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**Datasheet for the decision
of 30 January 2025**

Case Number: T 2071/22 - 3.2.03

Application Number: 12771449.1

Publication Number: 2697185

IPC: C10B49/02, C10B47/30,
C10B53/02, C10L5/44, C01B32/30

Language of the proceedings: EN

Title of invention:
PROCESSES FOR PRODUCING HIGH-CARBON BIOGENIC REAGENTS

Patent Proprietor:
Carbon Technology Holdings, LLC

Opponent:
Stora Enso Oyj

Headword:

Relevant legal provisions:
EPC Art. 84, 123(2), 123(3)
RPBA 2020 Art. 11

Keyword:

Amendments - allowable (yes) - extension beyond the content of
the application as filed (no) - broadening of claim (no)
Remittal - special reasons for remittal (yes)
Claims - clarity (yes)

Decisions cited:

Catchword:



Beschwerdekammern
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Case Number: T 2071/22 - 3.2.03

D E C I S I O N
of Technical Board of Appeal 3.2.03
of 30 January 2025

Appellant: Carbon Technology Holdings, LLC
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Decision under appeal: **Decision of the Opposition Division of the
European Patent Office posted on 8 July 2022
revoking European patent No. 2697185 pursuant to
Article 101(3) (b) EPC.**

Composition of the Board:

Chairwoman J. Hoppe
Members: B. Miller
B. Goers

Summary of Facts and Submissions

- I. European patent EP 2 697 185 B1 ("the patent") relates to a process for producing a high-carbon biogenic reagent from a feedstock comprising plant or plant-derived biomass.
- II. An opposition against the patent was filed on the grounds of Articles 100(b) and 100(c) EPC, and Article 100(a) EPC together with Articles 54 and 56 EPC.
- III. The opposition division concluded that the ground for opposition under Article 100(c) EPC prejudiced the maintenance of the patent and that none of auxiliary requests 1 to 23, submitted by the patent proprietor during the opposition proceedings, met the requirements of Article 123(2) or (3) EPC. The opposition division further concluded that auxiliary requests 24 and 25 were not to be admitted into the opposition proceedings. Therefore, the opposition division decided to revoke the patent.
- IV. The patent proprietor ("the appellant") appealed the decision of the opposition division.
- V. With its letter of reply to the statement of grounds of appeal the respondent submitted the following document:

D12: M.J. Antal: "A Review of the Vapor Phase Pyrolysis of Biomass Derived Volatile Matter", Fundamentals of Thermochemical Biomass Conversion, pages 511 to 537, 1985, https://doi.org/10.1007/978-94-009-4932-4_29

With the letter dated 4 January 2024 the respondent further submitted the following document:

D13: Carl Schaschke, A Dictionary of Chemical Engineering, First edition, Oxford University Press, 2014, ISBN: 978-0-19-965145-0, p. 325

- VI. With the summons to oral proceedings, the Board issued a communication pursuant to Article 15(1) RPBA indicating to the parties its intention to remit the case in the event of any of the requests being found allowable under Article 123(2) and (3) EPC.
- VII. Oral proceedings were held on 30 January 2025. In the course of the oral proceedings, the respondent confirmed that it would not be contesting the view that the subject-matter of claim 1 of auxiliary request 12 overcame its previous objection filed with respect to the main request. However, the respondent indicated that it would rely on its objection under Article 123(3) EPC as regards step (e) of claim 1 and on its additional objections under Articles 123(2) and 84 EPC, the latter objections being based on its view that the opposition division had interpreted the feature "solids residence time" with a meaning which was not originally disclosed and which allegedly reflected a lack of clarity.
- VIII. At the end of the oral proceedings, the following requests were maintained by the parties.

The appellant requested:

1. that the decision under appeal be set aside and the patent be maintained in amended form based on one of

auxiliary requests 12 to 47, all requests filed with the grounds of appeal;

2. that the case be remitted to the opposition division for further prosecution.

The respondent requested that the appeal be dismissed, or, as an auxiliary measure, that the case be remitted to the opposition division for further prosecution.

IX. Claim 1 of auxiliary request 12 reads (amendments compared to claim 1 as granted being marked in bold and strike-through by the Board):

A process for producing a high-carbon biogenic reagent, said process comprising:

- (a) providing a carbon-containing feedstock comprising plant or plant-derived biomass;
- (b) drying said feedstock to remove at least a portion of moisture contained within said feedstock;
- (c) deaerating said feedstock to remove at least a portion of interstitial oxygen, if any, contained within said feedstock or said dried feedstock;
- (d) **prior to step (e)**, preheating said dried feedstock in a preheating zone in the presence of a substantially inert gas for ~~from~~ at least 5 minutes ~~to at most 60 minutes~~ and with a preheating temperature selected from at least 80°C to at most 500°C, **and with a solids residence time of the preheating zone from 5 minutes to 60 minutes;**
- (e) in a pyrolysis zone, pyrolyzing said feedstock in the presence of a **said** substantially inert gas for ~~from~~ at least 10 minutes ~~to at most 120 minutes~~ and with a pyrolysis temperature selected from at least 250°C to at most 700°C, **and with a**

solids residence time of the pyrolysis zone from 10 minutes to 120 minutes, to generate hot pyrolyzed solids, condensable vapors, and non-condensable gases, wherein conditions for the step of pyrolyzing are selected to maintain the structural integrity or mechanical strength of said high-carbon biogenic reagent relative to said feedstock;

- (f) separating at least a portion of said condensable vapors and at least a portion of said non-condensable gases from said hot pyrolyzed solids;
- (g) in a cooling zone, cooling said hot pyrolyzed solids, in the presence of said substantially inert gas, for at least 5 minutes and with a cooling-zone temperature less than said pyrolysis temperature, to generate warm pyrolyzed solids;
- (h) in a cooler that is separate from said cooling zone, cooling said warm pyrolyzed solids to generate cool pyrolyzed solids; and
- (i) recovering a high-carbon biogenic reagent comprising at least a portion of said cool pyrolyzed solids, wherein said high-carbon biogenic reagent has an energy content of at least 25,586 kJ/kg [11,000 Btu/lb], at least 27,912 kJ/kg [12,000 Btu/lb], at least 30,238 kJ/kg [13,000 Btu/lb], at least 32,564 kJ/kg [14,000 Btu/lb], at least 33,727 kJ/kg [14,500 Btu/lb], or at least 34,192 kJ/kg [14,700 Btu/lb] on a dry basis.

The further auxiliary requests 13 to 47 are not discussed in the present decision. Their wording is thus not relevant.

X. The appellant's arguments, as far as they are relevant to the present decision, can be summarised as follows.

(a) Auxiliary request 12 - Article 84 EPC

The skilled person was well aware that the expression "solids residence time" referred to time the feedstock spent in the specified zone at its specific temperature. This commonly accepted meaning was also supported by paragraph [0229] of the patent. For example, the skilled person interpreted the expression "solids residence time of the preheating zone" as referring to the time which the dried solid feedstock spent in the preheating zone, with the preheating zone at the preheating temperature.

The interpretation adopted by the opposition division in its decision - that "solids residence time" in step (e) referred to the residence time of the "hot pyrolyzed solids" - was contrary to the understanding of the skilled person, as even acknowledged by the respondent. Hence, the expression could not be used to demonstrate that the subject-matter of claim 1 lacked clarity.

(b) Auxiliary request 12 - Article 123(2) EPC

The amendments in claim 1 were based on claim 4 as well as paragraphs [00246] and [00247] of the application as originally filed, which provided literal support for the amendments. The interpretation of the opposition division that "solids residence time" in step (e) referred to the residence time of the "hot pyrolyzed solids" was wrong and contrary to both the common understanding of the skilled person and the definition presented in the application as filed. If the correct

interpretation were applied, the feature would be considered originally disclosed.

(c) Auxiliary request 12 - Article 123(3) EPC

Claim 1 as granted specified in step (e) the time of pyrolysis of the solid feedstock. Claim 1 of auxiliary request 12 defined the lower limit of pyrolysing and additionally the solids residence time of the solid feedstock in the pyrolysis zone. Neither claim 1 as granted nor claim 1 of auxiliary request 12 defined the duration of the pyrolysis of volatile or liquid components in the reactor. The reformulation of claim 1 according to auxiliary request 12 did not therefore extend the scope of protection.

XI. The respondent's counter-arguments to each of the above points can be summarised as follows.

(a) Auxiliary request 12 - Article 84 EPC

Even though the interpretation applied by the opposition division did not make sense and was not consistent with the application as filed, it reflected the fact that it was unclear what was meant by the expression "solids residence time" in steps (d) and (e) of claim 1. The only solids referred to by claim 1 were the hot pyrolysed solids, as set out by the opposition division in the appealed decision. It could not be concluded that the feedstock after steps (a) to (d) consists only of solids, nor could it be concluded that the feedstock to step (e) was a solid feedstock. Hence, it was unclear whether the expression "solids residence time" referred to the residence time of the feedstock or the hot pyrolysed solids.

(b) Auxiliary request 12 - Article 123(2) EPC

The subject-matter of claim 1 extended beyond the content of the application as filed.

The opposition division found that the "solids residence time" in step (e) referred to the residence time of the "hot pyrolyzed solids". Paragraph [00246] of the application as originally filed did not provide support for the residence time of hot pyrolysed solids in the preheating zone. Hence, based on the interpretation applied by the opposition division, the amendment in step d) of claim 1 extended beyond the teaching of the application as originally filed.

The same applied mutatis mutandis to the amendments in step (e). Paragraph [00247] of the application as originally filed did not provide support for a residence time of the pyrolysed solids (i.e. the products of step (e)) in the pyrolysis zone.

(c) Auxiliary request 12 - Article 123(3) EPC

The subject-matter of claim 1 extended beyond the scope of claim 1 as granted.

Claim 1 did not specify that the feedstock was solid. The patent specification even suggested that the feedstock could be crude oil. Drying the feedstock in step (b) did not mean that the resulting product would be dry, as only part of the moisture needed to be removed. Moreover, during pyrolysis, not only solids but also liquid and volatile components were generated, as evidenced by D12. Since volatile and liquid components of the feedstock could have a different residence time, undefined in claim 1, claim 1 of

auxiliary request 12 no longer provided a limitation regarding the upper time limit of pyrolysis, contrary to claim 1 as granted.

Furthermore, according to the specification, the solids residence time in claim 1 of auxiliary request 12 could exclusively refer to solid additives whereas claim 1 as granted referred solely to the pyrolysis of the feedstock.

Moreover, even if step (e) referred to solid feedstock, claim 1 of auxiliary request 12 did not exclude continued pyrolysis of the feedstock after solids have left the pyrolysis zone. Therefore, pyrolysis could take longer than specified in claim 1 as granted.

Reasons for the Decision

1. Auxiliary request 12 - Article 84 EPC
 - 1.1 With its reply to the appeal the respondent raised a new objection under Article 84 EPC concerning the expression "solids residence time". This amounts to an amendment to the case pursuant to Article 12(4) RPBA.
 - 1.2 The new objection of the respondent is based on the interpretation of the term "solids" adopted by the opposition division. The opposition division found that the term "solids" in claim 1 referred to the "hot pyrolyzed solids", since claim 1 did not mention any further solids - see point II.17.3.3 of the reasons of the contested decision.

1.3 The Board does not agree with this interpretation by the opposition division and hence does not consider the new objection to be convincing.

1.4 Taking into account its technical context, the wording of claim 1 of auxiliary request 12 leaves the skilled person in no doubt that the solids meant by the expression "solids residence time" correspond - in line with common understanding of this expression - to the solid feedstock in the respective zone (see definition in the patent, paragraph [0230], emphasis added: "the residence time **across the zone**[s]"). These zones are defined in step (d) as the "preheating zone" and in step (e) as the "pyrolysis zone". It is implied by the definition of the solids residence time that the "feedstock" referred to by claim 1 has a solid content which may vary between the zones, for example due to drying processes or even the addition of certain solid additives (see point 1.6 below). It is also implied by the definition of the residence time that the zones are distinct zones (see patent, paragraph [0079]).

Hence, for the skilled person, the expression "solids residence time" refers to the time the solid feedstock supposedly spends in the specified zone at the zone's specific reaction temperature. This common understanding of the expression is also confirmed by paragraphs [0229] and [0230] of the patent. Further, this understanding does not contradict the general definition of "residence time" in D13, which also confirms that the residence time refers to the duration of a substance within a process and gives a measure of chemical reaction.

1.5 Regarding the process as defined in claim 1, this implies, for example, that the "solids residence time

of the preheating zone" in step d) of claim 1 refers to the time which the solid feedstock spends in the preheating zone, with the preheating zone at the preheating temperature.

Although the only solids explicitly referred to by claim 1 are hot pyrolysed solids in the following process step (e) ("to generate hot pyrolyzed solids"), it is immediately apparent to a skilled person that the "solids residence time" in the previous preheating step d) does not refer to the residence time of the hot pyrolysed solids, because they are the product of the pyrolysis zone defined in step (e).

Since the expression "solids residence time" in step d) of claim 1 cannot refer to the hot pyrolysed solids but, instead, refers to the feedstock of the preheating zone, an analogous interpretation for the same expression must also apply to the subsequent process step (e) of claim 1.

This understanding is also not at variance with the arguments of the respondent, which stated that the interpretation of the expression "solids residence time" as adopted by the opposition division in the context of the process of claim 1 was wrong because it

- "does not appear to make any sense that pyrolyzed solids should be preheated in the preheating zone" and
- "would not make any sense that the resulting product (i.e. pyrolyzed solids) would have any residence time to allow the carbonization chemistry to take place since this has already occurred in order to arrive at the product".

1.6 The respondent also argues that the expression "solids residence time" could refer exclusively to solid additives as defined in claims 10 and 11.

However, this argument is not convincing in the context of claim 1 already for the reason that solid additives are not required according to claim 1 but, instead, are only specified optionally. While additives may well be part of the solid feedstock, for example to the pyrolysis zone, it does not make technical sense to interpret the term "solids" in claim 1 exclusively in relation to an optional feature specified only in a dependent claim.

1.7 Hence, as demonstrated and agreed by the parties, the interpretation as set out in the impugned decision is not reasonable. It would thus not have been applied by the skilled person. Therefore, such an interpretation cannot be used to invoke a lack of clarity.

1.8 In view of the above considerations and irrespective of the question of admittance, the Board concludes that the amendments to claim 1 do not introduce a clarity issue and that the requirements of Article 84 EPC are fulfilled.

2. Auxiliary request 12 - Article 123(2) EPC

2.1 It is uncontested that the subject-matter of claim 1 of auxiliary request 12 has a literal basis in claims 1 and 4 as filed and also in paragraphs [00246] and [00247] of the application as originally filed (in this regard, reference is made to the corresponding publication WO 2012/142491 A1, "the application").

2.2 With its reply to the statement of grounds of appeal, the respondent raised a new objection under Article 123(2) EPC on the basis of an interpretation of the expression "solids residence time" adopted by the opposition division ("solids" refers to the "hot pyrolyzed solids") - see point 1.2 above. This constitutes an amendment to the case under Article 12(4) RPBA.

This objection is not convincing.

2.3 The requirements of Article 123(2) EPC refer to the application as filed. The Board has to interpret the wording of claim 1 ("solids residence time") independently of the opposition division's understanding and to further assess whether the technical meaning of the expression "solids residence time" in the application as filed has changed compared to amended claim 1 according to auxiliary request 12.

In the Board's view, this is clearly not the case, because the added feature is used in claim 1 of auxiliary request 12 in the same technical context and with the same meaning as in the application as filed (see paragraph [00244] of the application, which corresponds to paragraph [0229] of the patent). Moreover, as argued above in point 1, the opposition division's understanding of the expression "solids residence time" does not make technical sense in the context of claim 1 and in view of the description of the patent.

2.4 In view of the above, the Board concludes that, irrespective of the question of admittance of the new objection, claim 1 as amended fulfils the requirements of Article 123(2) EPC.

3. Auxiliary request 12 - Article 123(3) EPC

3.1 Claim 1 as granted defines a process wherein according to step (e) pyrolysis of feedstock takes place from at least 10 minutes to at most 120 minutes in the pyrolysis zone.

According to amended claim 1 of auxiliary request 12 the minimum time of the pyrolysis ("pyrolyzing of feedstock takes place for at least 10 minutes in the pyrolysis zone") and the "solids residence time of the pyrolysis zone from 10 minutes to 120 minutes" are defined.

The amendment according to claim 1 of auxiliary request 12 does not extend the scope of protection compared to claim 1 as granted, for the following reasons.

3.2 Paragraph [0223] of the patent explains that preheating may continue to take place in the pyrolysis zone. This is confirmed by the second sentence of paragraph [0232] of the patent, according to which the carbonisation reaction takes place "following the necessary heat transfer", and the explanations in paragraph [0231] of the patent in relation to the preheating step: the heat-transfer rate depends on the particle type and size, the physical apparatus, and on the heating parameters.

Hence, the patent confirms that the time of pyrolysis is not necessarily the same as the residence time in the pyrolysis zone, which includes both the time for heat transfer and the time for pyrolysis.

It follows that claim 1 as granted encompasses a process wherein the pyrolysis takes place for up to 120 minutes and the solids residence time can be longer than 120 minutes.

Through the amendment of claim 1 according to claim 1 of auxiliary request 12, the conditions of process step (e) have been limited, since the amended claim 1 defines the solid residence time in the pyrolysis zone. This implies that the pyrolysing time of the solids in the pyrolysis zone is also limited because pyrolysing the feedstock in this zone cannot take longer than its residence time therein.

Hence, the scope of protection of claim 1 as granted has been limited from a process wherein the feedstock can be in the pyrolysis zone for a period of from 5 minutes to more than 120 minutes to a process according to claim 1 of auxiliary request 12 wherein the (solid) feedstock is in the pyrolysis zone for a minimum of 5 minutes to a maximum of 120 minutes.

The same restriction applies with regard to process step d) of claim 1 of auxiliary request 12. Furthermore, the opponent has not argued - nor is it discernible for the Board - that the amendments to step (d) have to be considered differently.

The amendments in claim 1 of auxiliary request 12 thus fulfil the requirements of Article 123(3) EPC.

3.3 The opposition division concluded that the amendments extended the scope of protection as granted. The opposition division's assessment of the amendments is based on the interpretation that the feedstock referred to in step (e) of claim 1 as granted was not limited to

solids. The opposition division found that, for non-solid components, claim 1 of auxiliary request 12 did not provide a limitation concerning the pyrolysis time, contrary to claim 1 as granted.

This argument is not convincing.

- 3.3.1 Claim 1 as granted requires in step (e) not only that pyrolysis takes place at a specific temperature for a specified time but further requires that hot pyrolysed solids be generated and that the "conditions for the step of pyrolyzing are selected **to maintain the structural integrity or mechanical strength** of said high-carbon biogenic reagent relative to said feedstock" (emphasis added in bold by the Board).

Structural integrity and mechanical strength are properties which are exclusively related to solids (see, e.g., paragraphs [0099], [0211] of the patent: "structural objects"). Examples of suitable parameters to characterise these properties to be maintained from feedstock to pyrolysed products disclosed in the patent are also related to solids (see patent: paragraphs [0119] and [0374] to [0377] as well as examples: "CSR test", "drop shatter test").

Therefore, it is clear from the aim to produce pyrolysed solids as well as from the further conditions concerning the maintenance of the structural integrity or mechanical strength of said high-carbon biogenic reagent relative to said feedstock that the pyrolysis conditions in claim 1 refer to solid feedstock - see also point 1 above. The Board does not contest the view that, in general, pyrolysis of liquid or gaseous (volatile) components can also be the subject of pyrolysis, as also set out in D12. However, this

general teaching and the respondent's related argument are not relevant because, in view of the specific wording and the structure of claim 1, the pyrolysis of liquid or gaseous (volatile) parts of the feedstock for which no structural integrity or mechanical strength can be maintained is not considered in claim 1.

- 3.3.2 A further indicator in support of this interpretation is that the feedstock is "dried" in step (b), this being a term at least not used for pretreatment of liquid feedstock in application of a common technical understanding. Although drying methods for liquids exist in the field of chemistry, the patent does not suggest that any of these methods could be used for drying a liquid feedstock.

Hence, claim 1 indicates - at least implicitly - that the dried feedstock used for process steps (d) and (e) is a solid feedstock. This limitation already applied to claim 1 as granted and still further applies to amended claim 1 of auxiliary request 12.

- 3.3.3 The respondent argues that the patent also proposes to use "crude oil" as a feedstock (see paragraph [0207] of the patent) and hence presents the possibility that a liquid feedstock could be used in the process of claim 1.

This argument is not convincing.

The Board is convinced that neither step (e) of claim 1 as granted nor step (e) of claim 1 of auxiliary request 12 is to be interpreted as covering a liquid feedstock such as crude oil because, for a liquid component, it is not possible to determine and maintain structural integrity or mechanical strength.

A non-solid feedstock, even if mentioned in the patent specification, is thus not encompassed by the subject-matter of claim 1.

- 3.3.4 The respondent also argues that gaseous (volatile) or liquid products can be present in the pyrolysis zone resulting from
- i) the pyrolysis taking place in the preheating zone (see paragraph [0223] of the patent),
 - ii) the pyrolysis in the pyrolysis zone itself or
 - iii) recirculation of gaseous components within the reactor.

In the Board's view, reaction products generated by pyrolysis, irrespective of their zone of origin within the reactor, are not part of "said feedstock" addressed by step (e) of claim 1 as granted or step (e) of amended claim 1 according to auxiliary request 12, this being for the same reasons as those set out above in relation to liquids (structural integrity or mechanical strength of gaseous (volatile) or liquid products cannot be maintained).

Therefore, neither claim 1 as granted nor claim 1 of auxiliary request 12 is limited with respect to the time for pyrolysis of gaseous (volatile) or liquid components in the pyrolysis zone.

It follows that the amendments to claim 1 do not extend the scope of protection by omitting to define the pyrolysis time of any liquids or gases.

- 3.4 The respondent further argues that the expression "solids residence time" could exclusively refer to solid additives and not to the feedstock. Hence, based

on this interpretation, the pyrolysis time of the feedstock would not be limited and the scope of protection would be extended compared to claim 1 as granted.

This argument is also not convincing, since the skilled person would not interpret step (e) of claim 1 as referring to the additives, since additives are only optionally included according to claims 10 and 11 of auxiliary request 12. Further, it is immediately apparent from the wording of claim 1 itself that no further additives are covered by the expression "said feedstock" in step (e) of claim 1. Therefore, it does not make technical sense to assume that a skilled person would interpret the expression "solids residence time" as related to additives in the context of a process for producing a high-carbon biogenic reagent as defined in claim 1.

3.5 Finally, the respondent argues that the pyrolysis could continue even after solids had left the pyrolysis zone and, therefore, that the time of pyrolysis was not limited according to claim 1 of auxiliary request 12.

However, this was also possible for the process of claim 1 as granted because both claim 1 as granted and claim 1 of auxiliary request 12 only define the time of pyrolysis in the pyrolysis zone.

Moreover, based on the Board's interpretation that the feedstock considered in step (e) is only the solid feedstock, it is clear that claim 1 as granted also specifies the pyrolysing time only for solid feedstock.

Hence, the amendments in step (e) do not change and thus do not extend the scope with regard to the time of

pyrolysis taking place in a zone different from the pyrolysis zone.

3.6 In view of the above, the Board concludes that claim 1 of auxiliary request 12 fulfils the requirements of Article 123(3) EPC.

4. Remittal of the case

The opposition division has not yet decided upon the issues arising from the grounds for opposition pursuant to Article 100(a) and (b) EPC.

As it is the primary object of the appeal proceedings to review the decision under appeal in a judicial manner (Article 12(2) RPBA) and as both parties requested remittal of the case for further prosecution, the Board decided to remit the case for further prosecution to the department of first instance (Article 11 RPBA).

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the opposition division for further prosecution.

The Registrar:

The Chairwoman:



C. Spira

J. Hoppe

Decision electronically authenticated