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Datasheet for the decision of 25 June 2015

Case Number: T 1545/13 - 3.3.05

Application Number: 99933287.7

Publication Number: 1113997

IPC: C02F3/30

Language of the proceedings: EN

Title of invention:
PROCESS FOR THE TREATMENT OF WASTE WATER CONTAINING AMMONIA

Patent Proprietor:
Paques Bio Systems B.V.

Opponents:
Gottfried Wilhelm Leibniz Universität Hannover
PURAC AB

Headword:
Water treatment/PAQUES BIO SYSTEMS B.V.

Relevant legal provisions:
EPC Art. 83

Keyword:
Sufficiency of disclosure - (no)

Decisions cited:

Catchword:

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Case Number: T 1545/13 - 3.3.05

D E C I S I O N
of Technical Board of Appeal 3.3.05
of 25 June 2015

Appellant: (Patent Proprietor)	Paques Bio Systems B.V. T. de Boerstraat 13, P.O. Box 52 8560 AB Balk (NL)
Representative:	Nederlandsch Octrooibureau P.O. Box 29720 2502 LS The Hague (NL)
Respondent I: (Opponent 1)	Gottfried Wilhelm Leibniz Universität Hannover Welfengarten 1 30167 Hannover (DE)
Representative:	Kröncke, Rolf Gramm, Lins & Partner Patent- und Rechtsanwaltssozietät GbR Freundallee 13a 30173 Hannover (DE)
Respondent II: (Opponent 2)	PURAC AB Box 1146 221 05 Lund (SE)
Representative:	Müller Schupfner & Partner Patent- und Rechtsanwaltspartnerschaft mbB Bavariaring 11 80336 München (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 29 April 2013 revoking European patent No. 1113997 pursuant to Article 101(3)(b) EPC.**

Composition of the Board:

Chairman	G. Raths
Members:	H. Engl
	P. Guntz

Summary of Facts and Submissions

I. The European patent EP-B-1 113 997 is based on Euro-PCT application 99933287.7, filed on 13 July 1999 and published as WO-A-2000/005 176. The grant of the European patent was mentioned on 1 July 2009 (Bulletin 2009/27).

II. The patent in suit is concerned with a process for the biological treatment of ammonia-containing water by nitrite-producing bacteria.

III. Independent claim 1 as granted reads:

"1. A process for the biological treatment of water containing at least 50 mg/l of ammonia, wherein the water is treated with sludge containing nitrifying bacteria in an aerated reactor, applying a sludge retention time in the reactor which continuously favours nitrite-producing bacteria over nitrate-producing bacteria, characterised by reacting the nitrite produced by the nitrite-producing bacteria with ammonia in the presence of denitrifying bacteria to produce dinitrogen in the same reactor, and by controlling the sludge retention time by continuously separating part of the sludge from the reactor effluent and continuing the use of the separated part thus retained in the reactor, applying a sludge retention time which is shorter than the doubling time of the nitrate-producing bacteria and applying a hydraulic retention time which is shorter than the sludge retention time, and keeping the dissolved oxygen concentration in the reactor below 0.4 mg/l."

Claims 2 to 9 define particular preferred embodiments

of the process of claim 1 on which they depend.

IV. The European patent was opposed under the grounds of opposition according to Articles 100(a), (b) and (c) EPC.

V. The documents cited during opposition and appeal proceedings include inter alia the following:

D1: WO 98/07664 A

D7: Bischofsberger, W. and Deininger, A.: Fortbildungsstudium Weitergehende Abwasserreinigung - Seminarvorträge 1989/90. Berichte aus Wassergütewirtschaft und Gesundheitsingenieurswesen", Technische Universität München, 1991, Nr. 104, pages 74-77, 120-121, 124-125, 156-157

D16: Knowles G. et al., J. gen. Microbiol., 38, pages 263-278 (1965)

D18: Strous M. et al., Appl. Microbiol. Biotechnol., pages 589-596 (1998, accepted for publication 31.07.1998)

D19: Verstraete W. and Philips S., Environmental Pollution 102, pages 717-726 (1998, accepted for publication on 10 August 1998)

D21: Johansson P. et al., in Proceedings of a Polish-Swedish Seminar, Nowy Tag, October 1-2, 1998, pages 65-72

D22: Kuai L. and Verstraete W., Appl. Env. Microbiol. 64, pages 4500-4507 (1998,

accepted for publication on 26 August 1998)

D26: "Annex I", filed by respondent I

D27: Jetten M., van Loosdrecht M., et al. *"Novel principles in the microbial conversion of nitrogen compounds"*, Antonie van Leeuwenhoek 71 (1-2), pages 75-93 (1997)

D28, D28a: Brockmann D., Dissertation Universität Hannover (2006), ISBN 978-3-921421-65-9

D29, D29a: Musabyimana M., Dissertation Virginia Polytechnical Institute and State University (2008).

VI. According to the decision of the opposition division the patent failed to teach how to carry out the claimed invention over the whole scope as claimed without undue burden and the exercise of inventive skill. The patent in suit was therefore revoked (Article 83 EPC).

VII. The patentee (henceforth: the appellant) filed an appeal against this decision.

The notice of appeal of the appellant was received with letter dated 8 July 2013. The statement of grounds of appeal, of 6 September 2013, was accompanied by the following document:

D31: "Full Scale Examples of Wastewater treatment plants treating ammonia-containing waste water using nitrification/annamox denitrification" (undated, 1 page).

The appellant requested in writing that the impugned

decision be set aside and the patent be maintained in amended form on the basis of any one of the sets of claims according to the first and second auxiliary requests filed on 29 October 2012.

VIII. A communication of the board was issued on 3 February 2015 as an Annex to the summons for oral proceedings. The board raised objections under Article 123(2) EPC against certain claims of the auxiliary requests and indicated that the question of insufficiency of disclosure would be discussed at the oral proceedings.

IX. Under cover of a further letter dated 22 May 2015, the appellant submitted new arguments and filed new sets of claims as a first, second and third auxiliary request, replacing the respective requests previously on file. The appellant confirmed that its main request was directed at the claims as granted (see point III. above).

X. The independent claims in accordance with the auxiliary requests are worded as follows:

Auxiliary request 1:

Claim 1 thereof differs from claim 1 as granted in that the following passage is inserted in the third-last line, after the expression "which is shorter than the sludge retention time":

", in which the sludge retention time is at least 20 days,".

Auxiliary request 2:

Claim 1 thereof differs from claim 1 as granted in that the following passage is inserted in the third-last line, after the expression "which is shorter than the sludge retention time":

", in which the sludge retention time is between 20 and 30 days,".

Auxiliary request 3:

Claim 1 thereof differs from claim 1 as granted in that the expression "which is shorter than the sludge retention time" has been amended to read:

", which is less than half the sludge retention time,".

XI. The arguments of opponent I (henceforth: respondent I) were received with letters dated 19 March 2014 and 22 May 2015, respectively. Also, document

D30: EP 2 366 637 (cyklar-stutz Abwassertechnik GmbH), DE, attorney's docket # NYH-30-EP (2010)

was submitted.

XII. The arguments of opponent II (henceforth: respondent II) were received with letter dated 16 January 2014.

XIII. The appellant essentially argued as follows:

The appellant requested that D29 should not be admitted.

Insufficiency of disclosure:

The invention essentially consisted in allowing

effective biological ammonia removal through net conversion to molecular nitrogen by favouring the desired reactions

(1) $NH_3 + 3[O] \rightarrow NO_2^- + H_3O^+$ nitrite producing bacteria
and
(3) $NH_3 + NO_2^- \rightarrow N_2 + H_2O + OH^-$ anammox bacteria
and suppressing the undesired reaction
(2) $NO_2^- + [O] \rightarrow NO_3^-$ nitrate producing bacteria.

This could be achieved, apart from controlling oxygen and nitrite levels, by manipulating the retention times of the bacteria (sludge) in an absolute and relative sense. The solution proposed by the patent in suit consisted in continuously separating a part of the sludge from the single reactor effluent and withholding the other part in the reactor.

Example 2 demonstrated that an average retention time resulted in effective ammonia removal via the "anammox" reaction (3).

The opposition division had revoked the patent under Article 83 EPC with the following arguments:

(1) Sludge retention time (SRT) was not defined in claim 1 as granted (assuming that achieving an SRT of greater than 20 days was not possible, as suggested by the prior art);

(2) alleged absence of information on temperature and pH in the patent;

(3) alleged absence of precise information about the reactor content (the type of sludge) used in example 2.

However, in the appellant's view, none of these arguments were tenable, for the following reasons.

Argument (1) was essentially a question of the presence or not of an essential feature in a claim and hence a clarity or support issue (Article 84 EPC). The SRT was defined in the claims by the feature favouring nitrite-producers over nitrate producers; there was further guidance in the patent how this could be achieved.

Ad (2): pH and temperature used in the claimed process were conventional, as illustrated in the prior art. The opponents had not provided any evidence that common and conventional pH and temperature values, as used in the prior art and in example 1, would not work.

Ad (3) (bacterial sludge): It was stated in example 2 that an inoculum from another sequencing batch reactor was used. It contained desired nitrifying bacteria, nitrate forming bacteria (not desired) and denitrifying (anammox) bacteria (desired), in addition to others. The inoculum used in Example 2 did not need to be the same as in D18. In Document D31 process parameters of successful commercially operating treatment plants were summarized to show that the claimed process worked well on a real-life scale with relatively broadly varying parameters.

XIV. Respondent I essentially argued as follows:

The respondent requested that D31 should not be admitted.

Insufficiency of disclosure:

Claim 1 required a SRT in the reactor which continuously favoured nitrite-producing bacteria over nitrate-producing bacteria, which retention times were

known to be approximately 2 days (see D7, table 1). On the one hand, claim 1 also required a SRT which was shorter than the doubling time of the nitrate-producing bacteria (i.e. less than 2 days; see D16, D7 and D27, Figure 10). On the other hand, the sludge retention time for the dissolved oxygen concentration of below 0.4 mg/l (as required by claim 1 as granted) for the denitrifying bacteria had to be between 20 and 30 days (as confirmed by D18 disclosing that the SRT should be at least 11 days because the doubling time of the denitrifying bacteria was known to be 11 days at maximum growth rate, and 30 days as reported in D18 (page 589)).

Hence, there were conflicting requirements for the SRT in claim 1 as granted. The claim encompassed embodiments of processes having a SRT which could not be put into practice.

The appellant argued that the *average* SRT (sludge retention time) was different from the *effective* SRT for the lighter part of the sludge. However, the patent did not distinguish between *average* SRT and *effective* SRT. This argument was therefore without merit.

Essential process parameters such as the temperature and the pH value were discussed only in an example which was not in accordance with the invention. The bacteria sludge used in example 2 did not contain nitrate-producing bacteria, contrary to the appellant's statement.

XV. Respondent II essentially argued as follows:

The respondent requested that D31 should not be admitted.

Insufficiency of disclosure:

There were conflicting requirements for the SRT in claim 1 for the doubling times of the denitrifying bacteria (20 to 30 days) and the nitrate-producing bacteria (< 2 days). The appellant could not resolve this ambiguity by referring to "average" and "effective" SRTs because these definitions lacked a basis in the originally filed documents. At the relevant date of the opposed patent, the skilled person was unable to solve the problem caused by these contradicting requirements without inventive effort, because such a process was for the first time disclosed in D30.

XVI. Requests

The appellant requested that the decision of the opposition division be set aside and the patent be maintained as granted, or, in the alternative, in amended form on the basis of one of the sets of claims filed with letter dated 22 May 2015 as first to third auxiliary requests.

The respondents requested that the appeal be dismissed.

Reasons for the Decision

1. Amendments

Since the appeal fails for other reasons, there is no need to deal with objections raised under Article 123 (2) EPC.

2. Admissibility of prior art documents into the proceedings

2.1 The publication dates of **D18, D19, D21** and **D22** fall between the priority and filing dates of the patent in suit. It remained uncontested that these documents belong to the prior art under Article 54(2) EPC, since the priority of the patent in suit of 24 July 1998 is not validly claimed.

2.2 The board considers that **D28 (D28a)** (published 2006) and **D29 (D29a)** cannot be admitted into the proceedings because they became available to the public after the filing date of the opposed patent.

D26 is based on data taken from D28 (see respondent's letter of 31 October 2012, page 3). It does therefore not belong to the state of the art.

2.3 For the same reasons **D30** does not belong to the state of the art and could not be admitted except by referring to it as an expert opinion. However, the respondent's arguments based on D30 are based on speculation and the document is therefore not admitted.

2.4 To the benefit of the appellant, **D31** is exceptionally admitted.

3. Insufficiency of disclosure (Article 83 EPC)

3.1 *Methodical approach*

For making a case of insufficiency of disclosure, it is necessary to identify gaps in information resulting either from limitations in teaching or a lack of guidance in general, or a lack in guidance in case of

failures, or the impossibility to verify parameters, or purpose-related instructions or the absence of criteria for selection rules.

The board has therefore to decide whether the patent in suit suffers from such critical gaps in information or a lack of guidance. The question then has to be answered whether the skilled person with his common general knowledge can remedy these defects, or whether the consequences of the information gaps would result in an excessive number of experiments ("undue burden" or "research programme").

3.2 *Patent in suit and drawbacks in the prior art*

The patent in suit relates to a process for the treatment of water containing ammonia by nitrifying bacteria, wherein ammonia is predominantly oxidised to nitrite. Prior art processes of this kind, for instance as the so-called SHARON process disclosed in **D2** and **D27**) suffer from the disadvantages of low sludge concentration, relatively large reactor volume, poor settling characteristics or require expensive cultivation of selected micro-organisms (**D9**).

3.3 *Object of the invention*

The object of the patent under appeal is to overcome these drawbacks (see paragraph [0006] of the patent).

3.4 *Summary of the main issues*

Taking into account the arguments of the appellant during oral proceedings and the wording of claim 1, the board sums up the main issues as follows:

(1) Characterization of the process

The claimed process is characterized in that the sludge retention time (SRT) in the nitrification reactor is controlled independently from the hydraulic retention time (HRT).

(2) Parameter adjustments

According to claim 1 of the main request, due consideration has to be given to the following aspects:

(i) Control of the sludge retention time by continuously separating part of the sludge from the reactor effluent and

(ii) continued use of the separated part thus retained in the reactor; and

(iii) determination and application of a sludge retention time which is shorter than the doubling time of the nitrate-producing bacteria.

3.5 *The appellant's reasoning during oral proceedings*

3.5.1 According to the appellant, the following instructions were sufficient for putting the claimed process successfully into practice:

(1) Continuously remove a part of the sludge from the reactor. As a result, the sludge would be divided into (a) a heavier part of sludge and (b) a lighter part of sludge. Thereby, the heavier part of the sludge would be removed. The desired bacteria cultures (the nitrite-producing bacteria or AOB) were concentrated in the lighter part of the sludge and thus would be

predominantly retained in the reactor. In the end, the undesired heavier nitrate-producing bacteria or nitrite oxidising bacteria (NOB) would gradually be washed out.

(2) Adjust time for sludge built-up. It depended on the process parameters how long it would take to build up enough sludge containing the AOB bacteria, but the result was inevitable.

(3) Determination of retention time. When referring to the retention time (RT), an average retention time was meant. Because of the gradual washing out of the undesired NOB (nitrite oxidising bacteria), there was no conflict between NOB doubling time of up to 10 days and the SRT (between 20 and 30 days at low air saturation; see paragraph [0010]). Similarly, there was no conflict between the doubling time of the anammox bacteria (or denitrifying bacteria) and the SRT in the reactor.

3.5.2 Process illustration

The washing out of the lighter part of the sludge was illustrated by Example 2 (although not the complete process was shown). It could be assumed that similar bacteria as in D18 were used as an inoculum. The exact kind of sludge used initially was not decisive, because dormant AOB (ammonium oxidising bacteria or nitrite producing bacteria) would always be present; under aerobic conditions and continuous sludge removal they would start proliferation.

This start-up process could take up to 6 months.

3.5.3 Further experimental evidence

Document D31 demonstrated the successful commercial operation of two wastewater treatment plants using the nitrification/anammox denitrification process of the invention. The claimed process worked well on a real-life scale with relatively broadly varying parameters.

3.6 Identification of information gaps by the board

3.6.1 Incomplete teaching in regard of the sludge retention time (SRT)

The sludge retention time appears to be a critical parameter. According to the patent in suit the sludge retention time should be longer than the hydraulic retention time ([0010]) and shorter than the doubling time of the nitrate producing bacteria (NOB) (see claim 1). The appellant's line of argument introduced an additional interpretation of the sludge retention time:

(a) the average SRT and
(b) the effective SRT.

During oral proceedings, also the terms

(c) individual SRT and total SRT

were used when the parties referred to the oxidation reactions occurring during the invention process.

The appellant argued that the *average* SRT was different from the *effective* SRT for the lighter part of the sludge. However, the board cannot find a basis, explicit or implicit, for such a differentiation in the

originally filed documents.

As to individual sludge retention times, the appellant argued that the total SRT was the addition of the individual SRTs. It was the total SRT that was the important time constant, individual SRTs need not be known. As mentioned, the originally filed documents do not differentiate between effective and average times. There is also no implicit disclosure and the appellant has not argued to that effect.

As to the term "total sludge retention time", apparently the "sludge retention time" is meant; even assuming that the "total sludge retention time" is the addition of "individual sludge retention times" and even assuming that the "individual retention times" have not to be known, the term "total SRT" raises the question of the meaning of the non-defined terms "average time" and "effective time".

3.6.2 Incomplete teaching in regard of the sludge splitting and sludge removal

Following the appellant, a consequence of step 1 of the process (see 3.5.1, item (1)) was the splitting of the sludge in two parts, a heavier part and a lighter part.

However, the originally filed documents do not disclose a partial removal/retention of the bacterial sludge in such a manner that the lighter sludge comprising the desired bacteria would predominantly remain in the reactor.

Figures 1 and 2 illustrate two flow charts or apparatus designed for carrying out the process of the invention. These charts comprise a surplus sludge outlet (6) and

an optional bottom loop (7) equipped with a separator (8) and a surplus sludge outlet (9). The SRT may be controlled by adjusting the sludge removal through outlets (6) or (9) (see paragraph [0016]).

There is no disclosure of tapping undesired heavier sludge and keeping desired bacteria cultures (the nitrite-producing AOB bacteria) in the lighter part of the sludge since top and bottom sludge outlets are shown as equivalent.

Furthermore, the sludge outlets comprise separators (Figure 1, external separators (4) and (8); Figure 2, internal separator (4) and external separator (8)). The exact way of functioning of these separators (settling tank, filter, or centrifuge) is not described.

In summary, it cannot be clearly and unambiguously derived from the Figures and the corresponding parts of the description of the patent whether a separation in a heaver and lighter sludge is intended to take place, nor how this should be put into practice.

3.6.3 Missing instructions

While instructing the skilled person to carry out the claimed process under conditions which "continuously favour nitrite-producing bacteria over nitrate-producing bacteria", the patent in suit fails to disclose the means how this could be accomplished.

According to the appellant, step 1 (continuously remove a part of the sludge) and step 2 (adjust time for sludge built-up) were sufficient instructions (see 3.5.1). For adjusting the time for sludge built-up, the appellant argued that the adjusting procedure was a

function of the process parameters, but that sludge in which the the reaction involving nitrite oxidising bacteria (i.e. the undesired reaction) takes place would be gradually washed out. The desired result would be achieved automatically.

For the board, these instructions are insufficient for achieving the intended effect, because it is in fact essential to retain the lighter sludge which contains the desired bacteria. However, from the information contained in the description, the examples and the figures of the patent in suit the skilled person does not learn this crucial piece of information, nor does he become aware of the measures to take in order to put at least one way of the claimed process successfully into practice.

3.6.4 Unsuccessful reference to the common general knowledge

The appellant could not convince the board that these gaps in information could be filled by the skilled person's common knowledge.

(a) Reference to D1

The appellant referred to D1 (page 3, lines 15 to 21), a document describing a bioreactor, containing nitrifying and denitrifying microorganisms present on the respective outer and inner parts of a solid phase or carrier. The solid phase may consist of spontaneously formed aggregate. It is not clear to the board how precisely this piece of information could be used to fill the above mentioned gaps in information, as the nitritification reactor of D1 operates without sludge retention (page 2, lines 23 to 29). Moreover, D1 does not form part of the common knowledge.

(b) Reference to D31

The information contained in D31 cannot be used to fill any gaps in information, because there is no proof that its content was publicly available at the relevant day of the opposed patent.

3.7 *Conclusion*

In view of the above considerations, the board finds that the requirements of Article 83 EPC are not met as far as the claims of the main request are concerned.

Other issues of alleged insufficiency of disclosure raised and discussed *in extenso* by the respondents can therefore be left open. These issues were in particular whether the claimed process called for *conflicting* and *irreconcilable* requirements for the SRT, hydraulic retention time and the doubling times of the microorganisms, such that it could not be put into practice by the skilled person. Other objections concerned the question of whether Example 2 was in accordance with the invention and whether essential process parameters, in particular temperature and pH value, were missing in the independent claims.

3.8 Auxiliary requests 1 to 3

Claim 1 differs from claim 1 as granted in that the sludge retention time is at least 20 days (auxiliary request 1), or between 20 and 30 days (auxiliary request 2) or that the hydraulic retention time is less than half the sludge retention time (auxiliary request 3).

None of these amended claim features concern the question of the portion and quality of the bacterial sludge which should be preferentially removed from the reactor. Thus they do not bring any remedy for the critical deficiencies identified under points 3.5, 3.6 and 3.7 above.

3.9 It follows that the invention as defined in the claims of auxiliary requests 1 to 3 does not meet the requirements of Article 83 EPC.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

C. Vodz G. Raths

Decision electronically authenticated