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**Datasheet for the decision
of 19 November 2015**

Case Number: T 0138/12 - 3.3.10

Application Number: 05723599.6

Publication Number: 1737808

IPC: C07C51/12, C07C51/48

Language of the proceedings: EN

Title of invention:

REMOVAL OF PERMANGANATE REDUCING COMPOUNDS FROM METHANOL
CARBONYLATION PROCESS STREAM

Patent Proprietor:

Celanese International Corporation

Opponent:

Daicel Chemical Industries, Ltd.

Headword:

Relevant legal provisions:

EPC Art. 56, 123(2)

RPBA Art. 13(1)

Keyword:

Decisions cited:

T 0153/85, T 0936/96, T 0231/97, T 0170/06

Catchword:



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Case Number: T 0138/12 - 3.3.10

D E C I S I O N
of Technical Board of Appeal 3.3.10
of 19 November 2015

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Decision under appeal: **Interlocutory decision of the Opposition
Division of the European Patent Office posted on
18 November 2011 concerning maintenance of the
European Patent No. 1737808 in amended form.**

Composition of the Board:

Chairwoman J. Mercey
Members: J.-C. Schmid
F. Blumer

Summary of Facts and Submissions

I. Appellant I (Opponent) and Appellant II (Patent proprietor) lodged appeals against the interlocutory decision of the Opposition Division which found that European patent No. 1 737 808 in amended form met the requirements of the EPC. Claim 1 of auxiliary request 2 maintained by the Opposition Division reads as follows:

"[i)] A process for reduction and/or removal of permanganate-reducing compounds (PRC's) and C₂₋₁₂ alkyl iodide compounds formed in the carbonylation of a carbonylatable reactant selected from the group consisting of methanol, methyl acetate, methyl formate and dimethyl ether and mixtures thereof to produce a product comprising acetic acid, comprising the steps of:

- [a)] separating said carbonylation product to provide a volatile phase comprising acetic acid, and a less volatile phase;
- [b)] distilling said volatile phase to yield a purified acetic acid product and a first overhead comprising organic iodide, water, acetic acid, and at least one PRC;
- [c)] distilling at least a portion of the first overhead in a distillation apparatus to form a PRC enriched second overhead;
- [d)] extracting the second overhead with water and separating therefrom an aqueous stream comprising said at least one PRC;
- [e)] recycling at least a first portion of the extracted second overhead to said distillation apparatus; and
- [f)] introducing at least a second portion of the extracted second overhead directly or indirectly into the reaction medium,

[g)] wherein said second overhead comprises dimethyl ether in an amount effective to reduce the solubility of methyl iodide in said aqueous stream."

whereby the numbering and lettering of the various steps used by both parties throughout the proceedings, namely i) and a) to g), **do not form part of the claim**, but have been added by the Board and will be used in this decision for simplifying the understanding of the claims.

II. Notice of Opposition had been filed by Appellant I requesting revocation of the patent as granted in its entirety on the grounds of lack of novelty and inventive step (Article 100(a) EPC). *Inter alia* the following documents were submitted in opposition proceedings:

- (1) EP-A-687 662 and
- (2) US-B-6 339 171.

III. The Opposition Division found that the subject-matter of claims 1, 14 and 24 of the then pending main request lacked novelty over document (1), that of claims 2 to 23 of auxiliary request 1 did not satisfy the requirements of Article 123(2) EPC, whereas that of auxiliary request 2 was both novel and inventive, document (1) being considered to represent the closest prior art.

IV. With letter dated 19 October 2015, Appellant II filed a main request and auxiliary requests 1 to 4, and with letter dated 17 November 2015, it filed auxiliary requests 1A and 2A.

Claim 1 of the main request and each of auxiliary requests 1, 1A and 2 is identical to claim 1 of

auxiliary request 2 maintained by the Opposition Division.

Claim 1 of auxiliary request 2A reads:

"Use of dimethyl ether for reducing the solubility of methyl iodide in an aqueous stream in a process for producing acetic acid, comprising the steps of:

(a) carbonylating at least one reactant selected from the group consisting of methanol, methyl acetate, methyl formate and dimethyl ether in a reactor containing a suitable reaction medium;

(b) separating the products of said carbonylation into a volatile product phase comprising acetic acid and at least one permanganate reducing compound (PRC), and a less volatile phase;

(c) distilling said volatile product phase to yield a purified acetic acid product and a first overhead comprising organic iodide, water, acetic acid, and said at least one PRC;

(d) distilling at least a portion of the first overhead to produce a PRC-enriched second overhead; and

(e) extracting the second overhead with water and separating therefrom an aqueous extract containing concentrated PRC's for disposal,

wherein at least a first portion of the extracted second overhead is recycled and distilled in step (d) with the first overhead;

further comprising recycling at least a second portion of the extracted second overhead directly or indirectly to the reactor, and

wherein said second overhead comprises dimethyl ether in an amount effective to reduce the solubility of methyl iodide in said aqueous stream."

Claim 1 of auxiliary request 3 differs from claim 1 of the main request in that it has been further defined which portion of the first overhead is distilled in step c) and how said portion is obtained. More concretely, step c) of claim 1 of the main request has been replaced by the features which are denoted c') and c'') hereinafter:

c') directing the first overhead to an overhead receiver decanter wherefrom the light phase is directed to a distillation apparatus;

c'') distilling the light phase in the distillation apparatus to form a PRC enriched second overhead.

Claim 1 of auxiliary request 4 reads:

"A process for separating a mixture containing water, acetic acid, methyl iodide, methyl acetate, methanol, at least one C₂₋₁₂ alkyl iodide and at least one permanganate reducing compound (PRC), comprising:

(a) distilling the mixture to provide a PRC enriched overhead stream comprising methyl iodide, water and said at least one PRC;

(b) extracting the PRC enriched overhead stream with water and separating therefrom an aqueous stream containing said at least one PRC; and

(c) distilling at least a first portion of the extracted PRC enriched overhead with the mixture;

further comprising the step of providing said mixture by separating a liquid composition into a light phase and a heavy phase, said liquid composition comprising water, acetic acid, methyl iodide, methyl acetate, methanol, at least one C₂₋₁₂ alkyl iodide and said at least one PRC, wherein the light phase comprises said mixture and the heavy phase comprises methyl iodide, further comprising the steps of:

performing a liquid-vapor phase separation on the effluent of a methanol carbonylation reactor to form a vapor phase and a liquid phase;
distilling the vapor phase to form a first overhead and a liquid product; and
condensing at least a portion of the first overhead to provide said liquid composition;
further comprising recycling at least a portion of the extracted PRC enriched overhead directly or indirectly to the carbonylation reactor,
wherein said PRC enriched overhead comprises dimethyl ether in an amount effective to reduce the solubility of methyl iodide in said aqueous stream."

- V. Appellant I argued that the subject-matter of all requests was not inventive, starting either from document (1) or document (2). Since, however, document (2) (see Fig. 1 and description thereof) disclosed steps c') and c''), namely the condensation of the first overhead 28 in a decanter 16 and the distillation of the light phase 30 therefrom, said document was clearly closer to the process of claim 1 of auxiliary request 3 than document (1). The process of claim 1 of auxiliary request 3 differed from that of document (2) only by virtue of step f), namely the recycling of at least a first portion of the extracted second overhead to the distillation apparatus. In document (2) this extracted second overhead was recycled to the reactor, corresponding to present step e). Step g), namely that said second overhead comprised dimethyl ether (DME) in an amount effective to reduce the solubility of methyl iodide in the aqueous stream in step d), was not in effect a process step, since no activity was defined, but described merely an inevitable consequence of the other process steps. Said "step" was also an inevitable consequence of the very similar process steps of

document (2), evidence that DME was present in the second overhead 52 being the fact that essentially no methyl iodide was present in the aqueous purge stream 64. The skilled person, faced with the problem of removing more aldehyde from the system, would thus turn to document (1), which was also concerned with providing a process for producing high purity acetic acid, wherein the aldehyde removal from the system was improved. Document (1) solved this problem by recycling the methyl iodide-rich raffinate from the water extraction to the aldehyde-removal distillation column to thereby recirculate it into the reactor as a bottom withdrawn liquid. The skilled person would thus adapt the process of Fig. 2 of document (2) by recycling at least a portion of the stream 66 to column 22 in order to remove more aldehyde therefrom. Such a step would inevitably result in (more) DME being formed in column 22 in view of the larger amounts of methyl iodide entering *via* stream 40 and result in less methyl iodide exiting *via* the aqueous stream 64 because of the inherent property of DME of decreasing the solubility of methyl iodide in water.

Appellant I submitted that late-filed auxiliary requests 1A and 2A should not be admitted into the proceedings, in particular the subject-matter of auxiliary request 2A not fulfilling the requirements of Articles 123(2) or (3) EPC.

Appellant I also submitted that the subject-matter of at least claim 1 of the main request and auxiliary requests 1, 1A and 2 was not novel and that all other claims apart from claim 1 of these requests did not fulfil the requirements of Article 123(2) EPC.

VI. Appellant II argued that the subject-matter of all requests was inventive, starting either from document (1) or (2) as closest prior art. In the light of document (2), the Appellant II submitted at the oral proceedings before the Board and in its letter dated 19 October 2015 (see page 32, point 5.11) that the problem to be solved by the invention could be seen in, first, improving the aldehyde removal of the system, and to reduce the amount of methyl iodide which was removed from the process as waste. This problem was solved by the process steps e), f) and g) of claim 1 of auxiliary request 3, more particularly by e) recycling at least a first portion of the extracted second overhead to the distillation apparatus of steps c') and c''), f) introducing at least a second portion of the extracted second overhead directly or indirectly into the reaction medium, and g) wherein the second overhead comprises DME in an amount effective to reduce the solubility of methyl iodide in the aqueous stream of step d). The statements at col. 13, lines 21 to 24 and col. 14, lines 6 to 10 of the patent in suit showed that the problem was indeed solved. The skilled person would not have combined the teaching of document (1) with that of document (2), since they related to very different process set ups. In addition, in view of the potential problem of polymer formation from acetaldehyde in the distillation column 22 of document (2), the skilled person would not have recycled an acetaldehyde-containing stream thereto. Furthermore, both of documents (1) and (2) were completely silent on the presence of DME, and thus on any effect it might have. DME was not formed inherently in the processes of either of these documents, there not being enough water in the process of document (1), and not enough methyl iodide in the columns 18 and 22 of document (2), to allow its formation. Furthermore, in document (1), the extracted

second overhead was directed back to the distillation apparatus in its entirety, which would, when applied to the process of document (2), result in an unstable system in view of the volatility of DME. Appellant II did not provide any additional arguments for the inventiveness of the subject-matter of claim 1 of auxiliary request 4.

Appellant II submitted that auxiliary requests 1A and 2A should be admitted into the proceedings. More particularly, the subject-matter of auxiliary request 2A fulfilled the requirements of Articles 123(2) and (3) EPC.

Appellant II also submitted that the subject-matter of all requests was novel and fulfilled the requirements of Article 123(2) EPC.

VII. Appellant I requested that the decision under appeal be set aside and that the patent be revoked.

Appellant II requested that the decision under appeal be set aside and the patent be maintained on the basis of the main request or of any of auxiliary requests 1, 1A, 2, 2A, 3 or 4, the main request and auxiliary requests 1 to 4 being filed with letter dated 19 October 2015, and auxiliary requests 1A and 2A being filed with letter dated 17 November 2015.

VIII. At the end of the oral proceedings held on 19 November 2015, the decision of the Board was announced.

Reasons for the Decision

1. The appeals are admissible.

Main request and auxiliary requests 1, 1A, 2, 3 and 4

2. *Inventive step*

- 2.1 Independent claim 1 of auxiliary request 3 is directed to an embodiment of claim 1 of the main request, wherein the separation process has been further defined in steps c') and c'') by defining which "portion" of the first overhead is distilled in step c), namely the light phase, and how said portion is obtained, namely by separation in a receiver decanter (see point IV above). In case this embodiment according to auxiliary request 3 lacked inventive step, then the subject-matter of claim 1 of each of the main request and auxiliary requests 1, 1A and 2, which embraces this embodiment, cannot involve an inventive step either. Thus, the subject-matter of claim 1 of auxiliary request 3 is examined first as to inventive step.

- 2.2 Claim 1 of auxiliary request 3 is directed to a process for reduction and/or removal of permanganate-reducing compounds (PRC's), such as carbonyl compounds e.g. acetaldehyde and C₂₋₁₂ alkyl iodide compounds, formed in the carbonylation of *inter alia* methanol to produce a product comprising acetic acid.

- 2.3 Document (2) is also directed to a process for reduction and/or removal of PRC's, such as acetaldehyde and alkyl iodide compounds (see col. 2, lines 36 to 54), formed in the carbonylation of methanol to produce a product comprising acetic acid (see col. 1, lines 13 to 21). It is further stated therein that since many impurities

originate with acetaldehyde, as is the case in the patent in suit (see col. 3, lines 1 to 3 of patent in suit), it is a "primary objective" to remove or reduce the acetaldehyde and alkyl iodide content in the reaction system, this being successfully achieved by the process described therein (see col. 5, line 54 to col. 6, line 3 and col. 12, lines 10 to 33). Thus, document (2) addresses the same goals as the patent in suit (see col. 1, lines 7 to 15, col. 2, lines 22 to 58 and col. 4, lines 35 to 43 of patent in suit).

- 2.3.1 Document (2) is referred to several times in the patent in suit (see col. 4, lines 22 to 34, col. 9, lines 25 to 29 and col. 12, lines 8 to 11) and Fig. 1 of the patent in suit (see col. 5, lines 57 to 58) illustrates the process of document (2), Appellant II indicating that said document was indeed the actual starting point for the present invention.
- 2.3.2 It was undisputed between the parties that document (2) (see col. 5, lines 13 to 52, and Fig. 1 and description thereof from col. 9, line 60 to col. 12, line 10) discloses steps i), a), b), c'), c'') and d) of the process of claim 1 of auxiliary request 3. More particularly, Fig. 1 of document (2), which represents the process described therein, corresponds exactly to Fig. 2 of the patent in suit, which is an embodiment of the process of claim 1 of auxiliary request 3, apart from stream 68 in Fig. 2 of the patent in suit which corresponds to step e), namely recycling at least a first portion of the extracted second overhead to the distillation apparatus referred to in steps c') and c'').
- 2.3.3 Thus, referring to Fig. 1 of document (2), stream 26 represents the volatile phase comprising acetic acid of

present step a); said volatile phase is then distilled in column 14 to yield a purified acetic acid product 17 and a first overhead 28 comprising organic iodide, water, acetic acid, and at least one PRC corresponding to present step b); the first overhead 28 is directed to an overhead receiver decanter 16 wherefrom the light phase 30 is directed to distillation columns 18 and 22, corresponding to present step c'); the light phase is distilled in the distillation columns 18 and 22 to form a PRC enriched second overhead 52, corresponding to present step c'); the second overhead 52 is extracted with water in the extractor 27 and an aqueous stream 64 comprising said at least one PRC is separated therefrom corresponding to present step d). Said extracted second overhead 66 is then introduced directly into the reaction medium.

- 2.3.4 Thus, the Board considers that the process of document (2) represents the closest state of the art for the subject-matter of auxiliary request 3 and, hence, takes this document as the starting point when assessing inventive step.
- 2.3.5 This finding was not contested by the parties, both parties agreeing that the only other document which came into contention as closest prior art, namely document (1), did not disclose steps c') and c''), Appellant II being of the opinion that document (1) also did not disclose steps e), f) and g).
- 2.4 In view of this state of the art, the problem underlying auxiliary request 3 as formulated by Appellant II (see point VI above) can be seen in, first, improving the aldehyde removal of the system, and to reduce the amount of methyl iodide which is removed from the process as waste.

2.5 As the solution to this problem, Appellant II submitted that claim 1 of auxiliary request 3 proposed steps e), f) and g), namely e) recycling at least a first portion of the extracted second overhead to the distillation apparatus of steps c') and c''), f) introducing at least a second portion of the extracted second overhead directly or indirectly into the reaction medium, and g) wherein the second overhead comprised DME in an amount effective to reduce the solubility of methyl iodide in the aqueous stream of step d). The statements at col. 13, lines 21 to 24 and col. 14, lines 1 to 10 of the patent in suit showed that the problem was indeed solved.

2.5.1 Appellant I, on the other hand, submitted that claim 1 of auxiliary request 3 differed from the process of document (2) only with regard to step e). Thus, document (2) disclosed introducing at least a portion, namely all, of the extracted second overhead, namely stream 66, into the reaction medium. Furthermore, the second overhead in document (2), namely stream 52, inevitably comprised DME as a necessary consequence of the second distillation therein being carried out under exactly the same conditions as in distillation columns 18 and 22 of the patent in suit, the feeds to column 22, namely streams 40 and 50, comprising large amounts of water and methyl iodide, respectively, also being identical in both document(2) and the patent in suit. Since the reaction of methyl iodide and water gave methanol and hydrogen iodide, the latter being necessary to catalyse the reaction of methanol to give DME, DME was also formed in the process of document (2). The fact that essentially no methyl iodide was present in the aqueous purge stream 64 of document (2) (see col. 4, line 65 to col. 5, line 1) also implied the presence of DME in the

second overhead 52. Since the patent in suit did not define which amount was "effective to reduce the solubility of methyl iodide in said aqueous stream", it was to be assumed that any amount reduced its solubility.

2.5.2 Since the Board comes to the conclusion that the process of claim 1 of auxiliary request 3 is not inventive even if it is assumed that document (2) does not disclose any of steps e), f) and g), the position of Appellant II will be followed in this respect.

2.5.3 The Board considers that it is plausible that returning at least a first portion of the extracted second overhead to the distillation apparatus of steps c') and c'') improves the aldehyde removal efficiency of the entire system, since said extracted second overhead still contains acetaldehyde and said distillation apparatus removes acetaldehyde. The Board also accepts that DME reduces the solubility of methyl iodide in water and hence the presence of DME in the feed to extracting step d) reduces the amount of methyl iodide extracted into the aqueous stream and lost in waste water treatment, as indicated in col. 14, lines 1 to 10 of the patent in suit. Thus, the Board holds that it is credible that the problem is solved.

2.6 Finally, it remains to be decided whether or not the proposed solution to the objective problem underlying auxiliary request 3 is obvious in view of the state of the art.

2.6.1 The skilled person, seeking to improving the aldehyde removal of the system, knows from document (2) itself (see col. 2, lines 26 to 33) that trace impurities, such as carbonyl compounds, affect the quality of acetic

acid, especially when they are recirculated through the reaction process. The skilled person would thus wish to reduce the amount of acetaldehyde being recycled in step f) to the reaction medium, i.e. to reduce the amount of aldehyde in stream 66 in Fig. 1 of document (2).

- 2.6.2 Document (1) (see page 1, lines 3 to 6, page 3, lines 15 to 17 and claim 1) is also concerned with this very same problem, namely to provide a process for producing high purity acetic acid, wherein carbonyl compounds or organic iodides which are present as impurities are reduced by controlling the conditions of the reactor in which they are generated, preferably by removing acetaldehyde from the process liquid being circulated into the reactor (see page 3, lines 29 to 31). In [Example]/Example 1, this is achieved by recycling the methyl iodide-rich raffinate from the water extraction to an 80 plates distillation column to thereby recirculate it into the reactor as a bottom withdrawn liquid (see page 10, lines 38 to 41), the 80 plates distillation column of document (1) corresponding to the distillation apparatus referred to in steps c'), c'') and e) of claim 1 of auxiliary request 3, and to columns 18 and 22 of Fig. 1 of document (2) and Fig. 2 of the patent in suit. Since the purpose of said 80 plates distillation column is to remove acetaldehyde (see page 9, lines 41 to 43 and Tables on pages 9 and 10 showing "Composition of charged liquid" and "Top withdrawn liquid composition"), the aim of returning the methyl-iodide rich liquid obtained from the water extractor thereto before recycling it to the reactor 10 is thus to remove even more acetaldehyde therefrom, particularly in view of the aim of document (1), namely to reduce the amount of acetaldehyde being returned to the reaction medium (see 2.6.1 above). Thus, document (1) teaches recycling at least a part, i.e. all, of the extracted

second overhead to the distillation apparatus and introducing at least a part of the extracted second overhead indirectly, i.e. via the distillation apparatus, into the reaction medium.

2.6.3 Hence, the skilled person faced with the problem of reducing the amount of aldehyde in the methyl iodide-containing stream 66 which is returned to the reactor in document (2) would, instead of returning this stream in its entirety directly to the reactor, recycle at least a portion thereof to column 18 or 22 (corresponding to the 80 plates distillation column of document (1)), in order to remove more aldehyde therefrom. The size of said "portion" would depend merely on the subjective requirements of the skilled person regarding the purity of the acetic acid desired. Thus, step e) of claim 1 of auxiliary request 3, namely recycling at least a portion of the second overhead to the distillation apparatus of steps c') and c''), is obvious in view of the combination of the teachings of documents (2) and (1).

2.6.4 By recycling at least a portion of stream 66 in this manner, DME is inevitably formed in column 22 (as discovered by Appellant II, see col. 13, lines 21 to 24 and 40 to 46 of the patent in suit) in view of the temperature of said column (column 22 of document (2) being operated under exactly the same conditions as those given for column 22 of the patent in suit), the presence of higher amounts of methyl iodide resulting from the recycle via lines 68 and 40 of the methyl iodide stream 66, and large amounts of water entering via stream 50, Appellant II itself explaining that the reaction of methyl iodide and water gave methanol and hydrogen iodide, the latter being necessary to catalyse the reaction of methanol to give DME. DME formed in this column exits with the top stream 52 and enters the water

extractor 27, where it inherently reduces the solubility of methyl iodide in water, such that the separated aqueous stream 64 which is directed to waste treatment necessarily comprises less methyl iodide as a result. The process of document (2) already results in a very concentrated acetaldehyde stream 64 with "essentially no methyl iodide" being purged from the process (see col. 4, line 65 to col. 5, line 1), an embodiment of the present process resulting in a concentration of 0.5% methyl iodide in the corresponding stream 64 (see col. 14, lines 7 to 10 of the patent in suit), such that any improvement achieved by the process of the contested patent is, in any case, only minimal. Thus, when reducing the amount of aldehyde in stream 66 in an obvious manner (see points 2.6.1 to 2.6.3 above), the part of the problem relating to reducing the amount (said amount not being quantified) of methyl iodide lost to waste treatment is also inherently solved. Thus, step g) of claim 1 of auxiliary request 3, namely wherein said second overhead comprises dimethyl ether in an amount effective to reduce the solubility of methyl iodide in said aqueous stream is merely an inevitable consequence of step e), and therefore cannot confer inventiveness on the claimed process (see T 936/96, point 2.6 of the Reasons, T 231/97, point 5.7.5.2 of the Reasons and T 170/06, point 2.2.4 of the Reasons, none published in OJ EPO).

2.7 If the subject-matter of claim 1 of auxiliary request 3 is not inventive over a combination of documents (2) and (1), then it is irrelevant whether it is inventive over document (1) alone.

2.8 For the following reasons the Board cannot accept Appellant II's arguments designed for supporting inventive step.

2.8.1 Appellant II argued that the skilled person would not have combined documents (2) and (1), since they were directed to two fundamentally different set ups. More particularly, in document (1) the **heavy** phase separated from the first overhead was subjected to further distillation, whereas in document (2), the **light** phase was subjected to further treatment.

The set up of document (1) is, however, very similar to that of document (2), and thus also to that of claim 1 of auxiliary request 3, namely step a) is performed in flasher 12 to give overhead 15 in Fig. 1, corresponding to the volatile phase 26 in Fig. 1 of document (2), step b) is performed in splitter column 14 of Fig. 1 to give a first overhead 20, corresponding to column 14 and overhead 28 in Fig. 1 of document (2), and step d) is described at page 10, lines 31 to 38 and carried out in the separator having no number in Fig. 1, corresponding to decanter 16 in Fig. 1 of document (2). The steps between b) and d) in Example 1 of document (1) differ from those in document (2) only in that the heavy rather than the light phase, namely the lower (heavy) phase 30 in Fig. 1 of document (1) instead of the light phase 30 in Fig. 1 of document (2), is directed to a distillation column (see page 9, lines 37 to 43), this 80 plates distillation column corresponding to the distillation columns 18 and 22 of Fig 1 of document (2) and the distillation apparatus referred to in steps c'), c'') and e) of claim 1 of auxiliary request 3.

However, document (1) teaches in the general part of the description that the upper (light) stream 32 and the lower (heavy) phase 30 are **both** preferred as the process liquid which is a target for removing carbonyl impurities containing acetaldehyde (see page 5, lines 46

to 52 and page 7, lines 15 to 16 and lines 23 to 24), document (2) (see col. 12, lines 33 to 37) also teaching that **any** (emphasis added) stream in the carbonylation process having a high concentration of PRC's and alkyl iodides may be treated according to the invention described therein. Thus, the Board holds that the skilled person would have transferred the teaching from document (1) to document (2), both documents being primarily concerned with aldehyde removal in a process for producing high purity acetic acid (see points 2.3 and 2.6.2 above) and both teaching that **either phase** of the separation corresponding to step c') of claim 1 of auxiliary request 3 may be further treated according to the purification processes described therein.

2.8.2 Appellant II further argued that the teachings of documents (1) and (2) were incompatible, the skilled person not having considered recycling **any** of stream 66 which contained acetaldehyde to the distillation column 22 of document (2), because of the problem of polymer, most particularly metaldehyde, formation from acetaldehyde in column 22 described in document (2) (see col. 4, lines 39 to 44, col. 6, lines 4 to 12 and col. 10, line 62 to col. 11, line 18) and because of potential flooding of said column.

However, the problem of polymer formation is already solved by document (2) (see col. 4, lines 44 to 52, col. 5, lines 1 to 6, col. 6, lines 12 to 30 and col. 11, lines 18 to 42), the Board thus seeing no hindrance to the skilled person to feed an acetaldehyde-containing stream to a column designed for the separation of acetaldehyde. The Board also holds that the skilled person would have no difficulty in recycling at least a portion of stream 66 to column 22 without flooding said column, it being usual chemical engineering practice to

simply control the rate of recycle to avoid flooding. Indeed, the skilled person would know from document (1) that even the entire raffinate may be returned to the second distillation column without any associated difficulties.

- 2.8.3 Appellant II argued that had the skilled person nevertheless combined the teaching of document (1) with document (2), then he/she would have recycled **all** of the extracted second overhead to the second distillation apparatus, as was the case in document (1). However, in order to obtain a stable process it was necessary to recycle only a portion thereof, since returning it all led to a problematic build-up of pressure in the distillation apparatus due to the formation of large quantities of DME.

However, regardless of whether recycling "at least a first portion" of the extracted second overhead does in any case embrace recycling **all** of said extracted overhead, as argued by Appellant I and suggested by col. 13, lines 31 to 32 of the patent in suit, or not, as argued by Appellant II in the light of the fact that "at least a second portion" thereof must be introduced to the reaction medium, and regardless of whether a "portion" means **any** part of the extracted overhead, i.e. including parts which have, for example, been separated by distillation (as is the case in document (1)), as argued by Appellant I, or whether a "portion" only means parts of the extracted overhead which have been separated by merely splitting the stream and/or by phase separation/decantation, as argued by Appellant II, the Board does not see how the potential problem of over-pressure is avoided by the process of claim 1 of auxiliary request 3, since the amount "at least a portion" is not further specified in said claim. Thus,

even if the wording "at least a portion" excludes recycling all of the extracted second overhead to the distillation apparatus, said portion may nevertheless comprise, for example, 99% of the extracted second overhead, which would presumably result in an unstable process.

Furthermore, when applying the teaching of document (1) to that of document (2), the skilled person would not automatically recycle all of the extracted second overhead 66 to column 22, because as indicated in point 2.6.3 above, the actual amount of the extracted second overhead which the skilled person would recycle to column 22 depends on the subjective requirements of the skilled person regarding the purity of the acetic acid desired, the problem to be solved being merely to improve the aldehyde removal of the system, said improvement not being quantified.

- 2.9 For these reasons, the subject-matter of claim 1 of auxiliary request 3 is not allowable for lack of inventive step pursuant to Article 56 EPC.
- 2.10 The subject-matter of claim 1 of auxiliary request 4 corresponds almost exactly to that of claim 1 of auxiliary request 3, but wherein it is explicitly defined that at least a portion of the first overhead is condensed before separation into a light phase and a heavy phase, and said separation is not explicitly defined as taking place in a receiver decanter. In these circumstances, since the subject-matter of claim 1 of auxiliary request 4 corresponds almost exactly to that of claim 1 of auxiliary request 3, Appellant II agreeing herewith, and not providing any additional arguments in support of inventive step for auxiliary request 4,

auxiliary request 4 is also not allowable for lack of inventive step.

- 2.11 Since the process defined in claim 1 of auxiliary request 3 is encompassed by claim 1 of the main request (see point 2.1 above), and claim 1 of each of auxiliary requests 1, 1A and 2 is identical to claim 1 of the main request, these requests share the fate of auxiliary request 3 in that they too are not allowable for lack of inventive step pursuant to Article 56 EPC. It is thus not necessary for the Board to decide on the admissibility into the proceedings of auxiliary request 1A (see point V above).

Auxiliary request 2A

3. Admissibility

- 3.1 Auxiliary request 2A was filed by Appellant II with letter dated 17 November 2015, i.e. two days before the oral proceedings before the Board. Appellant I challenged the admissibility of this request on the grounds that it was late filed and did not fulfil the requirements of Articles 123(2) or (3) EPC.
- 3.2 According to the Rules of Procedure of the Boards of Appeal (RPBA), any amendment to a party's case after it has filed its grounds of appeal may be admitted and considered at the Board's discretion and is not a matter as of right (Article 13(1) RPBA). For exercising due discretion in respect of the admission of such a late filed request, it is established case law of the Boards of Appeal that one crucial criterion is whether the amended claims of this request are clearly allowable (see for example T 153/85, OJ EPO 1988, 1, points 2.1

and 2.2 of the reasons), otherwise violating the principle of procedural economy.

- 3.3 Claim 1 of the auxiliary request 2A has been amended *vis-à-vis* claim 10 of the main request (which is identical to claim 2 of each of auxiliary requests 1 and 1A) in that the category of the claim has been changed, namely from a process for producing acetic acid to the use of DME for reducing the solubility of methyl iodide in an aqueous stream in a process for producing acetic acid.
- 3.4 According to Appellant II, the feature "the use of dimethyl ether for reducing the solubility of methyl iodide in an aqueous stream" found a basis at page 15, line 19 of the application as filed.

However, said passage merely states that "DME reduces the solubility of methyl iodide in water" and not specifically in an aqueous stream. Furthermore, the passage at page 6, lines 19 to 20 referred to by Appellant I discloses DME in an amount effective to reduce the solubility of methyl iodide in **the** aqueous **extract** stream (emphasis added), i.e. in a particular, and not any, aqueous stream. In addition, original claim 3 discloses DME in an amount effective to reduce the solubility of methyl iodide in "said" aqueous stream, claim 3 being (indirectly) dependent on original claim 1, wherein said aqueous stream is that separated from the second overhead, i.e. again a particular aqueous stream. Thus, there would appear to be *prima facie* no basis for the use of DME for reducing the solubility of methyl iodide in **any** aqueous stream. Therefore, the original disclosure would not appear to support the generalisation indicated in claim 1.

As a consequence the fresh amendment to claim 1 results in the generation of subject-matter which does not clearly fulfil the requirements of Article 123(2) EPC.

- 3.5 Therefore, claim 1 is not clearly allowable with the consequence that in view of the very late state of the proceedings at which said request was filed, the Board exercises its discretion not to admit auxiliary request 2A into the proceedings for reasons of procedural economy (Article 13(1) RPBA).

4. *Other issues*

Appellant I also submitted that several of the requests did not fulfil the requirements of Articles 54 and/or 123(2) EPC.

In view of the negative conclusion in respect of inventive step for the subject-matter of all requests as set out in point 2 above, a decision of the Board on these issues is unnecessary.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The patent is revoked.

The Registrar:

The Chairwoman:



C. Rodríguez Rodríguez

J. Mercey

Decision electronically authenticated