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**Datasheet for the decision
of 3 November 2011**

Case Number: T 2418/10 - 3.3.10

Application Number: 01983367.2

Publication Number: 1341747

IPC: C07C 45/51

Language of the proceedings: EN

Title of invention:

Production of glycolaldehyde by hydrous thermolysis of sugars

Applicant:

Resource Transforms International Ltd.

Opponent:

-

Headword:

Production of glycolaldehyde/RESOURCE TRANSFORMS INT.

Relevant legal provisions:

EPC Art. 56

Relevant legal provisions (EPC 1973):

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Keyword:

-

Decisions cited:

T 0020/81, T 0197/86, T 0939/92, T 0355/97

Catchword:

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Case Number: T 2418/10 - 3.3.10

D E C I S I O N
of the Technical Board of Appeal 3.3.10
of 3 November 2011

Appellant: Resource Transforms International Ltd.
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Decision under appeal: Decision of the Examining Division of the
European Patent Office posted 12 July 2010
refusing European patent application
No. 01983367.2 pursuant to Article 97(2) EPC.

Composition of the Board:

Chairman: P. Gryczka
Members: J. Mercey
D. S. Rogers

Summary of Facts and Submissions

- I. The present appeal lies from the decision of the Examining Division posted on 12 July 2010 refusing European patent application No. 01 983 367.2.
- II. The Examining Division held that the subject-matter of the then pending request lacked inventive step. More particularly, the Examining Division found that in the absence of fair comparative data, it had not been shown that the process according to the then pending claim 1 produced glycolaldehyde with greater yields than those obtained in the closest prior art document (1):

(1) US-A-5 292 541.

Thus, the problem to be solved by the invention could be seen merely as the provision of an alternative method for producing glycolaldehyde. The solution proposed, namely the use of an aqueous solution of glucose or sucrose wherein the water content of the solution was at least 30% by weight and the filtering of the liquid condensate, were obvious alternatives for the skilled person.

- III. At the oral proceedings before the Board, held on 3 November 2011, the Appellant (Applicant) defended the application in suit on the basis of two sets of claims submitted as an amended main request and as an amended auxiliary request at these oral proceedings before the Board. Claim 1 of the main request read as follows:

"A hydrous thermolysis method for producing glycolaldehyde, said hydrous thermolysis method comprising the steps of:

- (a) preparing an aqueous solution of an aldose-containing sugar selected from the group consisting of glucose and sucrose, wherein the water content of the solution is at least 30% by weight;
- (b) atomising the aqueous sugar solution;
- (c) heating a reactor to between 500°C and 600°C;
- (d) injecting the sugar solution atomised at Step b into the reactor heated at Step c, whereby a vaporous pyrolysis product is produced;
- (e) cooling the vaporous pyrolysis product of Step d in a condenser, whereby a liquid condensate is obtained;
- (f) collecting said liquid condensate into a holding tank to yield a glycolaldehyde-rich liquid; and
- (g) filtering the glycolaldehyde-rich liquid, wherein the resulting yield of the glycolaldehyde is at least 30% by weight of the sugar used in the aqueous solution."

Claim 1 of the auxiliary request differed from claim 1 of the main request exclusively in that in step (b), the atomisation of the aqueous sugar solution was specified "to provide droplets having a diameter that is less than 200 microns".

- IV. With regard to inventive step, the Appellant submitted that starting from the disclosure of document (1), the problem to be solved by the invention was the provision of a process for producing glycolaldehyde in higher yield and with minimal impurities. This improvement was shown by comparing Example 1 of the application in suit with Example 2 of document (1), Examples 1, 3, 5 and 6

with Example 4 of the application in suit, and Example 1 with Example 2 of the application in suit. It argued that neither the atomisation of a sugar solution having a minimum level of water prior to pyrolysis, as required by claim 1 of the main request, nor atomisation to provide droplets having a diameter less than 200 microns, as required by claim 1 of the auxiliary request, was suggested by document (1), let alone that these features would lead to an increased yield of glycolaldehyde. Document (1) taught merely the pyrolysis of corn syrup or powders which did not lend themselves to atomisation.

V. The Appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of either the amended main request, or the amended first auxiliary request, both requests filed at the oral proceedings before the Board.

VI. At the end of the oral proceedings, the decision of the Board was announced.

Reasons for the Decision

1. The appeal is admissible.

Main request

2. *Amendments (Article 123(2) EPC)*

Claim 1 is based on original claim 1, together with page 11, lines 4 to 5 of the application as filed.

The Board thus concludes that amended claim 1 complies with the requirements of Article 123(2) EPC.

3. *Inventive Step*

3.1 The Board considers, in agreement with the Examining Division and the Appellant, that the closest prior art is the disclosure of document (1).

Document (1) discloses (see claims 1 and 2) a process for pyrolysing dextrose (i.e. D-glucose) to produce a vaporous pyrolysis product which is then condensed. The sugar may be injected as a solution, more particularly as an atomised liquid, into the reactor (see col. 4, lines 63 to 66, col. 9, lines 19 to 20 and 64 to 67), the temperature of which is preferably 500 to 600°C (see col. 9, lines 36-38), to form a pyrolysis liquid containing hydroxyacetaldehyde (i.e. glycolaldehyde) (see col. 5, lines 11-20).

3.2 In view of this state of the art, the problem underlying the present application, as formulated by the Appellant at the oral proceedings, was the provision of a process for producing glycolaldehyde in higher yield and with minimal impurities.

3.3 As the solution to this problem, the present application proposes a process as defined in claim 1, characterised in that an aqueous solution of an aldose-containing sugar selected from the group consisting of glucose and sucrose having a water content of at least 30% by weight is atomised and injected into the reactor and that the collected glycolaldehyde-rich liquid condensate is filtered.

3.4 To demonstrate that the process achieves the alleged improvement in yield and purity, the Appellant, who by alleging this fact carries the burden of proving it (see T 355/97, point 2.5.1 of the reasons, not published in OJ EPO), relied upon a comparison of Example 1 of the application in suit with Example 2 of document (1), Examples 1, 3, 5 and 6 with (comparative) Example 4 of the application in suit, and Example 1 with (comparative) Example 2 of the application in suit. The Appellant never argued that the final filtering step (g) contributed to the improvement in yield and purity.

3.5 However, (comparative) Examples 2 and 4 of the application in suit, cited by the Appellant for the purpose of comparison with the claimed process, do not reflect the structurally closest embodiment disclosed in the closest prior art document (1) (see claim 2), namely a thermolysis method for producing glycolaldehyde from glucose. Instead, comparisons with the ketose sugar, fructose (Example 2) and a mixture of oligosaccharides, namely corn syrup (Example 4), are provided, the Appellant itself arguing that this latter mixture did not fall under claim 1 of the application in suit. Hence, these comparative Examples relied upon by the Appellant for supporting the alleged improvement do not provide a comparison with the prior art which is closest to the invention, namely the pyrolysis of glucose disclosed in document (1), and thus cannot demonstrate that the technical problem has been solved *vis-à-vis* this prior art.

- 3.6 The Appellant also compared Example 1 of the application in suit, wherein an aqueous solution of glucose having a water content of 66% by weight is pyrolysed and yields of glycolaldehyde of 55.4 and 51.6% are obtained, with Example 2 of document (1), wherein powdered dextrose is pyrolysed to give a yield of glycolaldehyde of 25.5%.
- 3.7 According to established jurisprudence, in the case where comparative tests are chosen to demonstrate an inventive step with an improved effect over a claimed area, the nature of the comparison with the closest state of the art must be such that the effect is convincingly shown to have its origin in the characterising feature(s) of the invention. For this purpose it may be necessary to modify the elements of comparison so that they differ only by such a characterising feature or features (see T 197/86, EPO OJ 1989, 371, points 6.1.2 and 6.1.3 of the reasons).
- 3.7.1 In the present case, there are at least two crucial operating conditions which have not been shown to be the same in the examples to be compared, namely the reactor temperature and the residence time.
- 3.7.2 In Example 2 of document (1), the process is carried out at a reactor temperature of 600°C and a vapour residence time of 75 msec, whereas in Example 1 of the application in suit, reactor temperatures of 528°C and 573°C are used and the precise vapour residence time is not given, only that the sugar solution is fed at a rate of ca. 2.25 ml/min, residence times of approximately one second, with a preferred range of 0.5 to 2 seconds and a maximum range of 0.1 to 5 seconds

for the apparatus of Figure 1 used in Example 1 being given on page 13, lines 18 to 21 of the application in suit. The reactor temperature and the residence time are, however, crucial for defining the yield of desired product and amount of impurities produced in the pyrolysis. Residence time in thermal decomposition processes is described in the application in suit (see page 23, lines 8 to 10) as "a crucial variable as the desired primary reaction product may undergo secondary decomposition". It is further specified (see page 13, lines 23 to 26) that the residence time must be long enough to activate the thermolysis reaction, but not too long, since excessive residence time increases the number of secondary decomposition products and reduces the final yield. Reactor temperature has a similar, not necessarily predictable, influence, as can be seen from Examples 1 and 2 of the application in suit, wherein in Example 1 a higher yield is obtained at 528°C than at 573°C, whereas in Example 2, a higher yield is obtained at 571°C than at 534°C. For these reasons, Example 1 of the application in suit and Example 2 of document (1) cannot be fairly compared.

3.7.3 Thus in view of the fact that these two compared examples have not been shown to differ exclusively by virtue of the characterising features of the claimed invention, namely in that a glucose solution having a water content of at least 30% by weight is atomised and injected into the reactor, a causal link between any possible yield increase and the characterising features has not been shown.

3.7.4 According to the jurisprudence of the Boards of Appeal, alleged but unsupported advantages cannot be taken into consideration in respect of the determination of the problem underlying the invention (see e.g. decision T 20/81, OJ EPO 1982, 217, point 3, last paragraph of the reasons). Since in the present case the alleged improvement, namely improved yield and purity, lacks the required experimental support, the technical problem as defined in point 3.2 above needs reformulation.

3.8 Thus, in view of the teaching of document (1), the objective problem underlying the invention is merely the provision of an alternative process for producing glycolaldehyde.

3.9 Finally, it remains to decide whether or not the proposed solution to the objective problem underlying the application is obvious in view of the state of the art.

3.9.1 Document (1) itself teaches that the sugar may be injected as a solution, more particularly as an atomised liquid, into the reactor (see col. 4, lines 63 to 66, col. 9, lines 19 to 20 and 64 to 67). The water content of said sugar solution of at least 30% is neither critical nor a purposive choice for solving the objective problem underlying the patent in suit, since no unexpected effect has been shown to be associated with this particular lower limit. The act of picking out at random a lower limit for the water content of the solution is within the routine activity of the skilled person faced with the mere problem of providing an alternative process for producing glycolaldehyde.

Filtering the final product of a chemical process belongs to the common general knowledge of the skilled person, such a step not being excluded by the teaching of document (1) and the Appellant never arguing that this filtering step contributed to inventive step.

3.9.2 The Board thus concludes that the subject-matter of claim 1 of the application in suit results from an arbitrary choice within the ambit of document (1) and consequently lacks an inventive step in view of document (1) alone.

3.10 For the following reasons, the Board is not convinced by the Appellant's submissions in support of the presence of an inventive step.

3.10.1 The Appellant argued that on reading document (1), the skilled person would have used powders of corn syrup as the feedstock, neither said feedstocks, nor the nozzle size of 3/32 inch used to inject the syrup in Example 10 thereof, being suitable for atomisation.

However, the teaching of document (1) is not limited to its Examples, said document clearly allowing for injection into the reactor of atomised glucose or sucrose solutions (see point 3.9.1 above), it being within the routine practice of the skilled person to select a suitable nozzle size in order to achieve the atomisation taught by said document.

3.10.2 The Appellant further argued that the skilled person had no incentive to specifically select the injection into the reactor of an atomised glucose or sucrose solution from within the host of possible process

conditions taught by document (1), said combination of features being only obvious with the benefit of hindsight.

However, the fact that the skilled person had several alternatives at his disposition when looking for an alternative process for producing glycolaldehyde has no impact on the assessment of inventive step, since a mere choice from a host of possible solutions does not in itself involve inventive ingenuity (see decision T 939/92, OJ EPO 1996, 309, points 2.5.2 and 2.5.3 of the reasons). No specific motivation is required to make an arbitrary choice of particular process conditions, in this case the injection into the reactor of an atomised glucose or sucrose solution, from a host of process conditions taught by the single document (1) as being effective for the pyrolysis of sugars to glycolaldehyde, when the problem to be solved is merely to provide an alternative process.

3.10.3 All of the Appellant's arguments in support of inventive step which were based on the premise that the glycolaldehyde yield was improved *vis-à-vis* document (1) are redundant, since such an improved yield has not been shown (see point 3.7.4 above).

3.11 As a result, the Appellant's main request is not allowable as the subject-matter of claim 1 thereof lacks inventive step pursuant to Article 56 EPC.

Auxiliary request

4. *Amendments (Article 123(2) EPC)*

Claim 1 is based on original claims 1 and 5, together with page 11, lines 4 to 5 of the application as filed.

The Board thus concludes that amended claim 1 complies with the requirements of Article 123(2) EPC.

5. *Inventive Step*

5.1 Claim 1 according to the auxiliary request has been amended *vis-à-vis* claim 1 of the main request in that in step (b), the atomisation of the aqueous sugar solution is specified to provide droplets having a diameter that is less than 200 microns.

5.1.1 As with the water content of the aqueous sugar solution (see point 3.9.1 above), the droplet size achieved by atomisation of less than 200 microns is neither critical nor a purposive choice for solving the objective problem underlying the patent in suit, since no unexpected effect has been shown to be associated with this particular upper limit. The act of picking out at random an upper limit for the droplets of 200 microns is within the routine activity of the skilled person faced with the mere problem of providing an alternative process for producing glycolaldehyde, the Appellant itself submitting that the specification of the droplet size was merely to clarify the meaning of the term "atomising", and not that said size was associated with any particular effect. Therefore, the arbitrary choice of a droplet size of less than 200

microns cannot provide the claimed absorbent with any inventive ingenuity.

- 5.2 The Appellant argued that the nozzle having a 3/32 inch aperture used for injecting the moist corn syrup in Example 10 of document (1) was not suitable for providing droplets having a diameter less than 200 micron. Thus no injection apparatus capable of providing atomised droplets was disclosed.

However, as outlined in point 3.10.1 above, the teaching of document (1) is not limited to its Examples, document (1) already teaching the atomisation of a liquid sugar feed (see col. 9, lines 19 to 20). It is thus within the common general knowledge of the skilled person, seeking to achieve atomised droplets having a diameter that is less than 200 microns, to use a nozzle having a correspondingly small aperture.

- 5.3 Thus, the auxiliary request is also not allowable for lack of inventive step pursuant to Article 56 EPC.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

C. Rodríguez Rodríguez

P. Gryczka