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Datasheet for the decision of 14 October 2019

Case Number: T 1657/16 - 3.3.03

Application Number: 06732230.5

Publication Number: 1882712

IPC: C08G63/12, C08G63/78, C08L67/00

Language of the proceedings: EN

Title of invention:
BIOMASS-RESOURCE-DERIVED POLYESTER AND PRODUCTION PROCESS THEREOF

Patent Proprietor:
Mitsubishi Chemical Corporation

Opponents:
Dehns Limited
DSM IP Assets B.V.

Relevant legal provisions:
EPC Art. 54, 56
RPBA Art. 12(2), 13(3)

Keyword:
Novelty - (yes) - main request
Inventive step - (no) - main request
Auxiliary requests filed with rejoinder to statements of grounds of appeal but not motivated - admittance - no

Decisions cited:
T 0793/93, T 0687/15

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Case Number: T 1657/16 - 3.3.03

D E C I S I O N
of Technical Board of Appeal 3.3.03
of 14 October 2019

Appellant: (Opponent 1)	Dehns Limited 10 Salisbury Square London EC4Y 8JD (GB)
Representative:	Dehns St. Bride's House 10 Salisbury Square London EC4Y 8JD (GB)
Respondent: (Patent Proprietor)	Mitsubishi Chemical Corporation 1-1, Marunouchi 1-chome Chiyoda-ku Tokyo 100-8251 (JP)
Representative:	Vossius & Partner Patentanwälte Rechtsanwälte mbB Siebertstrasse 3 81675 München (DE)
Party as of right: (Opponent 4)	DSM IP Assets B.V. Het Overloon 1 6411 TE Heerlen (NL)
Representative:	DSM Intellectual Property P.O. Box 4 6100 AA Echt (NL)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 17 May 2016 concerning maintenance of the European Patent No. 1882712 in amended form.**

Composition of the Board:

Chairman	D. Semino
Members:	M. C. Gordon
	W. Ungler

Summary of Facts and Submissions

I. The appeal of the opponent lies from the interlocutory decision of the opposition division posted on 17 May 2016 concerning maintenance of European patent number 1 882 712 in amended form on the basis of the set of claims filed as "Auxiliary Request A1" on 15 February 2016 and a description adapted thereto.

II. The patent was granted with a set of 18 claims, whereby claim 1 read as follows:

"1. A biomass-resource-derived polyester comprising as a main repeating unit thereof a dicarboxylic acid unit and a diol unit, wherein at least one of the dicarboxylic acid and diol used as raw materials of the polyester is obtained from biomass resources and a nitrogen atom content in the polyester except nitrogen atoms contained in the covalently bonded functional group in the molecule of the polyester is, in terms of a mass ratio, 0.01 ppm or greater but not greater than 1000 ppm relative to the polyester and wherein an amount of terminal acid in the polyester is 100 equivalents/metric ton or less.

III. A total of four oppositions against the patent were filed. Third party observations were also filed.

The following documents cited before the opposition division are relevant for the present decision:

E17: JP-A-2005/139287 (filed as the original and as automated and human translations)
E19/E40: WO-A-2005/026232 and the related European document EP-A-1 679 332

E78: Experimental report in respect of E17.

IV. The decision under appeal was based on the claims of the patent as granted as main request and the aforementioned auxiliary request A1.

Claim 1 of this request differed from claim 1 as granted by restricting the upper limit of the content of terminal acid groups to 50 equivalents/metric ton or less. Moreover granted claim 2 was deleted.

According to the decision, granted claim 2 did not meet the requirements of Article 123(2) EPC.

Auxiliary request A1 was held to meet the requirements of the EPC.

Specifically it was concluded *inter alia* that the requirements of novelty were met and in particular that novelty over E17 had to be acknowledged since the experimental report - E78 - did not constitute an accurate replication thereof and consequently did not demonstrate the inevitable outcome of the process.

An inventive step was recognised in particular because the prior art provided no indication of the claimed nitrogen and terminal acid group content and the influence thereof on hydrolysis resistance. Said features provided a non-obvious solution to the problem of providing alternative polyester with satisfactory stability and biodegradability.

V. Three of the opponents lodged appeals against the decision, namely opponent 1, opponent 2 (Novamont SPA) and opponent 3 (Mr Donald McNab).

Opponent 4 neither filed an appeal nor participated in the appeal proceedings.

VI. A further experimental report in respect of E17: E84 was filed by opponent 2 with the statement of grounds of appeal.

VII. The oppositions of opponents 3 and 2 and consequently the associated appeals were withdrawn in the course of the appeal proceedings by letters of 29 July 2019 and 14 October 2019 respectively.

VIII. Together with the response to the statements of grounds of appeal the patent proprietor (respondent) requested that the appeals be dismissed and filed 18 auxiliary request, designated "Auxiliary Request 2" to "Auxiliary Request 19".

IX. Following issue of the summons to oral proceedings and the preliminary communication of the Board further submissions from the active parties were received whereby the respondent with letter of 29 March 2019 withdrew auxiliary requests 4, 5, 6, 13, 14, 15 and 16.

X. Oral proceedings were held before the Board on 14 October 2019.

In the course of the oral proceedings the respondent withdrew auxiliary requests 9 and 10.

XI. The arguments of the appellant (opponent 1) insofar as relevant for the decision can be summarised as follows:

(a) Novelty

The repetitions of E17 presented in experimental

reports E78 and E84 established that the product obtained according to the process thereof exhibited the features as required by claim 1, in particular the content of terminal acid groups.

(b) Inventive step

Assuming - *arguendo* - that the content of terminal acid groups was the distinguishing feature, it was known in the art, for example from E19/E40, that this materially affected the biodegradability and hydrolysis stability of the polyesters. It was a question of achieving a balance. Accordingly the only problem that could be formulated with respect to E17 was the provision of alternative or further polyesters exhibiting a good balance of biodegradability and hydrolysis stability. This aspect was independent from the origin of the polyesters - fossil fuels or biomass. Regarding the argument of the respondent, based on the teachings of E40, that it was not possible to prepare polyesters with very low or zero content of carboxylic end groups due to slowing of the reaction rate, it was noted that the patent did not require such a low level of terminal acid groups that this aspect would become problematic. In the granted patent the amount was 100 eq/metric ton or less whilst in the claims as upheld by the opposition division it was 50 eq/metric ton or less. Furthermore E40 itself recognised the unfeasibility of obtaining polyesters with very low (0.1, or 1) equivalent/metric ton of carboxylic groups. The invention of E40 was correspondingly directed to polyesters with a terminal acid group content of up to 20 eq/metric ton. On this basis an

inventive step should not be acknowledged

(c) Auxiliary requests - admittance

None of the (remaining) auxiliary requests 2, 3, 7, 8, 11, 12 and 17-19 should be admitted to the proceedings. The respondent had merely indicated the amendments that had been made with no explanation or argumentation as to the purpose thereof or why these would overcome the objections raised.

XII. The arguments of the respondent, insofar as relevant to the present decision, can be summarised as follows

(a) Novelty

The teaching of E17 had not been replicated in either of the experimental reports because the starting diacid had not been derived via the process of the document. Hence neither E78 nor E84 provided evidence of the properties of the polyester obtained according to E17.

(b) Inventive step

E17 was silent with respect to the distinguishing feature - the content of terminal carboxylic acid groups. Nor was any value or range implicitly indicated. E17 was not concerned with biodegradability and hence would provide the skilled person with no guidance towards obtaining a product with this property, or a suitable balance of biodegradability and hydrolysis resistance. The examples and comparative examples of the patent demonstrated the effect of the distinguishing

feature. It was known that biodegradability and hydrolysis stability were two sides of the same coin - both being influenced by the terminal carboxylic acid group content.

The challenge was to balance the competing or contrary properties biodegradability and hydrolysis stability. This was a complex matter for which the prior art did not provide guidance. This aspect was not even recognised in the closest prior art document. A further complicating factor was that at low terminal carboxylic acid content the polymerisation rate was very low as shown by E19/E40, meaning that a high degree of polymerisation and consequently practically useful polyesters with very low terminal acid content were not obtainable. This effect spoke against reducing the content of terminal carboxylic groups too far and would be contrary to the teaching and aim of E17 which was explicitly directed to the provision of high molecular weight polymers.

The optimisation of hydrolysis stability and biodegradability was not a straightforward or routine matter - rather the feedback loop or interdependency between these two properties made reconciling and balancing these two requirements complex. In effect multiple factors, which all interacted with and affected each other had to be simultaneously balanced. To achieve an appropriate balance was therefore far from trivial. On this basis an inventive step should be acknowledged.

(c) Auxiliary requests - admittance

The amendments made were self-evident and self-

explanatory in the light of the objections raised and the indications given. In some of the requests claims had been deleted. In others, for example auxiliary request 2, restrictions had been introduced to provide further distinctions over E17. The divergences and different strategies adopted in the auxiliary requests were a consequence of the complexity of the case and the differing nature of the objections raised. There was therefore no reason not to admit the auxiliary requests

XIII. The appellant requested that the decision under appeal be set aside and the patent be revoked.

XIV. The respondent requested that the appeal be dismissed (main request). In the alternative it requested that the patent be maintained in amended form on the basis of one of the sets of claims according to auxiliary requests 2, 3, 7, 8, 11, 12 and 17 to 19 as filed with the rejoinder to the statements of grounds of appeal.

Reasons for the Decision

1. Main request

1.1 Disclosure of E17

This citation relates to a method for producing high molecular weight polyester by reaction of a diacid and a diol, at least one of which has been produced by a fermentation process (section 57 "Summary", under the heading "Problem"; description, paragraphs [0006]-[0009]).

It is specified that the nitrogen content of the diacid raw material is preferably 4000 ppm or less, that succinic acid is the preferred acid (paragraph [0011]) and that the resulting polyesters preferably have nitrogen content of 1000 ppm or less, most preferably 100 ppm or less (paragraphs [0012] and [0037]).

Starting with reference example 1 in paragraph [0045] the fermentation process is described. The construction and generation of a specific Brevibacterium flavum strain as produced in reference example 4 is described. This is then employed in the formation of the fermentation liquid, (reference example 5), which is employed in reference example 6 to prepare succinic acid. The resulting acid is then subjected to two alternative purification procedures to obtain different batches of high purity succinic acid (reference examples 7 and 8).

In example of execution 1 the succinic acid obtained in reference example 7 (nitrogen content 300 ppm) is employed to prepare a polyester by reaction with 1,4-butane diol of non-disclosed provenance, resulting in a polyester with 55 ppm nitrogen. Example of execution 2 employs the succinic acid obtained in reference example 8, with an ammonia content of 87 ppm resulting in a polymer with 44 ppm nitrogen. Both of these examples thus result in nitrogen contents according to claim 1.

There is no disclosure in E17 of terminal acid content, either in general or specifically for the examples.

In "example for comparison 1", the directly obtained, unpurified succinic acid with nitrogen content 5000 ppm was employed. A polyester could not be obtained - only

low molecular weight oligomers resulted.

1.1.1 Novelty with respect to E17

E17 does not disclose the terminal acid content of the resulting polyester.

Neither of the experimental reports E78 and E84 relate to a replication of the process of E17. Instead a not further defined "biomass-resource-derived" succinic acid was employed (E78, page 2 "Synthesis", E84 section 2.2.1 "Synthesis"). No details of the preparation of this succinic acid were given, nor were the properties of the obtained succinic acid reported. Accordingly it is not possible to conclude to any extent, let alone to the very strict standards applied by the Boards, namely "beyond all reasonable doubt" (T 793/93 of 27 September 1995) that the evidence provided reflected the outcome of carrying out the teaching of E17. In this respect attention is directed to the Catchword and the fifth paragraph of section 2.1 of the decision in which it is stated:

> By parity of reasoning, the Board finds in the present case that, in deciding what is or is not the inevitable outcome of an express literal disclosure in a particular prior art document, a standard of proof much stricter than the balance of probability, to wit "beyond all reasonable doubt", needs to be applied. It follows that if any reasonable doubt exists as to what might or might not be the result of carrying out the literal disclosure and instructions of a prior art document, in other words if there remains a "grey area", then the case on anticipation based on such a document must fail.

The present Board agrees with this approach and concludes that the evidence advanced fails to establish

that the product resulting from the teaching of E17 falls within the terms of operative claim 1, so that novelty is acknowledged.

1.2 Inventive step

1.2.1 Closest prior art

The patent in suit relates to the provision of biomass resource derived polyester (paragraph [0001]). It was accepted by both parties that E17, at least in one approach, represents the closest prior art.

1.2.2 Distinguishing feature

As follows from the discussion of novelty above, the subject-matter of claim 1 is distinguished from the disclosure of E17 by the specified content of terminal acid.

1.2.3 Technical effect

Of particular relevance, as far as the technical effect of the distinguishing feature is concerned, is Table 3 of the patent which reports the hydrolysis resistance for polyesters of differing terminal acid contents. Examples 1 and 12 employ terminal acid group contents within the scope of claim 1, comparative example 3, with a level of 54 equivalent/metric ton is above the range permitted.

Table 3: Hydrolysis resistance test at 50°C and 90%RH

Sample	stored for	0 day	7 days	21 days	28 days
Example 1	Reduced viscosity (ηsp/c)	2.5	2.0	1.7	1.2
	Amount of terminal carboxylic acid (equivalent/ metric ton)	26	34	40	57
Example 12	Reduced viscosity (ηsp/c)	2.5	2.4	2.3	2.0
	Amount of terminal carboxylic acid (equivalent/ metric ton)	12	11	13	19
Comparative Example 3	Reduced viscosity (ηsp/c)	2.4	1.9	1.5	1.0
	Amount of terminal carboxylic acid (equivalent/ metric ton)	54	66	76	100

From example 12 and comparative example 3 it can be derived that hydrolysis stability of the polyesters decreases as the content of terminal acid groups increases, and that at values above the maximum permitted by the claim significantly poorer hydrolysis stability results.

While the respondent claims also a positive effect related to biodegradability, the patent provides no evidence relating the level of biodegradability to the terminal acid group content.

1.2.4 Objective problem

In the light of the foregoing the objective problem can be formulated as the provision of polyesters with a high level of hydrolysis stability.

1.2.5 Obviousness

E17 itself is silent in the question of hydrolysis stability of the polyester and hence can provide no guidance to the claimed solution to the objective problem.

E19/E40 is directed to a process for producing a thermally stable polyester and the resulting polyester.

In the following, page and line references relate to E40.

According to paragraph [0004] the concentration of terminal acid groups also influences the thermal stability of the polymer, such that increasing the content of terminal acid groups leads to lower thermal stability. The same information is to be found in paragraph [0009], line 20, paragraph [0014], paragraph [0045], lines 8-11 and paragraph [0100].

Paragraph [0100] of E40 explains that there is, as stated by the respondent, a trade off between the terminal acid group content and the degree of polymerisation, such that at low terminal terminal acid group content the polymerisation rate becomes very slow with the result that high molecular weight polymers cannot be obtained. Consequently said paragraph envisages values of terminal acid groups of 20 eq/ton or less, down to preferably 1.0 eq/ton. Although it is not specified which "ton" is meant - US/UK - corresponding to 1016 kg, or metric tonne - 1000 kg, this is not of significance in view of the small differences and the nature of the teaching.

The preferred - or feasible - range of terminal acid groups recommended by E19/E40 is within the range of operative claim 1 and significantly below the maximum permitted by the claim.

Regarding the question of biodegradability, which was invoked by the respondent, neither E17 nor E19/E40 address this matter in respect of the terminal acid group content. However by the same token, as mentioned above, the patent provides no evidence relating the level of biodegradability to the terminal acid content.

The position of the respondent that there is a trade off between the hydrolysis stability and biodegradability such that higher biodegradability results in or corresponds to lower hydrolytic stability is logical in view of the similarity of the mechanisms underlying the two processes.

The question to be answered is however whether the skilled person would be aware of how to adjust the polymer to control the level of hydrolytic stability and would be in a position to carry out the necessary adjustment.

In view of the teaching of E19/E40 that the stability to hydrolysis of the polyester is influenced by the level of carboxyl acid end groups, but that the lower limit of terminal acid group content is constrained by the limitations of the course of the polymerisation, there would be no alternative but for the skilled person to investigate a suitable compromise level which provided a polymer of sufficient molecular weight and thus physical properties rendering it suitable for use but also ensured adequate hydrolytic stability for the intended purpose. Similarly considering the aspect of biodegradability, and accepting, in favour of the respondent, that this too is influenced by the content of terminal acid groups, it would likewise be a matter of necessity to investigate and optimise the level of terminal groups in order to provide an appropriate balance.

Whilst it can be agreed with the respondent that multiple effects or parameters in respect of the properties of the polyester are being adjusted, namely molecular weight, hydrolytic stability and biodegradability these are influenced by a sole factor

- the content of acid end groups. It is not a case of needing to carry out modifications of a plurality of parameters relating to different aspects of the constitution of the product, under circumstances where all are interdependent and mutually influence each other in differing and competing manners, thus leading to a complex, multidimensional problem.

Rather the issue here is one of a linear adjustment or optimisation of a single structural property of the polymer which simultaneously controls a number of properties of the final material.

Thus it was known from the prior art document E19/E40 that the content of carboxylic acid end groups influenced the hydrolysis stability of polyesters. Likewise it was known - from the same document - that polyesters of useful molecular weight with very low amounts of these groups are unattainable due to the effect on the polymerisation rate. The adjustment of terminal acid groups in order to optimise the properties of the polymer was thus immediately identifiable from the cited documents as the route to achieve the necessary balance of properties. It has not been shown that there were any obstacles to achieving this and the suggested values in E19/E40 fall within the range in claim 1. Furthermore, the content of terminal acid groups specified is far above the range which according to E19/E40 is difficult or impossible to obtain by the polymerisation reaction.

Accordingly the subject-matter claimed is simply the result of a routine optimisation of the teaching of E17 based on known and understood factors.

An inventive step is therefore denied.

2. Auxiliary requests 2, 3, 7, 8, 11, 12, 17, 18, 19- admittance

In the rejoinder to the appeals, the submissions with respect to the auxiliary requests were limited to an indication of the amendments made. No explanation or argumentation of the manner in which the amendments were considered to address any of the objections raised by the appellants were provided. Even in the two written submissions following issue of the communication of the Board, only the most rudimentary indications of the purpose of the amendments were provided, e.g. explaining further delimitations over citations. However again no elucidation as to the purpose of the amendments or arguments in favour of patentability arising from the amendments made were provided.

Article 12(2) RPBA requires that parties to appeal proceedings present their complete case and expressly specify all arguments.

The approach of the respondent does not meet this standard. On the contrary, the onus is placed on the other party and the Board to place itself in the position of the patent proprietor in order to divine for themselves the intended arguments and, in the light of these "self assembled" arguments to knit these together with the substance of the case, to evaluate these and to produce appropriate responses. One consequence of admitting such auxiliary requests submitted in this approach, would have been that hitherto unadvanced arguments of the respondent would have to be introduced at the oral proceedings, i.e. an

amendment of the case previously advanced, raising issues for the first time in the oral proceedings which the Board or the other party cannot reasonably be expected to deal with without adjournment of the proceedings, contrary to the stipulations of Article 13(3) RPBA. In this respect reference may also be made to T 687/15 of 12 September 2019, section 2 of the reasons.

For these reasons, none of the auxiliary requests are admitted into the proceedings.

3. As the main request is found to lack inventive step and all auxiliary requests are not admitted into the proceedings, there is no need for the Board to decide on any other issue and the patent is to be revoked.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The patent is revoked.

The Registrar: The Chairman:

B. ter Heijden D. Semino

Decision electronically authenticated