condensing the stream $W(2)$, and feeding the stream obtained from mixing into the rectification column D at the position I(M), wherein I(M) = I(2), wherein preferably, I(M) is above I(1).
11. The process of any one of embodiments 1 to 10, wherein the rectification column D comprises at least one reboiler V(1a) and at least one reboiler V(1b) and wherein the at least
 25 one reboiler V(1a) is an intermediate reboiler and the at least one reboiler V(1b) is a bottom reboiler;
 wherein (b) comprises preparing at least three streams from the vapor phase V, comprising the vapor stream G having a pressure p_G and a temperature T_G with $0.95 \leq p_G/p_V \leq 1.00$, and further comprising two streams T(1a) and T(1b), said stream T(1a) having a
 30 pressure $p_{T(1a)}$ and a temperature $T_{T(1a)}$ and said stream T(1b) having a pressure $p_{T(1b)}$ and a temperature $T_{T(1b)}$ with $p_{T(1a)} > p_V$, and $p_{T(1b)} > p_V$,
 wherein (d) comprises
 (d.1) passing at least a part of the stream T(1a) as a heating medium through a reboiler
 35 V(1a) of the rectification column D, obtaining a stream $T_C(1a)$ having a temperature $T_{Tc(1a)}$ with $T_{Tc(1a)} < T_{T(1a)}$;
 (d.2) passing at least a part of the stream T(1b) as a heating medium through a reboiler V(1b) of the distillation column D, obtaining a stream $T_C(1b)$ having a temperature $T_{Tc(1b)}$ with $T_{Tc(1b)} < T_{T(1b)}$; and

wherein (e) comprises

(e.1) feeding at least a part of the stream $T_c(1a)$ into the rectification column D;

(e.2) feeding at least a part of the stream $T_c(1b)$ into the rectification column D.

- 5 12. The process of embodiment 11, wherein preparing the at least three streams according to (b) comprises
- (b.1) splitting the vapor phase V into at least two vapor streams comprising the stream G and a vapor stream T(1) having a pressure $p_{T(1)}$ and a temperature $T_{T(1)}$ with $0.95 \leq p_{T(1)}/p_v \leq 1.00$;
- 10 (b.2) preparing at least the two streams T(1a) and T(1b) from the vapor stream T(1).
13. The process of any one of embodiments 1 to 12, wherein the rectification column D is operated at a pressure at the top of D in the range of from 0.5 to 10 bar(abs), preferably in the range of from 0.75 to 6 bar(abs), more preferably in the range of from 1 to 5 bar(abs),
- 15 more preferably in the range of from 1 to 3 bar(abs).
14. The process of any one of embodiments 1 to 13, wherein the rectification column D is operated at a temperature at the top of D in the range of from 45 to 137 °C, preferably in the range of 49 to 118, more preferably in the range of from 64 to 111 °C, more preferably in
- 20 the range of from 64 to 95°C.
15. The process of any one of embodiments 1 to 14, wherein the rectification column is operated without top vapor recompression.
- 25 16. The process of any one of embodiments 1 to 14, wherein the rectification column D is operated at a reflux ratio of at least 0.5:1, preferably in the range of from 0.55:1 to 1.4:1, or preferably in the range of from 0.6:1 to 1.4:1.
17. The process of embodiment 16, wherein the rectification column D is operated with top
- 30 vapor recompression.
18. The process of embodiment 16 or 17, wherein realizing the reflux ratio comprises preparing from the vapor phase V a further vapor stream T(2), passing said stream T(2) through a condenser V(2), obtaining a liquid stream T(3) and a waste gas stream T(2w), and feed-
- 35 ing the liquid stream T(3) into the top of the rectification column D.
19. The process of embodiment 18, wherein the waste gas stream T(2w) essentially consists of oxygen, nitrogen, carbon dioxide and methanol, wherein the amount of methanol in

T(2w) is preferably in the range of from 2 to 80 weight-%, preferably in the range of from 10 to 30 weight-% based on the total weight of T(2w).

20. The process of embodiment 18 or 19, wherein at least a part of T_c(1a) is fed to a first condensate drum CD(1), wherein from said first condensate drum CD(1), a gas stream T(1g) and a liquid stream T(1l) are removed, said gas stream T(1g) being fed into the condenser V(2) together with T(2) and said liquid stream T(1l) being combined with the liquid streams T(2l) and (T2gl) in depressurized form, obtaining a combined liquid stream which is fed as the stream T(3) into the top of the rectification column D.
21. The process of any one of embodiments 1 to 20, wherein vapor phase V has a pressure p_v, in the range of from 0.5 to 10 bar(abs), preferably in the range of from 0.75 to 6 bar(abs), more preferably in the range of from 1 to 5 bar(abs), more preferably in the range of from 1 to 3 bar(abs).
22. The process of any one of embodiments 1 to 21, wherein vapor phase V has a temperature T_v in the range of from 45 to 137 °C, preferably in the range of 49 to 118, more preferably in the range of from 64 to 111 °C, more preferably in the range of from 64 to 95 °C.
23. The process of any one of embodiments 1 to 22, wherein a stream T(Di) is taken from the rectification column D and passed for heating purpose through reboiler V(1a) of the rectification column D, obtaining a heated stream T_h(Di) having a temperature T_{Th}(Di) with T_{Th}(Di) > T_T(Di), wherein heated stream T_h(Di) is reintroduced into rectification column D.
24. The process of embodiment 23, wherein stream T(1a) has a pressure p_{T(1a)}, which is adjusted so that T_{condT(1a)} is ≥ T_{boilT(Di)} + 3 K, wherein T_{condT(1a)} is the condensation temperature of stream T(1a) at a pressure p_{T(1a)} and T_{boilT(Di)} is the boiling temperature of stream T(Di) at a pressure p_{T(Di)}.
25. The process of embodiment 23 or 24, wherein stream T(1a) has a condensation temperature T_{condT(1a)} which is in the range of from 3 to 30 K, preferably in the range of from 4 and 25 K, more preferably in the range of from 5 and 20 K, higher than T_{boilT(Di)}.
26. The process of any one of embodiments 1 to 25, wherein a stream T(Db) is taken from the rectification column D and passed for heating purpose through reboiler V(1b) of the rectification column D, obtaining a heated stream T_h(Db) having a temperature T_{Th}(Db) with T_{Th}(Db) > T_T(Db), wherein heated stream T_h(Db) is reintroduced into rectification column D.

27. The process of embodiment 26, wherein stream T(1b) has a pressure $p_{T(1b)}$, which is adjusted so that $T_{\text{cond}T(1b)} \geq T_{\text{boil}T(\text{Db})} + 3 \text{ K}$, wherein $T_{\text{cond}T(1b)}$ is the condensation temperature of stream T(1b) at a pressure $p_{T(1b)}$ and $T_{\text{boil}T(\text{Db})}$ is the boiling temperature of stream T(Db) at a pressure $p_{T(\text{Db})}$.
- 5
28. The process of embodiment 26 or 27, wherein T(1b) has a condensation temperature $T_{\text{cond}T(1b)}$ which is in the range of from 3 to 30 K, preferably in the range of from 4 and 25 K, more preferably in the range of from 5 and 20 K, higher than $T_{\text{boil}T(\text{Db})}$.
- 10
29. The process of any one of embodiments 1 to 28, further comprising for at least one reactive distillation column K(i), preferably for n reactive distillation columns K(i), feeding the stream G(i) into the lower part of the reactive distillation column K(i) and feeding the aqueous liquid stream H(i) into the upper part of the reactive distillation column K(i).
- 15
30. The process of any one of embodiments 1 to 29, wherein prior to preparing the n streams G(i) from the vapor stream G according to (c), the stream G is passed through a compressor C_G, thereby obtaining a compressed stream G_c having a pressure p_{Gc} and a temperature T_{Gc} with $p_{Gc} > p_G$.
- 20
31. The process of any one of embodiments 1 to 29, wherein prior to be fed into the reactive distillation column K(i), each of the n streams G(i) is passed through a compressor C(i), thereby obtaining n compressed streams G_{c(i)} having a pressure $p_{Gc(i)}$ and a temperature $T_{Gc(i)}$ with $p_{Gc(i)} > p_G$.
- 25
32. The process of any one of embodiments 1 to 31, wherein a stream H(1) comprises dissolved sodium hydroxide and a stream H(2) comprises dissolved potassium hydroxide, wherein sodium methoxide is prepared in the reactive distillation column K(1) from which the stream W(1) is obtained and potassium methoxide is prepared in the reactive distillation column K(2) from which the stream W(2) is obtained.
- 30
33. The process of any one of embodiments 1 to 32, wherein n = 2.
34. The process of embodiment 33, wherein the stream H(1) comprises dissolved sodium hydroxide and the stream H(2) comprises dissolved potassium hydroxide, wherein sodium methoxide is prepared in the reactive distillation column K(1) from which the stream W(1) is obtained and potassium methoxide is prepared in the reactive distillation column K(2) from which the stream W(2) is obtained.
- 35

35. The process of embodiment 33 or 34, wherein the stream $W(1)$ comprises methanol and water at a molar methanol-to-water ratio $r(1)$ and wherein the stream $W(2)$ comprises methanol and water at a molar methanol-to-water ratio $r(2)$ with $r(2) < r(1)$.
- 5 36. A chemical production unit for carrying out the process according to any one of embodiments 1 to 35, comprising
- a rectification column D comprising
 - in its lower part, inlet means for feeding streams $W(i)$ or one or more combined stream thereof into D;
 - 10 -- in its upper part, outlet means for removing a vapor stream V or divided streams thereof, comprising at least a gaseous stream G and at a stream $T(1a)$, from the top of D;
 - at least one reboiler $V(1a)$;
 - optionally a stream dividing device S_o for dividing V or substreams of V into (further)
15 sub streams thereof;
 - a first compressor $C_T(1)$ for compressing $T(1a)$ or a part thereof;
 - means for passing compressed sub streams of $T(1)$ from $C_T(1)$ as heating medium through reboiler $V(1a)$;
 - a stream dividing device S for dividing the stream G into n streams $G(i)$;
 - 20 - means for passing the stream G to said stream dividing device S;
 - n reactive distillation columns $K(i)$, $n \geq 2$ and $i = 1 \dots n$; said reactive distillation columns $K(i)$ being arranged in parallel, each reactive distillation column $K(i)$ comprising
 - in its upper part, preferably in its top, inlet means for feeding a stream $H(i)$ into $K(i)$;
 - 25 -- in its lower part, inlet means for feeding a stream $G(i)$ into $K(i)$;
 - outlet means for removing a stream $W(i)$ from the top of $K(i)$;
 - a bottom reboiler;
 - outlet means for removing a bottoms stream from $K(i)$;
 - a stream dividing means for separating a stream $P(i)$ from the bottoms stream
30 removed from $K(i)$;
 - means for passing the streams $G(i)$ to the reactive distillation columns $K(i)$;
 - means for exchanging heat and/or for combining at least one of the streams $W(i)$ with a methanol stream M and means for feeding resulting stream(s) into D;
 - 35 - means for passing at least another one of the streams $W(i)$ to the rectification column D;

- one or more compressors C(i) for compressing either the stream G and/or the streams G(i) and/or the streams W(i).
37. The chemical production unit of embodiment 36, comprising an intermediate reboiler V(1a) and a bottom reboiler V(1b), further comprising a second compressor C_T(2) for compressing T(1b) and means for passing compressed sub streams of T(1) from C_T(2) as heating medium through bottom reboiler V(1b).
38. The chemical production unit of embodiment 36 or 37 comprising means for passing condensed sub streams of T(1a) and optionally of T(1b) after passage through reboiler V(1a) and optionally through bottom reboiler V(1b) into D, the means preferably comprising
- at least one condenser, preferably a condenser V(2) and optionally a further condenser V(3) arranged downstream of V(2), having inlet means for receiving condensed stream of T(1a) after passage through intermediate reboiler V(1a) and optionally condensed stream T(1b) after passage through bottom reboiler V(1b), and having outlet means for removing a condensed stream T(3) and for removing a waste gas stream;
 - inlet means for feeding the stream T(3) to the top of D.
38. Use of a chemical production unit according to embodiment 36 or 37 or of a process according to any one of embodiments 1 to 35 for simultaneously producing n mixtures P(i) comprising alkali metal methoxide and methanol, n being an integer with $n \geq 2$ and $i = 1 \dots n$, wherein either at least 2 of the mixtures P(i) comprise different alkali metal methoxides A(i)OMe, and/or at least 2 of the mixtures P(i) comprise the same alkali metal alkoxide A(i)OMe at different concentrations.

The present invention is further illustrated by the following reference examples, comparative examples, and examples.

Examples

1. Reference Example 1: Simultaneous production of sodium methoxide and potassium

methoxide without top vapor recompression in rectification column D

Fig. 5 shows the process scheme for preparing a mixture P(1) comprising NaOMe and MeOH and a mixture P(2) comprising KOMe and MeOH according to Reference Example 1. Regarding the operating conditions of the distillation column D and of the reactive distillation columns K(1) and K(2), reference is made to Table 1a below. Regarding the relative mass flow rates, reference is made to Table 1b below.

5

Table 1a

Operating conditions of the columns D, K(1) and K(2)

Column D	Pressure at the top / bar(abs)	2.1
	Temperature at the top / °C	84
	Pressure at the bottom / bar(abs)	2.23
	Temperature at the bottom / °C	124
	Theoretical stages	50
	W(1), W(2) to theoretical stage from bottom	8th
	M fed to theoretical stage from bottom	42th
Column K(1)	Pressure at the top / bar(abs)	2.15
	Temperature at the top / °C	89
	Pressure at the bottom / bar(abs)	2.3
	Temperature at the bottom / °C	117
	Number of trays	40
Column K(2)	Pressure at the top / bar(abs)	2.15
	Temperature at the top / °C	89
	Pressure at the bottom / bar(abs)	2.3
	Temperature at the bottom / °C	116
	Number of trays	40

10 **Table 1b**

Relationships between the mass flow rates f of the different streams

Definition of streams	Specified:	H(1), H(2)
	M(1), M(2):	part of condensate from V(2)
	H(1):	NaOH 50 weight-% in water
	H(2):	KOH 48 weight-% in water
Ratios of mass flow rates of streams	$f(G(1)) / f(H(1))$	13.3
	$f(G(2)) / f(H(2))$	9.03
	$f(M(1)) / f(H(1))$	0.55

	$f(M(2)) / f(H(2))$	0.40
	$f(T(3)) / f(G)^*$	0.92
	$f(P(1)) / f(H(1))$	2.25
	$f(P(2)) / f(H(2))$	1.86
	$f(\text{waste gas}) / f(G)^*$	< 0.0015

*) $f(G) = f(G(1)) + f(G(2))$

P(1): 30 weight-% of sodium methoxide in methanol, < 1000 ppm of water.

P(2): 32 weight-% of potassium methoxide in methanol, < 1000 ppm of water.

5

In the following, it is indicated how the mass flow rate of the methanol contained in the stream M (methanol balance, fresh methanol stream), $f_{\text{MeOH}}(M)$, is calculated. In this calculation, the water contents of P(1) and P(2), both being less than 1000 weight-ppm, are neglected. According to this calculation, $f_{\text{MeOH}}(P(1))$ is the mass flow rate of MeOH contained in the stream P(1),

10 $f_{\text{MeOH}}(P(2))$ is the mass flow rate of MeOH contained in the stream P(2), $f_{\text{MeOH}}(\text{water})$ is the mass flow rate of MeOH contained in the water stream, and $f_{\text{MeOH}}(\text{waste gas})$ is the mass flow rate of MeOH contained in the waste gas stream:

$$f_{\text{MeOH}}(M) = f_{\text{MeOH}}(P(1)) + f_{\text{MeOH}}(P(2)) + f_{\text{MeOH}}(\text{water}) + f_{\text{MeOH}}(\text{waste gas})$$

15

$$1.1 \quad f_{\text{MeOH}}(P(1)) = [(1 - C_{\text{NaOMe}}) * f(P(1))] + [(M_{\text{MeOH}}/M_{\text{NaOH}} * C_{\text{NaOH}}) * f(H(1))]$$

Molecular mass M / concentration c	values	units
M_{MeOH}	32	kg/kmol
M_{NaOH}	40	kg/kmol
C_{NaOH} in H(1)	0.5	kg/kg
C_{NaOMe} in P(1)	0.3	kg/kg

$$1.2 \quad f_{\text{MeOH}}(P(2)) = [(1 - C_{\text{KOMe}}) * f(P(2))] + [(M_{\text{MeOH}}/M_{\text{KOH}} * C_{\text{KOH}}) * f(H(2))]$$

20

Molecular mass M / concentration c	values	units
M_{MeOH}	32	kg/kmol
M_{KOH}	56	kg/kmol
C_{KOH} in H(2)	0.48	kg/kg
C_{KOMe} in P(2)	0.32	kg/kg

$$1.3 \quad f_{\text{MeOH}}(\text{water}) = 0.001 * f(\text{water}) \text{ (maximum value)}$$

$$1.4 \quad f_{\text{MeOH}}(\text{waste gas}) = 0 \text{ (neglected)}$$

- 5 In the following, it is indicated how the mass flow rate of the water contained in the stream water (bottom stream of D, waste water stream), $f(\text{water})$, is calculated. In this calculation, the water contents of P(1) and P(2), both being less than 1000 weight-ppm, are neglected.

$$1.5 \quad f(\text{water}) = f_{\text{H}_2\text{O}}(\text{H}(1)) + f_{\text{H}_2\text{O}}(\text{H}(2)) + f_{\text{H}_2\text{O}}(\text{M}) - f_{\text{H}_2\text{O}}(\text{waste gas})$$

10

$f_{\text{H}_2\text{O}}(\text{H}(1))$ is the mass flow rate of water contained in the stream H(1) and $f_{\text{H}_2\text{O}}(\text{H}(2))$ is the mass flow rate of water contained in the stream H(2) and $f_{\text{H}_2\text{O}}(\text{M})$ is the mass flow rate of water contained in the stream M:

$$15 \quad 1.5.1 \quad f_{\text{H}_2\text{O}}(\text{H}(1)) = [(1 - c_{\text{NaOH}}) * f(\text{H}(1))] + [(M_{\text{H}_2\text{O}}/M_{\text{NaOH}} * c_{\text{NaOH}}) * f(\text{H}(1))]$$

Molecular mass M / concentration c	values	units
$M_{\text{H}_2\text{O}}$	18	kg/kmol
M_{NaOH}	40	kg/kmol
c_{NaOH} in H(1)	0.5	kg/kg

$$1.5.2 \quad f_{\text{H}_2\text{O}}(\text{H}(2)) = [(1 - c_{\text{KOH}}) * f(\text{H}(2))] + [(M_{\text{H}_2\text{O}}/M_{\text{KOH}} * c_{\text{KOH}}) * f(\text{H}(2))]$$

Molecular mass M / concentration c	values	units
$M_{\text{H}_2\text{O}}$	18	kg/kmol
M_{KOH}	56	kg/kmol
c_{KOH} in H(2)	0.48	kg/kg

20

$$1.5.3 \quad f_{\text{H}_2\text{O}}(\text{M}) = 0.001 * f(\text{M})$$

$$1.5.4 \quad f_{\text{H}_2\text{O}}(\text{waste gas}) = 0 \text{ (neglected)}$$

25 2. Reference Example 2: Simultaneous production of sodium methoxide and potassium

methoxide with top vapor recompression (first compression unit) for intermediate reboiler in rectification column D

Fig. 6 shows the process scheme for preparing a mixture P(1) comprising NaOMe and MeOH and a mixture P(2) comprising KOMe and MeOH according to Reference Example 2. Regarding the operating conditions of the rectification column D and of the reactive distillation columns

- 5 K(1) and K(2), reference is made to Table 2a below. Regarding the relative mass flow rates, reference is made to Table 2b below.

The use of vapor recompression reduces the energy demand of the distillation in rectification column D considerably. It is possible to have a ratio of the heat streams to V(1b) and V(1a) of
 10 about 1:4. That means, the energy demand decreases to 20 %. But about 10 % (depending on the pressure) of the energy which is transferred in V(1a) is needed as power for the compressor $C_T(1)$. All in all, there is already some energy saving by using vapor recompression.

Table 2a

- 15 Operating conditions of the columns D, K(1) and K(2)

Column D	Pressure at the top / bar(abs)	2.1
	Temperature at the top / °C	84
	Pressure at the bottom / bar(abs)	2.23
	Temperature at the bottom / °C	124
	Theoretical stages	50
	W(1), W(2) to theoretical stage from bottom	8th
	M fed to theoretical stage from bottom	42th
	Pressure at outlet of $C_T(1)$ / bar(abs)	5
Column K(1)	Pressure at the top / bar(abs)	2.15
	Temperature at the top / °C	89
	Pressure at the bottom / bar(abs)	2.3
	Temperature at the bottom / °C	117
	Number of trays	40
Column K(2)	Pressure at the top / bar(abs)	2.15
	Temperature at the top / °C	89
	Pressure at the bottom / bar(abs)	2.3
	Temperature at the bottom / °C	116
	Number of trays	40

Table 2b

Relationships between the mass flow rates f of the different streams

Definition of streams	Specified:	H(1), H(2)
	M(1), M(2):	part of condensate from V(2)
	H(1):	NaOH 50 weight-% in water
	H(2):	KOH 48 weight-% in water
Ratios of mass flow rates of streams	$f(G(1)) / f(H(1))$	13.3
	$f(G(2)) / f(H(2))$	9.03
	$f(M(1)) / f(H(1))$	0.55
	$f(M(2)) / f(H(2))$	0.40
	$f(T(3)) / f(G) *$	1.0
	$f(P(1)) / f(H(1))$	2.25
	$f(P(2)) / f(H(2))$	1.86
	$f(\text{waste gas}) / f(G) *$	< 0.0015
	$f(T(1)) / f(T(2))$	3.97

*) $f(G) = f(G(1)) + f(G(2))$

P(1): 30 weight-% of sodium methoxide in methanol, < 1000 ppm of water.

P(2): 32 weight-% of potassium methoxide in methanol, < 1000 ppm of water.

5

In the following, it is indicated how the mass flow rate of the methanol contained in the stream M (methanol balance, fresh methanol stream), $f_{\text{MeOH}}(M)$, is calculated. In this calculation, the water contents of P(1) and P(2), both being less than 1000 weight-ppm, are neglected. According to this calculation, $f_{\text{MeOH}}(P(1))$ is the mass flow rate of MeOH contained in the stream P(1),

10 $f_{\text{MeOH}}(P(2))$ is the mass flow rate of MeOH contained in the stream P(2), $f_{\text{MeOH}}(\text{water})$ is the mass flow rate of MeOH contained in the water stream, and $f_{\text{MeOH}}(\text{waste gas})$ is the mass flow rate of MeOH contained in the waste gas stream:

$$f_{\text{MeOH}}(M) = f_{\text{MeOH}}(P(1)) + f_{\text{MeOH}}(P(2)) + f_{\text{MeOH}}(\text{water}) + f_{\text{MeOH}}(\text{waste gas})$$

15

$$2.1 \quad f_{\text{MeOH}}(P(1)) = [(1 - C_{\text{NaOMe}}) * f(P(1))] + [(M_{\text{MeOH}}/M_{\text{NaOH}} * C_{\text{NaOH}}) * f(H(1))]$$

Molecular mass M / concentration c	values	units
M_{MeOH}	32	kg/kmol
M_{NaOH}	40	kg/kmol
C_{NaOH} in H(1)	0.5	kg/kg
C_{NaOMe} in P(1)	0.3	kg/kg

$$2.2 \quad f_{\text{MeOH}}(\mathbf{P(2)}) = [(1 - c_{\text{KOME}}) * f(\mathbf{P(2)})] + [(M_{\text{MeOH}}/M_{\text{KOH}} * c_{\text{KOH}}) * f(\mathbf{H(2)})]$$

Molecular mass M / concentration c	values	units
M_{MeOH}	32	kg/kmol
M_{KOH}	56	kg/kmol
c_{KOH} in H(2)	0.48	kg/kg
c_{KOME} in P(2)	0.32	kg/kg

$$2.3 \quad f_{\text{MeOH}}(\mathbf{water}) = 0.001 * f(\mathbf{water}) \text{ (maximum value)}$$

5

$$2.4 \quad f_{\text{MeOH}}(\mathbf{waste\ gas}) = 0 \text{ (neglected)}$$

In the following, it is indicated how the mass flow rate of the water contained in the stream water (bottom stream of D, waste water stream), $f(\mathbf{water})$, is calculated. In this calculation, the water contents of P(1) and P(2), both being less than 1000 weight-ppm, are neglected.

10

$$2.5 \quad f(\mathbf{water}) = f_{\text{H}_2\text{O}}(\mathbf{H(1)}) + f_{\text{H}_2\text{O}}(\mathbf{H(2)}) + f_{\text{H}_2\text{O}}(\mathbf{M}) - f_{\text{H}_2\text{O}}(\mathbf{waste\ gas})$$

15

$f_{\text{H}_2\text{O}}(\mathbf{H(1)})$ is the mass flow rate of water contained in the stream H(1) and $f_{\text{H}_2\text{O}}(\mathbf{H(2)})$ is the mass flow rate of water contained in the stream H(2) and $f_{\text{H}_2\text{O}}(\mathbf{M})$ is the mass flow rate of water contained in the stream M:

$$2.5.1 \quad f_{\text{H}_2\text{O}}(\mathbf{H(1)}) = [(1 - c_{\text{NaOH}}) * f(\mathbf{H(1)})] + [(M_{\text{H}_2\text{O}}/M_{\text{NaOH}} * c_{\text{NaOH}}) * f(\mathbf{H(1)})]$$

Molecular mass M / concentration c	values	units
$M_{\text{H}_2\text{O}}$	18	kg/kmol
M_{NaOH}	40	kg/kmol
c_{NaOH} in H(1)	0.5	kg/kg

20

$$2.5.2 \quad f_{\text{H}_2\text{O}}(\mathbf{H(2)}) = [(1 - c_{\text{KOH}}) * f(\mathbf{H(2)})] + [(M_{\text{H}_2\text{O}}/M_{\text{KOH}} * c_{\text{KOH}}) * f(\mathbf{H(2)})]$$

Molecular mass M / concentration c	values	units
$M_{\text{H}_2\text{O}}$	18	kg/kmol
M_{KOH}	56	kg/kmol

c_{KOH} in H(2)	0.48	kg/kg
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2.5.3 $f_{\text{H}_2\text{O}}(\text{M}) = 0.001 * f(\text{M})$

2.5.4 $f_{\text{H}_2\text{O}}(\text{waste gas}) = 0$ (neglected)

5

3. Example 1: Passing stream W(2) into a heat exchanger E with feeding of resulting at least partially condensed stream $W_{\text{C}}(2)$ into the rectification column D at the position I(2), combined with passing the stream M into heat exchanger E, and feeding the resulting stream into the rectification column D at the position I(M)

10

Fig. 7 shows the process scheme of Example 1 for preparing a mixture P(1) comprising NaOMe and MeOH and a mixture P(2) comprising KOMe and MeOH as in Fig. 2. Contrary to Fig. 2, the stream G is split and a stream G(1), after having passed a compressor $C_{\text{G}(1)}$ is passed into K(1), and a stream G(2) after having passed a compressor $C_{\text{G}(2)}$ is passed into K(2). The remaining process is as in Fig. 2. Regarding the operating conditions of the rectification column D and of the reactive distillation columns K(1) and K(2), reference is made to Table 3a below. Regarding the relative mass flow rates, reference is made to Table 3b below.

15

20 The use of vapor recompression reduces the energy demand of the distillation in D considerably. It is possible to have a ratio of the heat streams to V(1b) and V(1a) of about 1:4. That means, the energy demand decreases to 20 %. But about 10 % (depending on the pressure) of the energy which is transferred in V(1a) is needed as power for the compressor $C_{\text{T}}(1)$. All in all, there is a large energy saving by using vapor recompression.

25 Passing the vapor stream W(2) having a temperature $T_{\text{W}(2)}$ through a heat exchanger E(1a), obtaining a partially condensed stream $W_{\text{C}1}(2)$ having a temperature $T_{\text{WC}1(2)}$ with $T_{\text{WC}1(2)} < T_{\text{W}(2)}$; and passing the stream M having the temperature $T_{\text{M}1}$ also through the heat exchanger E(1a), obtaining the stream M having the temperature $T_{\text{M}2}$ with $T_{\text{M}2} > T_{\text{M}1}$; combined with passing the stream $W_{\text{C}1}(2)$ having the temperature $T_{\text{WC}1(2)}$ through a further heat exchanger E(1b), obtaining
30 a, preferably completely condensed, stream $W_{\text{C}2}(2)$ having a temperature $T_{\text{WC}2(2)}$ with $T_{\text{WC}2(2)} < T_{\text{WC}1(2)}$; and feeding at least a part of the stream $W_{\text{C}2}(2)$ into the lower part of the rectification column D at the position I(2); combined with feeding at least a part of the stream M having the temperature $T_{\text{M}2}$ into the upper part of the rectification column D at the position I(M) (wherein I(M) is above I(2) and I(2) is above I(1)), allows to heat up stream M and get after E(1b) a complete liquid stream. That means, only a small pipe and a small nozzle for feeding the condensed stream into D is necessary.
35

Table 3a

Operating conditions of the columns D, K(1) and K(2)

Column D	Pressure at the top / bar(abs)	2.1
	Temperature at the top / °C	84
	Pressure at the bottom / bar(abs)	2.23
	Temperature at the bottom / °C	124
	Theoretical stages	50
	W(1) to theoretical stage from bottom	8th
	W _{c2} (2) to theoretical stage from bottom	14th
	M fed to theoretical stage from bottom	42th
	Pressure at outlet of C _T (1) / bar(abs)	5
Column K(1)	Pressure at the top / bar(abs)	2.15
	Temperature at the top / °C	89
	Pressure at the bottom / bar(abs)	2.3
	Temperature at the bottom / °C	117
	Number of trays	40
Column K(2)	Pressure at the top / bar(abs)	2.15
	Temperature at the top / °C	89
	Pressure at the bottom / bar(abs)	2.3
	Temperature at the bottom / °C	116
	Number of trays	40

Table 3b5 Relationships between the mass flow rates *f* of the different streams

Definition of streams	Specified:	H(1), H(2)
	M(1), M(2):	part of condensate from V(2)
	H(1):	NaOH 50 weight-% in water
	H(2):	KOH 48 weight-% in water
Ratios of mass flow rates of streams	$f(G(1)) / f(H(1))$	13.3
	$f(G(2)) / f(H(2))$	9.03
	$f(M(1)) / f(H(1))$	0.55
	$f(M(2)) / f(H(2))$	0.40
	$f(T(3)) / f(G \quad *)$	1.0
	$f(P(1)) / f(H(1))$	2.25

	$f(P(2)) / f(H(2))$	1.86
	$f(\text{waste gas}) / f(G) \quad ^*)$	< 0.0015
	$f(T(1)) / f(T(2))$	7.36

$^*) f(G) = f(G(1)) + f(G(2))$

P(1): 30 weight-% of sodium methoxide in methanol, < 1000 ppm of water.

P(2): 32 weight-% of potassium methoxide in methanol, < 1000 ppm of water.

5

In the following, it is indicated how the mass flow rate of the methanol contained in the stream M (methanol balance, fresh methanol stream), $f_{\text{MeOH}}(M)$, was calculated. In this calculation, the water contents of P(1) and P(2), both being less than 1000 weight-ppm, were neglected. According to this calculation, $f_{\text{MeOH}}(P(1))$ was the mass flow rate of MeOH contained in the stream P(1),

10 $f_{\text{MeOH}}(P(2))$ was the mass flow rate of MeOH contained in the stream P(2), $f_{\text{MeOH}}(\text{water})$ was the mass flow rate of MeOH contained in the water stream, and $f_{\text{MeOH}}(\text{waste gas})$ was the mass flow rate of MeOH contained in the waste gas stream:

$$f_{\text{MeOH}}(M) = f_{\text{MeOH}}(P(1)) + f_{\text{MeOH}}(P(2)) + f_{\text{MeOH}}(\text{water}) + f_{\text{MeOH}}(\text{waste gas})$$

15

$$3.1 \quad f_{\text{MeOH}}(P(1)) = [(1 - C_{\text{NaOMe}}) * f(P(1))] + [(M_{\text{MeOH}}/M_{\text{NaOH}} * C_{\text{NaOH}}) * f(H(1))]$$

Molecular mass M / concentration c	values	units
M_{MeOH}	32	kg/kmol
M_{NaOH}	40	kg/kmol
C_{NaOH} in H(1)	0.5	kg/kg
C_{NaOMe} in P(1)	0.3	kg/kg

$$3.2 \quad f_{\text{MeOH}}(P(2)) = [(1 - C_{\text{KOMe}}) * f(P(2))] + [(M_{\text{MeOH}}/M_{\text{KOH}} * C_{\text{KOH}}) * f(H(2))]$$

20

Molecular mass M / concentration c	values	units
M_{MeOH}	32	kg/kmol
M_{KOH}	56	kg/kmol
C_{KOH} in H(2)	0.48	kg/kg
C_{KOMe} in P(2)	0.32	kg/kg

$$3.3 \quad f_{\text{MeOH}}(\text{water}) = 0.001 * f(\text{water}) \text{ (maximum value)}$$

$$3.4 \quad f_{\text{MeOH}}(\text{waste gas}) = 0 \text{ (neglected)}$$

In the following, it is indicated how the mass flow rate of the water contained in the stream water (bottom stream of D, waste water stream), $f(\text{water})$, was calculated. In this calculation, the water contents of P(1) and P(2), both being less than 1000 weight-ppm, were neglected.

$$3.5 \quad f(\text{water}) = f_{\text{H}_2\text{O}}(\text{H}(1)) + f_{\text{H}_2\text{O}}(\text{H}(2)) + f_{\text{H}_2\text{O}}(\text{M}) - f_{\text{H}_2\text{O}}(\text{waste gas})$$

$f_{\text{H}_2\text{O}}(\text{H}(1))$ was the mass flow rate of water contained in the stream H(1) and $f_{\text{H}_2\text{O}}(\text{H}(2))$ was the mass flow rate of water contained in the stream H(2) and $f_{\text{H}_2\text{O}}(\text{M})$ was the mass flow rate of water contained in the stream M:

$$3.5.1 \quad f_{\text{H}_2\text{O}}(\text{H}(1)) = [(1 - c_{\text{NaOH}}) * f(\text{H}(1))] + [(M_{\text{H}_2\text{O}}/M_{\text{NaOH}} * c_{\text{NaOH}}) * f(\text{H}(1))]$$

Molecular mass M / concentration c	values	units
$M_{\text{H}_2\text{O}}$	18	kg/kmol
M_{NaOH}	40	kg/kmol
c_{NaOH} in H(1)	0.5	kg/kg

$$3.5.2 \quad f_{\text{H}_2\text{O}}(\text{H}(2)) = [(1 - c_{\text{KOH}}) * f(\text{H}(2))] + [(M_{\text{H}_2\text{O}}/M_{\text{KOH}} * c_{\text{KOH}}) * f(\text{H}(2))]$$

Molecular mass M / concentration c	values	units
$M_{\text{H}_2\text{O}}$	18	kg/kmol
M_{KOH}	56	kg/kmol
c_{KOH} in H(2)	0.48	kg/kg

$$3.5.3 \quad f_{\text{H}_2\text{O}}(\text{M}) = 0.001 * f(\text{M})$$

$$3.5.4 \quad f_{\text{H}_2\text{O}}(\text{waste gas}) = 0 \text{ (neglected)}$$

4. Example 2: Passing the vapor stream W(2) through heat exchanger E(2), and admixing the at least partially condensed stream W_c(2) with the stream M, prior to feeding it into the rectification column D at the position I(M)

Fig. 8 shows the process scheme of Example 2 for preparing a mixture P(1) comprising NaOMe and MeOH and a mixture P(2) comprising KOMe and MeOH as in Fig. 3. Contrary to Fig. 3, the

stream G is split into two streams and a stream G(1), after having passed a compressor C_G(1) was passed into K(1), and a stream G(2), after having passed a compressor C_G(2) was passed into K(2). The remaining process is as in Fig. 3. Regarding the operating conditions of the rectification column D and of the reactive distillation columns K(1) and K(2), reference is made to

5 Table 4a below. Regarding the relative mass flow rates, reference is made to Table 4b below.

The use of vapor recompression reduces the energy demand of the distillation in D considerably. It is possible to have a ratio of the heat streams to V(1b) and V(1a) of about 1:4. That means, the energy demand decreases to 20 %. But about 10 % (depending on the pressure) of
 10 the energy which is transferred in V(1a) is needed as power for the compressor C(3). All in all, there is a large energy saving by using vapor recompression.

Passing the vapor stream W(2) having a temperature T_{W(2)} through at least one heat exchanger E(2), obtaining an at least partially, preferably essentially completely, condensed stream W_C(2)
 15 having a temperature T_{W_C(2)} with T_{W_C(2)} < T_{W(2)}; and admixing the stream M, prior to feeding it into the rectification column D at the position I(M), with at least a part of the stream W_C(2) (wherein I(M) = I(2) and I(M) is above I(1)), allows to use only one nozzle to feed both streams in the column D.

20 Table 4a

Operating conditions of the columns D, K(1) and K(2)

Column D	Pressure at the top / bar(abs)	2.1
	Temperature at the top / °C	84
	Pressure at the bottom / bar(abs)	2.23
	Temperature at the bottom / °C	124
	Theoretical stages	50
	W(1) to theoretical stage from bottom	8th
	W _C (2)+M to theoretical stage from bottom	17th
	Pressure at outlet of C _T (1) / bar(abs)	5
Column K(1)	Pressure at the top / bar(abs)	2.15
	Temperature at the top / °C	89
	Pressure at the bottom / bar(abs)	2.3
	Temperature at the bottom / °C	117
	Number of trays	40
Column K(2)	Pressure at the top / bar(abs)	2.15

	Temperature at the top / °C	89
	Pressure at the bottom / bar(abs)	2.3
	Temperature at the bottom / °C	116
	Number of trays	40

Table 4b

Relationships between the mass flow rates *f* of the different streams

Definition of streams	Specified:	H(1), H(2)
	M(1), M(2):	part of condensate from V(2)
	H(1):	NaOH 50 weight-% in water
	H(2):	KOH 48 weight-% in water
Ratios of mass flow rates of streams	$f(G(1)) / f(H(1))$	13.3
	$f(G(2)) / f(H(2))$	9.03
	$f(M(1)) / f(H(1))$	0.55
	$f(M(2)) / f(H(2))$	0.40
	$f(T(3)) / f(G \quad *)$	1.0
	$f(P(1)) / f(H(1))$	2.25
	$f(P(2)) / f(H(2))$	1.86
	$f(\text{waste gas}) / f(G \quad *)$	< 0.0015
	$f(T(1)) / f(T(2))$	6.46

*) $f(G) = f(G(1)) + f(G(2))$

5

P(1): 30 weight-% of sodium methoxide in methanol, < 1000 ppm of water.

P(2): 32 weight-% of potassium methoxide in methanol, < 1000 ppm of water.

In the following, it is indicated how the mass flow rate of the methanol contained in the stream M (methanol balance, fresh methanol stream), $f_{MeOH}(M)$, was calculated. In this calculation, the water contents of P(1) and P(2), both being less than 1000 weight-ppm, were neglected. According to this calculation, $f_{MeOH}(P(1))$ was the mass flow rate of MeOH contained in the stream P(1), $f_{MeOH}(P(2))$ was the mass flow rate of MeOH contained in the stream P(2), $f_{MeOH}(\text{water})$ was the mass flow rate of MeOH contained in the water stream, and $f_{MeOH}(\text{waste gas})$ was the mass flow rate of MeOH contained in the waste gas stream:

$$f_{MeOH}(M) = f_{MeOH}(P(1)) + f_{MeOH}(P(2)) + f_{MeOH}(\text{water}) + f_{MeOH}(\text{waste gas})$$

$$4.1 \quad f_{MeOH}(P(1)) = [(1 - C_{NaOMe}) * f(P(1))] + [(M_{MeOH}/M_{NaOH} * C_{NaOH}) * f(H(1))]$$

20

Molecular mass M / concentration c	values	units
M_{MeOH}	32	kg/kmol
M_{NaOH}	40	kg/kmol
c_{NaOH} in H(1)	0.5	kg/kg
c_{NaOMe} in P(1)	0.3	kg/kg

$$4.2 \quad f_{\text{MeOH}}(\mathbf{P(2)}) = [(1 - c_{\text{KOME}}) * f(\mathbf{P(2)})] + [(M_{\text{MeOH}}/M_{\text{KOH}} * c_{\text{KOH}}) * f(\mathbf{H(2)})]$$

Molecular mass M / concentration c	values	units
M_{MeOH}	32	kg/kmol
M_{KOH}	56	kg/kmol
c_{KOH} in H(2)	0.48	kg/kg
c_{KOME} in P(2)	0.32	kg/kg

$$5 \quad 4.3 \quad f_{\text{MeOH}}(\mathbf{water}) = 0.001 * f(\mathbf{water}) \text{ (maximum value)}$$

$$4.4 \quad f_{\text{MeOH}}(\mathbf{waste gas}) = 0 \text{ (neglected)}$$

10 In the following, it is indicated how the mass flow rate of the water contained in the stream water (bottom stream of D, waste water stream), $f(\mathbf{water})$, was calculated. In this calculation, the water contents of P(1) and P(2), both being less than 1000 weight-ppm, were neglected.

$$4.5 \quad f(\mathbf{water}) = f_{\text{H}_2\text{O}}(\mathbf{H(1)}) + f_{\text{H}_2\text{O}}(\mathbf{H(2)}) + f_{\text{H}_2\text{O}}(\mathbf{M}) - f_{\text{H}_2\text{O}}(\mathbf{waste gas})$$

15 $f_{\text{H}_2\text{O}}(\mathbf{H(1)})$ was the mass flow rate of water contained in the stream H(1) and $f_{\text{H}_2\text{O}}(\mathbf{H(2)})$ was the mass flow rate of water contained in the stream H(2) and $f_{\text{H}_2\text{O}}(\mathbf{M})$ was the mass flow rate of water contained in the stream M:

$$4.5.1 \quad f_{\text{H}_2\text{O}}(\mathbf{H(1)}) = [(1 - c_{\text{NaOH}}) * f(\mathbf{H(1)})] + [(M_{\text{H}_2\text{O}}/M_{\text{NaOH}} * c_{\text{NaOH}}) * f(\mathbf{H(1)})]$$

20

Molecular mass M / concentration c	values	units
$M_{\text{H}_2\text{O}}$	18	kg/kmol
M_{NaOH}	40	kg/kmol
c_{NaOH} in H(1)	0.5	kg/kg

4.5.2 $f_{H_2O}(H(2)) = [(1 - c_{KOH}) * f(H(2))] + [(M_{H_2O}/M_{KOH} * c_{KOH}) * f(H(2))]$

Molecular mass M / concentration c	values	units
M_{H_2O}	18	kg/kmol
M_{KOH}	56	kg/kmol
c_{KOH} in H(2)	0.48	kg/kg

4.5.3 $f_{H_2O}(M) = 0.001 * f(M)$

4.5.4 $f_{H_2O}(\text{waste gas}) = 0$ (neglected)

5. Example 3: Admixing vapor stream W(2) with the stream M, and feeding the at least partially condensed stream obtained therefrom into the rectification column D at the position I(M)

Fig. 9 shows the process scheme of Example 3 for preparing a mixture P(1) comprising NaOMe and MeOH and a mixture P(2) comprising KOMe and MeOH as in Fig. 4. Contrary to Fig. 4, the stream G is split into two streams and a stream G(1), after having passed a compressor C_G(1) was passed into K(1), and a stream G(2), after having passed a compressor C_G(2) was passed into K(2). The remaining process is as in Fig. 4. Regarding the operating conditions of the rectification column D and of the reactive distillation columns K(1) and K(2), reference is made to Table 5a below. Regarding the relative mass flow rates, reference is made to Table 5b below.

The use of vapor recompression reduces the energy demand of the distillation in D considerably. It is possible to have a ratio of the heat streams to V(1b) and V(1a) of about 1:4. That means, the energy demand decreases to 20 %. But about 10 % (depending on the pressure) of the energy which is transferred in V(1a) is needed as power for the compressor C_T(1). All in all, there is a large energy saving by using vapor recompression.

Admixing the vapor stream W(2) having a temperature T_{W(2)} with the stream M having a temperature T_{M1} with T_{W(2)} > T_{M1}, thereby at least partially condensing the stream W(2), and feeding the stream obtained from mixing into the rectification column D at the position I(M) (wherein I(M) = I(2) and I(M) is above I(1)), allows to use only one nozzle to feed both streams in the column D.

Table 5a
Operating conditions of the columns D, K(1) and K(2)

Column D	Pressure at the top / bar(abs)	2.1
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	Temperature at the top / °C	84
	Pressure at the bottom / bar(abs)	2.23
	Temperature at the bottom / °C	124
	Theoretical stages	50
	W(1) to theoretical stage from bottom	8th
	W(2) + M to theoretical stage from bottom	17th
	Pressure at outlet of C _T (1) / bar(abs)	5
Column K(1)	Pressure at the top / bar(abs)	2.15
	Temperature at the top / °C	89
	Pressure at the bottom / bar(abs)	2.3
	Temperature at the bottom / °C	117
	Number of trays	40
Column K(2)	Pressure at the top / bar(abs)	2.15
	Temperature at the top / °C	89
	Pressure at the bottom / bar(abs)	2.3
	Temperature at the bottom / °C	116
	Number of trays	40

Table 5bRelationships between the mass flow rates *f* of the different streams

Definition of streams	Specified:	H(1), H(2)
	M(1), M(2):	part of condensate from V(2)
	H(1):	NaOH 50 weight-% in water
	H(2):	KOH 48 weight-% in water
Ratios of mass flow rates of streams	$f(G(1)) / f(H(1))$	13.3
	$f(G(2)) / f(H(2))$	9.03
	$f(M(1)) / f(H(1))$	0.55
	$f(M(2)) / f(H(2))$	0.40
	$f(T(3)) / f(G) \quad ^*)$	1.0
	$f(P(1)) / f(H(1))$	2.25
	$f(P(2)) / f(H(2))$	1.86
	$f(\text{waste gas}) / f(G) \quad ^*)$	< 0.0015
	$f(T(1)) / f(T(2))$	3.9

*) $f(G) = f(G(1)) + f(G(2))$

P(1): 30 weight-% of sodium methoxide in methanol, < 1000 ppm of water.

P(2): 32 weight-% of potassium methoxide in methanol, < 1000 ppm of water.

- 5 In the following, it is indicated how the mass flow rate of the methanol contained in the stream M (methanol balance, fresh methanol stream), $f_{\text{MeOH}}(\text{M})$, was calculated. In this calculation, the water contents of P(1) and P(2), both being less than 1000 weight-ppm, were neglected. According to this calculation, $f_{\text{MeOH}}(\text{P}(1))$ was the mass flow rate of MeOH contained in the stream P(1), $f_{\text{MeOH}}(\text{P}(2))$ was the mass flow rate of MeOH contained in the stream P(2), $f_{\text{MeOH}}(\text{water})$ was the mass flow rate of MeOH contained in the water stream, and $f_{\text{MeOH}}(\text{waste gas})$ was the mass flow rate of MeOH contained in the waste gas stream:

$$f_{\text{MeOH}}(\text{M}) = f_{\text{MeOH}}(\text{P}(1)) + f_{\text{MeOH}}(\text{P}(2)) + f_{\text{MeOH}}(\text{water}) + f_{\text{MeOH}}(\text{waste gas})$$

15 5.1 $f_{\text{MeOH}}(\text{P}(1)) = [(1 - C_{\text{NaOMe}}) * f(\text{P}(1))] + [(M_{\text{MeOH}}/M_{\text{NaOH}} * C_{\text{NaOH}}) * f(\text{H}(1))]$

Molecular mass M / concentration c	values	units
M_{MeOH}	32	kg/kmol
M_{NaOH}	40	kg/kmol
C_{NaOH} in H(1)	0.5	kg/kg
C_{NaOMe} in P(1)	0.3	kg/kg

5.2 $f_{\text{MeOH}}(\text{P}(2)) = [(1 - C_{\text{KOMe}}) * f(\text{P}(2))] + [(M_{\text{MeOH}}/M_{\text{KOH}} * C_{\text{KOH}}) * f(\text{H}(2))]$

Molecular mass M / concentration c	values	units
M_{MeOH}	32	kg/kmol
M_{KOH}	56	kg/kmol
C_{KOH} in H(2)	0.48	kg/kg
C_{KOMe} in P(2)	0.32	kg/kg

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5.3 $f_{\text{MeOH}}(\text{water}) = 0.001 * f(\text{water})$ (maximum value)

5.4 $f_{\text{MeOH}}(\text{waste gas}) = 0$ (neglected)

In the following, it is indicated how the mass flow rate of the water contained in the stream water (bottom stream of D, waste water stream), $f(\text{water})$, was calculated. In this calculation, the water contents of P(1) and P(2), both being less than 1000 weight-ppm, were neglected.

$$5.5 \quad f(\text{water}) = f_{\text{H}_2\text{O}}(\text{H}(1)) + f_{\text{H}_2\text{O}}(\text{H}(2)) + f_{\text{H}_2\text{O}}(\text{M}) - f_{\text{H}_2\text{O}}(\text{waste gas})$$

$f_{\text{H}_2\text{O}}(\text{H}(1))$ is the mass flow rate of water contained in the stream H(1) and $f_{\text{H}_2\text{O}}(\text{H}(2))$ was the mass flow rate of water contained in the stream H(2) and $f_{\text{H}_2\text{O}}(\text{M})$ was the mass flow rate of water contained in the stream M:

10

$$5.5.1 \quad f_{\text{H}_2\text{O}}(\text{H}(1)) = [(1 - c_{\text{NaOH}}) * f(\text{H}(1))] + [(M_{\text{H}_2\text{O}}/M_{\text{NaOH}} * c_{\text{NaOH}}) * f(\text{H}(1))]$$

Molecular mass M / concentration c	values	units
$M_{\text{H}_2\text{O}}$	18	kg/kmol
M_{NaOH}	40	kg/kmol
c_{NaOH} in H(1)	0.5	kg/kg

$$5.5.2 \quad f_{\text{H}_2\text{O}}(\text{H}(2)) = [(1 - c_{\text{KOH}}) * f(\text{H}(2))] + [(M_{\text{H}_2\text{O}}/M_{\text{KOH}} * c_{\text{KOH}}) * f(\text{H}(2))]$$

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Molecular mass M / concentration c	values	units
$M_{\text{H}_2\text{O}}$	18	kg/kmol
M_{KOH}	56	kg/kmol
c_{KOH} in H(2)	0.48	kg/kg

$$5.5.3 \quad f_{\text{H}_2\text{O}}(\text{M}) = 0.001 * f(\text{M})$$

$$5.5.4 \quad f_{\text{H}_2\text{O}}(\text{waste gas}) = 0 \text{ (neglected)}$$

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Short description of the Figures

Fig. 1 shows a schematic overview of a process according to the present invention wherein a vapor phase V comprising methanol is obtained at the top of the rectification column

25 D. From said vapor phase V, at least three streams are prepared, comprising a vapor stream G, a stream T(1) and a stream T(2). The gas stream G, exhibiting a flow rate $f(\text{G})$, is passed through a compressor C_G , and the thus compressed stream is then divided into two compressed streams G(1) and G(2), both having the same composition as G. The stream G(1) exhibits a

flow rate $f(G(1))$, the stream $G(2)$ exhibits a flow rate $f(G(2))$, wherein $f(G(1)) + f(G(2)) = f(G)$. The compressed stream $G(1)$ is fed into the lower part of reactive distillation column $K(1)$, wherein into the upper part of $K(1)$, a liquid aqueous stream $H(1)$ comprising a dissolved alkali metal hydroxide $A(1)OH$ is fed. $K(1)$ is equipped with a bottom reboiler $V_K(1)$. The bottoms stream removed from the column $K(1)$ is the mixture $P(1)$ comprising alkali metal methoxide $A(1)OMe$ and methanol. From the top of the column $K(1)$, which is operated without reflux, a gas stream $W(1)$ essentially consisting of methanol and water is removed, wherein $W(1)$ is fed into a lower part of the rectification column D at a position $I(1)$. The compressed stream $G(2)$ is fed into the lower part of reactive distillation column $K(2)$, wherein into the upper part of $K(2)$, a liquid aqueous stream $H(2)$ comprising a dissolved alkali metal hydroxide $A(2)OH$ is fed. $K(2)$ is equipped with a bottom reboiler $V_K(2)$. The bottoms stream from $K(2)$ is the mixture $P(2)$ comprising alkali metal methoxide $A(2)OMe$ and methanol. From the top of the column $K(2)$, which is operated without reflux, a gas stream $W(2)$ essentially consisting of methanol and water is removed, wherein $W(2)$ having a temperature $T_{W(2)}$ is fed, separated from $W(1)$, into a heat exchanger E .

Stream M having a temperature T_{M1} is passed through heat exchanger E , obtaining a stream M having a temperature T_{M2} with $T_{M2} > T_{M1}$, which is fed into the rectification column D at the position $I(M)$. The partially condensed stream $W_C(2)$ obtained from the heat exchanger E having a temperature $T_{WC(2)}$ with $T_{WC(2)} < T_{W(2)}$ is fed to the rectification column D at the position $I(2)$.

The stream $T(1)$ having a temperature $T_{T(1)}$ is passed through a compressor $CT(1)$ and the resulting stream $T(1a)$ having a temperature $T_{T(1a)}$ with $T_{T(1a)} > T_{T(1)}$ is passed as a heating medium through an intermediate reboiler $V(1a)$ of the rectification column D , thereby obtaining a condensed stream $T_C(1a)$ having a temperature $T_{Tc(1a)}$ with $T_{Tc(1a)} < T_{T(1a)}$ and stream $T_C(1a)$ is passed into the rectification column D as outlined in detail below and shown in the Figure. Intermediate reboiler $V(1a)$ is supplemented by sump reboiler $V(1b)$ at the bottom of rectification column D .

The realization of the reflux ratio for rectification column D is shown in the upper part of Fig. 1, wherein realizing the reflux ratio comprises preparing from the vapor phase V a further vapor stream $T(2)$, passing said stream $T(2)$ through a condenser $V(2)$, obtaining a liquid stream $T(3)$ and a waste gas stream $T(2w)$, and feeding the liquid stream $T(3)$ into the top of the rectification column D . Stream $T_C(1a)$ is fed to a first condensate drum $CD(1)$, wherein from said first condensate drum $CD(1)$, a gas stream $T(1g)$ and a liquid stream $T(1l)$ are removed, said gas stream $T(1g)$ being fed into the condenser $V(2)$ and said liquid stream $T(1l)$ being combined with the liquid streams $T(2l)$ and $T(2gl)$ in a second condensate drum $CD(2)$ in depressurized form, obtaining a combined liquid stream which is fed as the stream $T(3)$ into the top of the rectification column D .

Fig. 2 shows a modification of the schematic overview of Fig. 1, wherein gas stream W(2) essentially consisting of methanol and water and having a temperature $T_{W(2)}$ is fed, separated from W(1), into a heat exchanger E(1a). Stream M having a temperature T_{M1} is passed through the same heat exchanger E(1a), obtaining a stream M having a temperature T_{M2} with $T_{M2} > T_{M1}$, which is fed into the rectification column D at the position I(M). The partially condensed stream $W_{C1(2)}$ obtained from the heat exchanger E(1a) having a temperature $T_{WC(2)}$ with $T_{WC(2)} < T_{W(2)}$ is passed through another heat exchanger E(1b), obtaining a completely condensed stream $W_{C2(2)}$ having a temperature $T_{WC2(2)}$ with $T_{WC2(2)} < T_{WC1(2)}$. $W_{C2(2)}$ is then passed into the rectification column D at the position I(2).

Fig. 3 shows a schematic overview of a process according to the present invention wherein a vapor phase V comprising methanol is obtained at the top of the rectification column D. From said vapor phase V, at least three streams are prepared, comprising a vapor stream G, a stream T(1) and a stream T(2). The gas stream G, exhibiting a flow rate $f(G)$, is passed through a compressor C_G , and the thus compressed stream is then divided into two compressed streams G(1) and G(2), both having the same composition as G. The stream G(1) exhibits a flow rate $f(G(1))$, the stream G(2) exhibits a flow rate $f(G(2))$, wherein $f(G(1)) + f(G(2)) = f(G)$. The compressed stream G(1) is fed into the lower part of reactive distillation column K(1), wherein into the upper part of K(1), a liquid aqueous stream H(1) comprising a dissolved alkali metal hydroxide A(1)OH is fed. K(1) is equipped with a bottom reboiler $V_K(1)$. The bottoms stream removed from the column K(1) is the mixture P(1) comprising alkali metal methoxide A(1)OMe and methanol. From the top of the column K(1), which is operated without reflux, a gas stream W(1) essentially consisting of methanol and water is removed, wherein W(1) is fed into a lower part of the rectification column D at a position I(1). The compressed stream G(2) is fed into the lower part of reactive distillation column K(2), wherein into the upper part of K(2), a liquid aqueous stream H(2) comprising a dissolved alkali metal hydroxide A(2)OH is fed. K(2) is equipped with a bottom reboiler $V_K(2)$. The bottoms stream from K(2) is the mixture P(2) comprising alkali metal methoxide A(2)OMe and methanol. From the top of the column K(2), which is operated without reflux, a gas stream W(2) essentially consisting of methanol and water is removed, wherein W(2) having a temperature $T_{W(2)}$ is passed through heat exchanger E(2), wherein heat is transferred to a cooling medium (such as water or ambient air), obtaining a condensed stream $W_C(2)$ having a temperature $T_{WC(2)}$ with $T_{WC(2)} < T_{W(2)}$. The stream M, prior to feeding it into the rectification column D at the position I(M) is admixed with at least a part of the stream $W_C(2)$.

The stream T(1) having a temperature $T_{T(1)}$ is passed through a compressor CT(1) and the resulting stream T(1a) having a temperature $T_{T(1a)}$ with $T_{T(1a)} > T_{T(1)}$ is passed as a heating medium through an intermediate reboiler V(1a) of the rectification column D, thereby obtaining a

condensed stream $T_{C(1a)}$ having a temperature $T_{Tc(1a)}$ with $T_{Tc(1a)} < T_{T(1a)}$ and stream $T_{C(1a)}$ is passed into the rectification column D. Intermediate reboiler $V(1a)$ is supplemented by sump reboiler $V(1b)$ at the bottom of rectification column D.

- 5 The realization of the reflux ratio for rectification column D is shown in the upper part of Fig. 1, wherein realizing the reflux ratio comprises preparing from the vapor phase V a further vapor stream $T(2)$, passing said stream $T(2)$ through a condenser $V(2)$, obtaining a liquid stream $T(3)$ and a waste gas stream $T(2w)$, and feeding the liquid stream $T(3)$ into the top of the rectification column D. Stream $T_{c(1a)}$ is fed to a first condensate drum $CD(1)$, wherein from said first condensate drum $CD(1)$, a gas stream $T(1g)$ and a liquid stream $T(1l)$ are removed, said gas stream $T(1g)$ being fed into the condenser $V(2)$ and said liquid stream $T(1l)$ being combined with the liquid streams $T(2l)$ and $T(2gl)$ in a second condensate drum $CD(2)$ in depressurized form, obtaining a combined liquid stream which is fed as the stream $T(3)$ into the top of the rectification column D.

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- Fig. 4** shows a schematic overview of a process according to the present invention wherein a vapor phase V comprising methanol is obtained at the top of the rectification column D. From said vapor phase V, at least three streams are prepared, comprising a vapor stream G, a stream $T(1)$ and a stream $T(2)$. The gas stream G, exhibiting a flow rate $f(G)$, is passed through a compressor C_G , and the thus compressed stream is then divided into two compressed streams $G(1)$ and $G(2)$, both having the same composition as G. The stream $G(1)$ exhibits a flow rate $f(G(1))$, the stream $G(2)$ exhibits a flow rate $f(G(2))$, wherein $f(G(1)) + f(G(2)) = f(G)$. The compressed stream $G(1)$ is fed into the lower part of reactive distillation column $K(1)$, wherein into the upper part of $K(1)$, a liquid aqueous stream $H(1)$ comprising a dissolved alkali metal hydroxide $A(1)OH$ is fed. $K(1)$ is equipped with a bottom reboiler $V_{K(1)}$. The bottoms stream removed from the column $K(1)$ is the mixture $P(1)$ comprising alkali metal methoxide $A(1)OMe$ and methanol. From the top of the column $K(1)$, which is operated without reflux, a gas stream $W(1)$ essentially consisting of methanol and water is removed, wherein $W(1)$ is fed into a lower part of the rectification column D at a position $I(1)$. The compressed stream $G(2)$ is fed into the lower part of reactive distillation column $K(2)$, wherein into the upper part of $K(2)$, a liquid aqueous stream $H(2)$ comprising a dissolved alkali metal hydroxide $A(2)OH$ is fed. $K(2)$ is equipped with a bottom reboiler $V_{K(2)}$. The bottoms stream from $K(2)$ is the mixture $P(2)$ comprising alkali metal methoxide $A(2)OMe$ and methanol. From the top of the column $K(2)$, which is operated without reflux, a gas stream $W(2)$ essentially consisting of methanol and water is removed, wherein $W(2)$ having a temperature $T_{W(2)}$ is combined with the stream M having a temperature T_{M1} with $T_{W(2)} > T_{M1}$, resulting in an at least partial condensation of the stream $W(2)$. The stream obtained from mixing is fed into the rectification column D at the position $I(M)$.

The stream $T(1)$ having a temperature $T_{T(1)}$ is passed through a compressor $CT(1)$ and the resulting stream $T(1a)$ having a temperature $T_{T(1a)}$ with $T_{T(1a)} > T_{T(1)}$ is passed as a heating medium through an intermediate reboiler $V(1a)$ of the rectification column D , thereby obtaining a
5 condensed stream $T_C(1a)$ having a temperature $T_{T_C(1a)}$ with $T_{T_C(1a)} < T_{T(1a)}$ and stream $T_C(1a)$ is passed into the rectification column D . Intermediate reboiler $V(1a)$ is supplemented by sump reboiler $V(1b)$ at the bottom of rectification column D .

The realization of the reflux ratio for rectification column D is shown in the upper part of Fig. 1,
10 wherein realizing the reflux ratio comprises preparing from the vapor phase V a further vapor stream $T(2)$, passing said stream $T(2)$ through a condenser $V(2)$, obtaining a liquid stream $T(3)$ and a waste gas stream $T(2w)$, and feeding the liquid stream $T(3)$ into the top of the rectification column D . Stream $T_C(1a)$ is fed to a first condensate drum $CD(1)$, wherein from said first condensate drum $CD(1)$, a gas stream $T(1g)$ and a liquid stream $T(1l)$ are removed, said gas
15 stream $T(1g)$ being fed into the condenser $V(2)$ and said liquid stream $T(1l)$ being combined with the liquid streams $T(2l)$ and $T(2gl)$ in a second condensate drum $CD(2)$ in depressurized form, obtaining a combined liquid stream which is fed as the stream $T(3)$ into the top of the rectification column D .

20 **Fig. 5** shows a schematic overview of a comparative process as used in Reference Example 1, wherein streams $W(1)$ and also $W(2)$ are directly (but separated from each other) fed into the rectification column D , without an interaction of stream $W(2)$ or parts thereof with methanol stream M .

25 **Fig. 6** shows a schematic overview of a comparative process, with a first compression unit $C_T(1)$ as used in Reference Example 2, wherein streams $W(1)$ and also $W(2)$ are directly (but separated from each other) fed into the rectification column D , without an interaction of stream $W(2)$ or parts thereof with methanol stream M .

30 **Fig. 7** shows a schematic overview of a process according to the present invention as in Fig. 2 as used in Example 1. Contrary to Fig. 2, the stream G is not compressed in a compressor CG but rather separated into two streams $G(1)$ and $G(2)$, wherein each of $G(1)$, $G(2)$ is passed through a compressor $C_G(1)$, $C_G(2)$ before being passed into the respective reactive distillation column $K(1)$, $K(2)$.

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Fig. 8 shows a schematic overview of a process according to the present invention as in Fig. 3 as used in Example 2. Contrary to Fig. 3, the stream G is not compressed in a compressor CG but rather separated into two streams $G(1)$ and $G(2)$, wherein each of $G(1)$, $G(2)$ is

passed through a compressor $C_G(1)$, $C_G(2)$ before being passed into the respective reactive distillation column $K(1)$, $K(2)$.

Fig. 9 shows a schematic overview of a process according to the present invention as in

- 5 Fig. 4 as used in Example 3. Contrary to Fig. 4, the stream G is not compressed in a compressor CG but rather separated into two streams G(1) and G(2), wherein each of G(1), G(2) is passed through a compressor $C_G(1)$, $C_G(2)$ before being passed into the respective reactive distillation column $K(1)$, $K(2)$.

10 **Cited Literature**

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Claims

1. An integrated process for simultaneously preparing n mixtures $P(i)$ comprising alkali metal methoxide and methanol, comprising
 - 5 providing n reactive distillation columns $K(i)$;
 - providing n aqueous liquid streams $H(i)$, a given stream $H(i)$ comprising a dissolved alkali metal hydroxide $A(i)OH$, wherein n is an integer with $n \geq 2$ and $i = 1 \dots n$; and
 - providing a rectification column D comprising at least one reboiler $V(1a)$;
 - wherein the process comprises preparing the one or more alkali metal methoxides in the n reactive distillation column $K(i)$ under reactive distillation conditions from the n streams $H(i)$ and n streams $G(i)$ comprising methanol, thereby obtaining n vapor top streams $W(i)$ comprising methanol and water; and obtaining n bottoms streams $P(i)$ comprising alkali metal methoxide $A(i)OMe$ and methanol;
 - the process further comprising
 - 15 (a) obtaining a vapor phase V comprising methanol at the top of the rectification column D , said vapor phase V having a pressure p_V and a temperature T_V ;
 - (b) preparing at least two streams from the vapor phase V , comprising a vapor stream G having a pressure p_G and a temperature T_G with $0.95 \leq p_G/p_V \leq 1.05$, and further comprising a stream $T(1a)$, said stream $T(1a)$ having a pressure $p_{T(1a)}$ and a temperature $T_{T(1a)}$ with $p_{T(1a)} > p_V$;
 - 20 (c) preparing the n streams $G(i)$ from the vapor stream G , each of the streams $G(i)$ having a pressure $p_{G(i)}$ and a temperature $T_{G(i)}$ with $p_{G(i)} > p_G$ for each stream $G(i)$; and feeding each stream $G(i)$ into the respective reactive distillation column $K(i)$;
 - (d) passing at least a part of the stream $T(1a)$ as a heating medium through the reboiler $V(1a)$ of the rectification column D , obtaining a, preferably at least partially condensed, stream $T_C(1a)$ having a temperature $T_{T_C(1a)}$ with $T_{T_C(1a)} < T_{T(1a)}$;
 - 25 (e) feeding at least a part of the stream $T_C(1a)$ into the rectification column D ;
 - (f) feeding at least a part of a first vapor stream $W(1)$ into the lower part of the rectification column D at a position $I(1)$;
 - 30 (g) at least partially condensing at least a part of a second vapor stream $W(2)$, obtaining an at least partially condensed stream $W_C(2)$, and feeding at least a part of the stream $W_C(2)$ into the rectification column D at a position $I(2)$.
2. The process of claim 1, further comprising for at least one reactive distillation column $K(i)$, preferably for n reactive distillation columns $K(i)$, feeding the stream $G(i)$ into the lower part of the reactive distillation column $K(i)$ and feeding the aqueous liquid stream $H(i)$ into the upper part of the reactive distillation column $K(i)$.

3. The process of claim 1 or 2 further comprising
(h) feeding a stream M comprising methanol into the rectification column D at a position I(M).
- 5 4. The process of claim 3, wherein (g) comprises passing the vapor stream W(2) having a temperature $T_{W(2)}$ through at least one heat exchanger E, obtaining an at least partially condensed stream $W_{C(2)}$ having a temperature $T_{WC(2)}$ with $T_{WC(2)} < T_{W(2)}$, and feeding at least a part of the at least partially condensed stream $W_{C(2)}$ into the the rectification column D at the position I(2); and wherein (h) comprises passing the stream M having a temperature T_{M1} through one or more of said at least one of heat exchangers E, obtaining a stream M having a temperature T_{M2} with $T_{M2} > T_{M1}$, and feeding the stream M having the temperature T_{M2} into the upper part of the rectification column D at the position I(M), wherein preferably, I(M) is above I(2) and I(2) is above I(1).
- 10
- 15 5. The process of claim 4, wherein (g) comprises
(g.1) passing the vapor stream W(2) having a temperature $T_{W(2)}$ through a heat exchanger E(1a), obtaining a partially condensed stream $W_{C(2)}$ having a temperature $T_{WC(2)}$ with $T_{WC(2)} < T_{W(2)}$;
(g.2) feeding at least a part of the at least partially condensed stream $W_{C(2)}$ into the lower
20 part of the rectification column D at the position I(2);
and wherein (h) comprises
(h.1) passing the stream M having the temperature T_{M1} through the heat exchanger E(1a), obtaining the stream M having the temperature T_{M2} ;
(h.2) feeding the stream M having the temperature T_{M2} into the upper part of the rectifica-
25 tion column D at the position I(M),
wherein preferably, I(M) is above I(2) and I(2) is above I(1).
6. The process of claim 4, wherein (g) comprises
(g.1') passing the vapor stream W(2) having a temperature $T_{W(2)}$ through a heat exchanger
30 E(1a), obtaining a partially condensed stream $W_{C1(2)}$ having a temperature $T_{WC1(2)}$ with $T_{WC1(2)} < T_{W(2)}$;
(g.2') passing the stream $W_{C1(2)}$ having the temperature $T_{WC1(2)}$ through a heat exchanger E(1b), obtaining a, preferably completely condensed, stream $W_{C2(2)}$ having a temperature $T_{WC2(2)}$ with $T_{WC2(2)} < T_{WC1(2)}$;
35 (g.3') feeding at least a part of the stream $W_{C2(2)}$ into the lower part of the rectification column D at the position I(2);
and wherein (h) comprises

- (h.1) passing the stream M having the temperature T_{M1} through the heat exchanger E(1a), obtaining the stream M having the temperature T_{M2} ;
- (h.2) feeding at least a part of the stream M having the temperature T_{M2} into the upper part of the rectification column D at the position I(M),
- 5 wherein preferably, I(M) is above I(2) and I(2) is above I(1).
7. The process of claim 3, wherein (g) and (h) comprise passing the vapor stream W(2) having a temperature $T_{W(2)}$ through at least one heat exchanger E(2), obtaining an at least partially, preferably essentially completely, condensed stream $W_C(2)$ having a temperature $T_{WC(2)}$ with $T_{WC(2)} < T_{W(2)}$; and admixing the stream M, prior to feeding it into the rectification column D at the position I(M), with at least a part of the stream $W_C(2)$, wherein I(M) = I(2),
- 10 wherein preferably, I(M) is above I(1).
8. The process of claim 3, wherein (g) and (h) comprise admixing the vapor stream W(2) having a temperature $T_{W(2)}$ with the stream M having a temperature T_{M1} with $T_{W(2)} > T_{M1}$, thereby at least partially condensing the stream W(2), and feeding the stream obtained from mixing into the rectification column D at the position I(M), wherein I(M) = I(2), wherein preferably, I(M) is above I(1).
- 15
9. The process of any one of claims 1 to 8, wherein the rectification column D comprises at least one reboiler V(1a) and at least one reboiler V(1b) and wherein the at least one reboiler V(1a) is an intermediate reboiler and the at least one reboiler V(1b) is a bottom reboiler;
- 20 wherein (b) comprises preparing at least three streams from the vapor phase V, comprising the vapor stream G having a pressure p_G and a temperature T_G with $0.95 \leq p_G/p_V \leq 1.00$, and further comprising two streams T(1a) and T(1b), said stream T(1a) having a pressure $p_{T(1a)}$ and a temperature $T_{T(1a)}$ and said stream T(1b) having a pressure $p_{T(1b)}$ and a temperature $T_{T(1b)}$ with $p_{T(1a)} > p_V$, and $p_{T(1b)} > p_V$,
- 25 wherein (d) comprises
- (d.1) passing at least a part of the stream T(1a) as a heating medium through a reboiler V(1a) of the rectification column D, obtaining a stream $T_C(1a)$ having a temperature $T_{Tc(1a)}$ with $T_{Tc(1a)} < T_{T(1a)}$;
- (d.2) passing at least a part of the stream T(1b) as a heating medium through a reboiler V(1b) of the distillation column D, obtaining a stream $T_C(1b)$ having a temperature $T_{Tc(1b)}$ with $T_{Tc(1b)} < T_{T(1b)}$; and
- 30
- 35 wherein (e) comprises
- (e.1) feeding at least a part of the stream $T_C(1a)$ into the rectification column D;
- (e.2) feeding at least a part of the stream $T_C(1b)$ into the rectification column D.

10. The process of any one of claims 1 to 9, wherein a stream H(1) comprises dissolved sodium hydroxide and a stream H(2) comprises dissolved potassium hydroxide, wherein sodium methoxide is prepared in the reactive distillation column K(1) from which the stream W(1) is obtained and potassium methoxide is prepared in the reactive distillation column K(2) from which the stream W(2) is obtained.
11. The process of claim 10, wherein the stream W(1) comprises methanol and water at a molar methanol-to-water ratio $r(1)$ and wherein the stream W(2) comprises methanol and water at a molar methanol-to-water ratio $r(2)$ with $r(2) < r(1)$.
12. A chemical production unit for carrying out the process according to any one of claims 1 to 11, comprising
- a rectification column D comprising
 - in its lower part, inlet means for feeding streams W(i) or one or more combined stream thereof into D;
 - in its upper part, outlet means for removing a vapor stream V or divided streams thereof, comprising at least a gaseous stream G and at a stream T(1a), from the top of D;
 - at least one reboiler V(1a);
 - optionally a stream dividing device S_o for dividing V or substreams of V into (further) sub streams thereof;
 - a first compressor C_T(1) for compressing T(1a) or a part thereof;
 - means for passing compressed sub streams of T(1) from C_T(1) as heating medium through reboiler V(1a);
 - a stream dividing device S for dividing the stream G into n streams G(i);
 - means for passing the stream G to said stream dividing device S;
 - n reactive distillation columns K(i), $n \geq 2$ and $i = 1 \dots n$; said reactive distillation columns K(i) being arranged in parallel, each reactive distillation column K(i) comprising
 - in its upper part, preferably in its top, inlet means for feeding a stream H(i) into K(i);
 - in its lower part, inlet means for feeding a stream G(i) into K(i);
 - outlet means for removing a stream W(i) from the top of K(i);
 - a bottom reboiler;
 - outlet means for removing a bottoms stream from K(i);
 - a stream dividing means for separating a stream P(i) from the bottoms stream removed from K(i);
 - means for passing the streams G(i) to the reactive distillation columns K(i);

- means for exchanging heat and/or for combining at least one of the streams W(i) with a methanol stream M and means for feeding resulting stream(s) into D;
 - means for passing at least another one of the streams W(i) to the rectification column D;
 - 5 - one or more compressors C(i) for compressing either the stream G and/or the streams G(i) and/or the streams W(i).
13. Use of a chemical production unit according to claim 12 or of a process according to any one of claims 1 to 11 for simultaneously producing n mixtures P(i) comprising alkali metal methoxide and methanol, n being an integer with $n \geq 2$ and $i = 1 \dots n$, wherein
- 10 either at least 2 of the mixtures P(i) comprise different alkali metal methoxides A(i)OMe, and/or at least 2 of the mixtures P(i) comprise the same alkali metal alkoxide A(i)OMe at different concentrations.