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D E C I S I O N
of 14 September 1994

Case Number: T 0947/92 - 3.3.2

Application Number: 90300298.8

Publication Number: 0382340

IPC: C02F 3/30

Language of the proceedings: EN

Title of invention:
Two-stage anaerobic/aerobic wastewater treatment process

Applicant:
Zimpro Environmental, Inc.

Opponent:
-

Headword:
Wastewater treatment/ZIMPRO

Relevant legal norms:
EPC Art. 56

Keyword:
"Inventive step - main and first auxiliary request (no) - second auxiliary request (yes)"

Decisions cited:

Catchword:
-

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Case Number: T 0947/92 - 3.3.2

D E C I S I O N
of the Technical Board of Appeal 3.3.2
of 14 September 1994

Appellant: Zimpro Environmental, Inc.
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Decision under appeal: Decision of the Examining Division of the European Patent Office dated 22 May 1992 refusing European patent application No. 90 300 298.8 pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: A. J. Nuss
Members: G. J. Wassenaar
J. A. Stephens-Ofner

Summary of Facts and Submissions

I. European patent application No. 90 300 298.8 (publication No. 0 382 340) was refused by a decision of the Examining Division.

The decision was taken on the basis of Claims 1 to 20 as originally filed. Claim 1 reads as follows:

"1. A two-stage process for treating COD containing wastewater comprising the steps:-

(a) contacting said wastewater with anaerobic biosolids and powdered adsorbent in an anaerobic first treatment zone (12) to form an anaerobic mixed liquor and remove a substantial portion of the COD from said wastewater;

(b) separating fuel gas from said anaerobic mixed liquor within said first treatment zone (12);

(c) separating a substantial portion of the anaerobic biosolids and powdered adsorbents from said anaerobic mixed liquor by separating means (14, 20; 54; 164) within said first treatment zone (12) to produce a first solids phase and a first aqueous phase;

(d) transferring said first aqueous phase from said first treatment zone (12) to a second aerobic treatment zone (28; 60, 62; 102; 132, 140) containing aerobic mixed liquor solids comprising of aerobic biosolids powdered adsorbent;

(e) aerating and mixing said first aqueous phase with said aerobic mixed liquor solids in said second treatment zone using an oxygen containing gas, to remove a substantial portion of the remaining COD from said first aqueous phase;

(f) separating said aerobic mixed liquor solids from said thus-treated liquid to produce a second settled solids phase and a second aqueous phase;

(g) discharging said second aqueous phase to the environment or to reuse;

(h) transferring a portion of the second settled solids phase from the second treatment zone to the first treatment zone, thereby maintaining the desired concentration of aerobic biosolids within the second treatment zone;

(i) adding sufficient powdered adsorbent to said second treatment zone to compensate for powdered adsorbent transferred to said first treatment zone in step (h); and

(j) removing a sufficient amount of anaerobic mixed liquor from said first treatment zone to control solids concentration therein."

Dependent Claims 2 to 19 and independent Claim 20 are particular embodiments of the process of Claim 1.

II. The Examining Division held that the subject matter of Claims 1 to 20 did not meet the requirements of Article 56 EPC, having regard to the following documents:

(1) EP-A-0 218 331
(2) US-A-3 904 518
(3) US-A-4 676 906
(4) Korrespondenz Abwasser 10/86, pages 877 to 892
(5) DE-A-3 324 073
(6) Frostell, "ANAMET anaerobic-aerobic treatment of concentrated wastewaters"

In its decision the Examining Division took the view that the claimed process did not involve an inventive step for the following reasons:

The closest prior art was considered to be (1). The problem underlying the claimed invention was considered to be the improvement of the purification performance of the wastewater treatment. It was accepted that this problem was solved by the process of Claim 1, which differed from (1) by replacing the adsorption treatment to decolour the effluent of the anaerobic digester with an aerobic treatment zone, including aeration in the presence of a powdered adsorbent. It was, however considered that the use of an aerobic treatment stage to purify the effluent of an anaerobic digester was well known in the art, for example from (4),(5) and (6). Since it was further known from (2) to integrate the adsorption stage with the aerobic treatment to improve the performance of a biological aerobic water purification plant, the skilled man would have been led to combine the process of (1) with the process of (2). The process of Claim 1 was thus no more than the obvious solution of the problem to be addressed and hence did not involve an inventive step.

III. The Appellant lodged an appeal against this decision. In the Statement of Grounds of Appeal, the Appellant argued that (1) should not be taken as a starting point of the invention, because the invention was concerned with intermediate strength wastewaters, whereas (1) related to high strength liquors. It was further argued that there was nothing in the cited documents to suggest that an adsorbent assisted aerobic treatment stage could be usefully employed following an adsorbent assisted anaerobic first treatment stage and that the cited art would not lead the skilled man to transfer a portion of the adsorbent containing solids phase from the aerobic second stage to the anaerobic first stage.

Amendments were proposed in three auxiliary requests which limited the scope of the original independent

... ...

claims. Special attention was drawn to the second auxiliary request, according to which the powdered adsorbent leaving the second treatment zone provided the sole supply of adsorbent to the first treatment zone after the commencement of the process.

IV. During oral proceedings, which were held on 14 September 1994, it was further argued that the skilled man would not have sought to improve the process of (1) because the results were already satisfactory and that further improvement by integrating an aerobic treatment would be expected to be minimal and so not worth the additional cost of trying. It was also argued that although the adsorbent-assisted aerobic treatment according to (2) was known since 1975, it was never used in combination with an aerobic treatment, the combination of aerobic and anaerobic treatment according to (6) having itself been known since 1980.

With respect to the second auxiliary request, it was put forward that the additional measure did not further improve the clarification, but simply resulted in a more economic process, because installation and process costs were reduced as there was no need for continuously adding fresh adsorbent or regeneration of adsorbent as was required by the process according to Figure 4 of (1).

V. The Appellant requested that the decision under appeal be set aside and, as a main request, that a patent be granted on the basis of the documents as filed. In a first auxiliary request he requested the amendment of the preamble of Claims 1 and 20 so as to read: "A two-stage process for treating wastewater containing a COD of from 5000 to 50,000 mg/l comprising the steps:-"

In a second auxiliary request he requested to amend step (h) of Claims 1 and step (j) of Claim 20 by inserting the following limitation before the; at the end: ", said powdered adsorbent in said transferred portion of the solids providing the sole supply of adsorbent to said first treatment zone after commencement of the process".

In a third auxiliary request it was requested to amend Claims 1 and 20 as proposed in the first and second auxiliary request.

Reasons for the Decision

1. The appeal is admissible.

Main request

2. *Novelty*

Novelty was not disputed in the contested decision, so it need, and indeed may not be considered on appeal.

3. *Inventive step*

3.1 The closest prior art is (1). This document discloses a process for treating high strength liquors, which comprise waste waters containing 700 to 160,000 mg/l COD, comprising the steps:

(a) contacting said wastewater with anaerobic biosolids and powdered adsorbent in an anaerobic first treatment zone to form an anaerobic mixed liquor and remove a substantial portion of the COD from said wastewater (page 7, lines 12 to 14 and page 8, line 15 to page 9, line 29);

(b) separating fuel gas from said anaerobic mixed liquor within said first treatment zone (page 11, lines 17 to 23);
(c) separating a substantial portion of the anaerobic biosolids and powdered adsorbents from said anaerobic mixed liquor by separating means within said first treatment zone to produce a first solids phase and a first aqueous phase (page 10, lines 1 to 11);
(d) transferring said first aqueous phase from said first treatment zone to a second treatment zone containing mixed liquor solids comprising powdered adsorbent (page 15, lines 5 to 29);
(e) contacting said first aqueous phase with said liquor solids in said second treatment zone to remove a further portion of the remaining COD from said first aqueous phase (page 15, lines 13 to 15);
(f) separating said mixed liquor solids from said thus treated liquid to produce a second settled solids phase and a second aqueous phase (page 15, lines 8 to 13);
(g) discharging said second aqueous phase to the environment or to reuse (page 15, lines 15 to 19);
(h) transferring a portion of the second settled solids phase from the second treatment zone to the first treatment zone (page 17, lines 4 to 11);
(i) adding sufficient powdered adsorbent to said second treatment zone to compensate for powdered adsorbent transferred to said first treatment zone in step (h) (page 17, lines 12 to 15); and
(j) removing a sufficient amount of anaerobic mixed liquor from said first treatment zone to control solids concentration therein (page 10, lines 12 to 27).

According to Example V, this process achieves a COD removal of 95.4% with a feed containing 12,700 mg l COD.

3.2 The Appellant disagreed that (1) should be considered as the closest prior art, because (1) was specially adapted to treat high strength liquor, whereas the claimed invention was concerned with intermediate strength wastewaters. The Board does not accept this argument, because Claim 1 is not restricted to specific wastewaters nor does it exclude high strength liquors. Moreover, the range of 5000 to 50,000 mg/l for the COD values mentioned in the description for wastewaters suitable for treatment with the process of the invention falls within the range for high strength liquors to be treated in (1) (see point 3.1 above), and includes the COD values of the high strength liquors treated in the Examples of (1). In addition the Appellant has failed to indicate which other prior art document should consider to be the closest prior art. Since (1) is the only prior art document on file disclosing an adsorbent assisted first anaerobic stage, the Board considers that (1) is the closest prior art and is, therefore, to be taken is starting point for assessing inventive step.

3.3 The problem underlying the invention consists in achieving a further reduction of the COD content of wastewater. This problem is solved by features (d) and (e) as indicated in Claim 1. According to Table 1, a COD reduction of at least 97.3% is obtained with a COD feed of 16,500 mg/l. Thus there is indeed a slight improvement in comparison with the process described in (1), so that it can be accepted that the problem is solved by the process of Claim 1.

3.4 Thus the claimed solution differs from the process described in (1) in that in the second treatment zone (steps (d) and (e)) the mixed liquor solids additionally contain aerobic biosolids and are aerated, so that aerobic biosolids are formed, which contributes to a further reduction of COD.

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It was however known in the art, that the COD content of anaerobically treated wastewater could be further reduced by an aerobic second treatment, see (4), page 890; (5), abstract and (6). According to (6), page 270, the second stage of an Anamet plant is a conventional activated sludge plant in which further degradation of the sludge occurs. The excess sludge from the aerobic treatment tank is separated and transferred to the anaerobic tank. Document (2) further describes that a conventional activated sludge plant can be combined with an adsorption step by adding powdered activated carbon to the aeration tank and that this combination efficiently reduces COD in an unusually rapid manner (see the abstract). Thus it was not only known that the addition of aerobic biosolids and the aeration of the second treatment zone of (1) would solve the problem, but it was also known that an adsorption step, as described in (1) could be combined with an aerobic, activated sludge aeration treatment. The Board therefore finds, that it would have been obvious to the skilled man to replace the simple adsorption stage in the second treatment zone of (1) with an adsorption assisted aerobic treatment, so as to result in a process according to present Claim 1.

3.5 According to Figure 4 of (1), a portion of the solid phase from the decolouring step, i.e. the spent colour adsorbent is recycled to the anaerobic digester. If this known process step is replaced with an adsorption assisted aerobic treatment, it would be obvious to treat the solid phase from the aerobic treatment, which would also inevitably contain spent adsorbent, in the same way as is indicated for the spent colour adsorbent in (1), i.e. to transfer a portion of the adsorbent containing solid phase from the aerobic second stage to the anaerobic first stage. This feature is thus the straight forward consequence of replacing the decolorization step

of (1) as illustrated in Figure 4 with the adsorbent assisted aerobic treatment stage according to (2).

The Appellant's allegation that the cited art would not lead the skilled man to transfer a portion of the adsorbent containing solids phase from the aerobic second stage to the anaerobic first stage is therefore not convincing.

3.6 The argument that there was no reason for the skilled man to further improve the performance of the process of (1) is also not convincing, as it is the normal task of the man skilled in the art to look for improvements of known processes. Moreover, as environmental regulations require more and more restrictions on the wastewater contaminants, the skilled man would be even more likely to try to improve further the quality of wastewater.

3.7 The final argument that despite the technical facilities for further improvement having been known for more than 10 years before the filing date, the claimed improvement was not applied earlier, thereby pointing to or establishing its non-obviousness cannot be accepted, in the absence of cogent evidence of a technical prejudice. It is well accepted that the fact that specific solutions to technical problems are sometimes not applied as soon as they become available, is not necessarily the result of lack of inventiveness by persons skilled in the art, but can be put down to other factors, e.g. costs; shortage of materials; corporate inertia etc.

Thus the Board finds that Claim 1 of the main request lacks inventive step.

First auxiliary request.

4. *Allowability of amendments*

The amendment limits the main Claim to a COD range as disclosed on page 5 of the description as originally filed. Claim 1 of the first auxiliary request fulfils the requirements of Article 123(2) EPC.

5. *Novelty*

Since the scope of Claim 1 of the first auxiliary request is narrower than that of Claim 1 of the main request the novelty of which is not here at issue, it, too, possesses novelty.

6. *Inventive step*

The introduction of the COD content range of the wastewater to be treated does not influence the inventive step considerations outlined above in respect of the main request, because the wastewaters treated in the Examples of (1) all fall into the range of the amended main claim, as explained above under paragraph 3.2. Thus Claim 1 of the first auxiliary request also lacks an inventive step.

Second auxiliary request.

7. *Allowability of amendments*

Claims 1 and 20 of this request differ from the corresponding Claims as originally filed by the additional requirement that it is the powdered adsorbent from the aerobic second treatment zone that provides the sole supply of adsorbent to the first anaerobic treatment zone after the commencement of the process. This amendment is based on page 8, lines 10-14 of the description as filed, indicating that an initial charge

of powdered adsorbent can be added to the first treatment zone 12 to attain the desired adsorbent concentration therein during startup and that this material is supplemented with adsorbent removed from the following aerobic treatment step, in combination with the description of the Example on pages 21 and 22 of the description as filed, indicating that the only powdered carbon added to the anaerobic step was from waste solids removed from the aerobic treatment step. Thus the amended Claims fulfil the requirements of Article 123(2) EPC.

8. *Novelty*

Since the scope of Claim 1 of the second auxiliary request is narrower than that of Claim 1 of the main request the novelty of which is not here at issue, it, too, possesses novelty.

9. *Inventive step*

9.1 The closest prior art with respect to Claim 1 of the second auxiliary request is again (1). The technical problem underlying the invention can be seen as the achievement of improved purification performance, without concomitant and undue complication of the process. This problem is solved by the use of an adsorbent-assisted aerobic treatment stage (steps (d) and (e)), in combination with using the adsorbent from the aerobic treatment as the sole supply for the adsorbent to the first anaerobic treatment stage as defined in Claim 1 of the second auxiliary request.

As indicated in paragraph 3.3 above, the figures in the Example, which was performed in accordance with Claim 1 of the second auxiliary request, show an

improvement in purification performance (97.3% versus 95.4%).

According to Figure 4 of (1) and its description on page 17, the sole embodiment according to which spent adsorbent is recycled to the anaerobic treatment stage, the anaerobic digester is also supplied with regenerated adsorbent. According to page 17, lines 2-7, the supply with the regenerated adsorbent from the settler is obligatory, whereas the supply with the spent colour adsorbent is merely optional. The statement in paragraph 6 of the decision under appeal that (1) discloses that the entire need for the make-up adsorbent in the first, anaerobic treatment zone can be covered by the recycle of adsorbent that has been used in a second treatment zone, is therefore clearly not supported by the facts. The use of regenerated adsorbent requires a separate regeneration step, which is not required in the process of Claim 1 of the second auxiliary request. Although the additional feature in Claim 1 according to this auxiliary request gives no further improvement in the purification performance, as was indeed confirmed by the Appellant during oral proceedings, it does have the advantage of omitting a separate adsorbent regeneration step. Thus, although the additional aeration step complicates the process, the omission of a regeneration step means a substantial simplification, which is likely to be of more importance than the complication which arises from it. Thus the Board is satisfied that the said problem is solved by the process of Claim 1 of the second auxiliary request.

9.2 It remains therefore to be descided if, for solving the above stated problem, it was obvious that the supply of regenerated adsorbent in the embodiment of Figure 4 of (1) could be omitted provided that the decclouring step was replaced with an aeration treatment step. According

to page 17, lines 2-4 of (1) a portion or all of the regenerated adsorbent is directed to the digester. On lines 12 to 15 of page 17 it is further indicated that in some cases, recycle of spent adsorbent to the digester may fully replace the need for fresh adsorbent. Nothing in (1) suggests, however, that non-regenerated spent colour adsorbent could be sufficient as adsorbent supply to the anaerobic digester and could be used as sole supply without regenerated adsorbent. The other cited prior art documents are much less pertinent and do not relate to a water purification process involving an adsorbent assisted anaerobic treatment so that they cannot afford the skilled man any incentive to reach for the claimed solution of the relevant problem.

In the judgement of the Board, "reduced complexity" of a process without loss of performance generally involves an inventive step, if it was not obvious that the simplification was possible without loss of such performance. In the present case, where reduced complexity is accompanied with is slight improvement of performance, this general conclusion is certainly applicable.

For these reasons the process of Claim 1 of the second auxiliary request involves an inventive step.

Since the dependent Claims 2 to 19 and independent Claim 20 relate to particular embodiments of Claim 1, the same applies to said claims.

10. *Third auxiliary request*

Since the second auxiliary request is allowed, there is no need to consider the third auxiliary request.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to grant a patent on the basis of the second auxiliary request.

The Registrar: The Chairman:

P. Martorana A. J. Nuss