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D E C I S I O N
of 18 September 2003

Case Number: T 1020/00 - 3.3.3
Application Number: 95908521.8
Publication Number: 0741753
IPC: C08G 63/08
Language of the proceedings: EN

Title of invention:

Biodegradable copolymers and plastic articles comprising
biodegradable copolymers of 3-hydroxyhexanoate

Applicant:

THE PROCTER & GAMBLE COMPANY

Opponent:

-

Headword:

-

Relevant legal provisions:

EPC Art. 54, 56, 83, 84, 123(2)
EPC R. 86(3)

Keyword:

"Late filed requests (not admitted)"
"Inventive step (second and third auxiliary request) - no"
"Inventive step (fifth auxiliary request) - yes"

Decisions cited:

T 0153/85

Catchword:

-



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Boards of Appeal

Chambres de recours

Case Number: T 1020/00 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 18 September 2003

Appellant:

THE PROCTER & GAMBLE COMPANY
One Procter & Gamble Plaza
Cincinnati, Ohio 45202 (US)

Representative:

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Decision under appeal:

Decision of the Examining Division of the
European Patent Office posted 4 May 2000
refusing European application No. 95908521.8
pursuant to Article 97(1) EPC.

Composition of the Board:

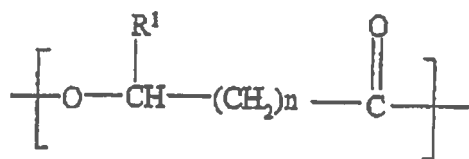
Chairman: R. Young
Members: C. Idez
E. Dufrasne

Summary of Facts and Submissions

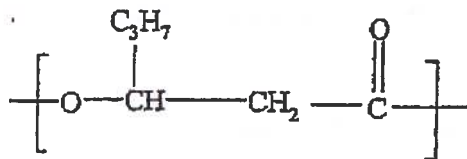
- I. European patent application No. 95 908 521.8, based on International application No. PCT/US95/00569, was filed on 13 January 1995, claiming the priority of 28 January 1994 of an earlier US patent application (08/189,029) and published under No. WO-A-95/20615 on 3 August 1995, was refused by a decision of the Examining Division issued in writing on 4 May 2000.
- II. The decision of the Examining Division was based on a set of 13 claims as submitted with letter of 14 March 1997 of the Applicant.

Independent Claims 1, 7, and 11 read as follows:

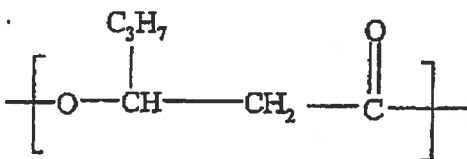
- "1. A plastic article comprising a biodegradable copolymer, characterized in that the biodegradable copolymer comprises at least two randomly repeating monomer units wherein the first randomly repeating monomer unit has the structure



wherein R¹ is H or C₂ alkyl, and n is 1 or 2;
the second randomly repeating monomer unit has the structure

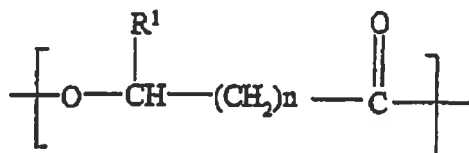


the second randomly repeating monomer has the

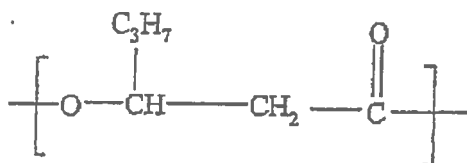


;and wherein at least 50% of the randomly repeating monomer units have the structure of the first randomly repeating monomer unit.

7. An absorbent article comprising:
- a) a liquid pervious topsheet;
 - b) a liquid impervious backsheet comprising a biodegradable copolymer,
- characterized in that the biodegradable copolymer comprises at least two randomly repeating monomer units wherein the first randomly repeating monomer unit has the structure



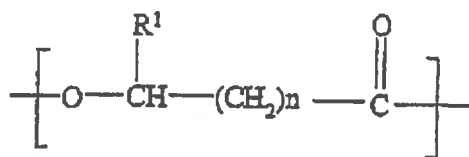
wherein R¹ is H or C₂ alkyl, and n is 1 or 2; the second monomer unit has the structure



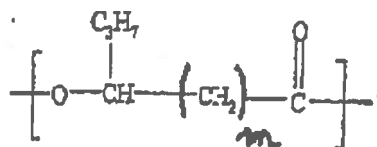
; and wherein at least 50% of the random repeating monomer units have the structure of the first randomly repeating monomer unit; and

c) an absorbent core positioned between the topsheet and the backsheet.

11. A biodegradable copolymer comprising at least two randomly repeating monomer units characterized in that the first randomly repeating monomer unit has the structure



wherein R¹ is H or C₂ alkyl, and n is 1 or 2; the second randomly repeating monomer unit has the structure



(sic)

and wherein at least 50% of the randomly repeating monomer units have the structure of the first randomly repeating monomer unit."

Claims 2 to 6, and 12 were dependent on Claims 1 and 11 respectively. Claims 8, 9, 10 and 13 were dependent on Claim 7.

III. The Examining Division rejected the application on the grounds that it did not meet the requirements of Article 84 EPC and Article 56 EPC.

Concerning Article 84, the Examining Division stated that Examples 3 to 17 did not fall under the scope of the claims and this inconsistency between claims and description led to doubts concerning the protection conferred by the claims and thus rendering them unclear.

According to the decision, the subject-matter of independent Claims 1 and 11 differed from that of D1 (EP-A-0 533 144) in that 3-hydroxyvalerate (3HV), 3-hydroxypropionate (3HP), 4-hydroxyhexanoate (4HH) or 4-hydroxybutyrate (4HB) were used as monomer units instead of 3-hydroxybutyrate (3HB). Since there was no evidence that this distinguishing feature brought any effect other than that already achieved by the copolymers of D1, the objective technical problem was seen as to provide further copolymers based on hydroxyalkanoates.

Since the use of homologous hydroxyalkanoates was a normal design procedure as shown by documents D1, D2 (EP-A-0 069 497) and D3 (WO-A-94 00506), the Examining Division concluded that the use of known homologous hydroxyalkanoates in order to provide further copolymers did not involve an inventive step. Thus, the subject-matter of Claims 1 and 11 did not meet the requirements of Article 56 EPC.

IV. On 22 June 2000 a Notice of Appeal against the above decision was lodged by the Appellant (Applicant). The prescribed fee was paid on the 23 June 2000. With the Statement of Grounds of Appeal filed on 14 September 2000, the Appellant filed a set of 13 claims as new main request. Claims 1 to 13 thereof generally corresponded to those on which the decision of the Examining Division was based. The Appellant argued essentially as follows:

(i) Concerning Article 84 EPC:

The Appellant was prepared to delete the Examples 3 to 17.

(ii) Concerning inventive step:

(1) The only relevant disclosure in document D1 was a copolymer of 3HB3HH.

(2) The only statements in D1 concerning the possible use of the copolymers were entirely general and the abstract of D1 could not be used for assessing inventive step.

- (3) D1 did not teach the forming of the copolymers into films or other types of plastic articles.
- (4) In fact D1 taught away from the copolymers according to the application in suit, since the skilled person would have believed that copolymers which were structurally close to 3HB polymers would be equally unsatisfactory in respect to their thermal properties.
- (5) The Examining Division read in D1 the possible uses of the copolymers according to the application in suit as plastic articles and had thus used inadmissible hindsight knowledge of the invention.
- (6) D1 was not directed to the same purpose as the claimed invention and it could not lead the skilled person to the claimed invention in an obvious way.

V. Following a communication dated 30 November 2001 of the Board, the Appellant submitted, with its letter dated 3 June 2002, a set of 12 claims as new main request and made the main request filed with the Statement of Grounds of Appeal its first auxiliary request. It also submitted a declaration of the inventor Mr Isao Noda and a new document referred to as D5 (US-A-4 880 592).

Claim 1 of the main request differed from Claim 1 of the request submitted with the Statement of Grounds of appeal in that the claim was directed to a film and the radical R¹ could also be a C₁ alkyl group.

The arguments presented by the Appellant in its letter may be summarized as follows:

(i) Concerning Article 84 EPC:

Since the claims had been amended to include the possibility for R^1 to be a C_1 radical, Examples 3 to 17 fell now under the scope of the claims.

(ii) Concerning Article 56 EPC:

- (1) The technical problem underlying the application in suit was to provide copolymers which could be easily processed into films, unlike the 3HB homopolymers and the 3HB3HV copolymers of the prior art.
- (2) Document D2 which was the only document dealing with the manufacture of films from polyhydroxyalkanoates represented the closest state of the art.
- (3) The declaration of Mr Oda provided evidence that the copolymers according to the application in suit had better film forming properties than 3HB3HV copolymers.
- (4) Document D1 which made no mention of the film properties of the copolymers described therein, D3 and D4 (EP-A-0 553 394) which referred only to 3HB and 3HB3HV polymers and D5 which taught that 3HB3HV copolymers were very difficult to process into films could

not provide any hint to the solution proposed by the application in suit.

VI. In a communication dated 15 May 2003 and annexed to the Summons to Oral Proceedings, the Rapporteur drew the attention of the Appellant on the following documents of which the Board had become aware:

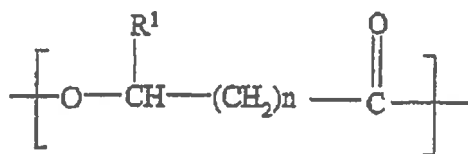
- D6: Koyabashi, G. et al, "Biosynthesis and Characterization of Poly(3-hydroxy butyrate-co-3-hydroxyhexanoate) from Oils and Fats by *Aeromonas* sp.OL-338 and *Aeromonas* sp.FA-440", Abstracts of the 3rd International Scientific Workshop on Biodegradable Plastics and Polymers; 9 November (Tuesday) until 11 November (Thursday) 1993,
- D7: R.A. Gross et al "The Biosynthesis and Characterization of new Poly(β -hydroxyalkanoates)"; Polymer Preprints, American Chemical Society, Vol. 30, No. 1, 1 April 1989, pages 492 to 493, and
- D8: H. Brandl et al "Ability of the phototropic bacterium *Rhodospirillum rubrum* to produce various poly(β -hydroxy-alkanoates): potential sources for biodegradable polyesters"; Int. J. Biol.Macromol., February 1989, Vol. 11, pages 49 to 55.

It also presented its provisional view concerning novelty and inventive step of the subject-matter of the main and the auxiliary request then on file.

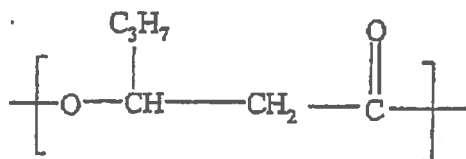
VII. With its letter dated 22 July 2003, the Appellant filed five sets of claims as new main, first, second, third, and fourth auxiliary requests, respectively.

Independent Claims 1 and 7 of the main request read as follows:

"1. A film comprising a biodegradable copolymer, characterized in that the biodegradable copolymer comprises at least two randomly repeating monomer units wherein the first randomly repeating monomer unit has the structure

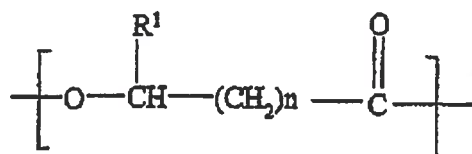


wherein R¹ is H, C₁ or C₂ alkyl, and n is 1 or 2; the second randomly repeating monomer unit has the structure

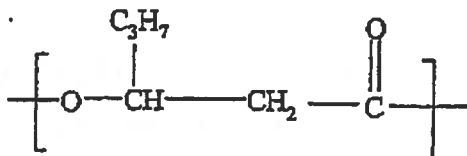


and wherein at least 50% of the randomly repeating monomer units have the structure of the first randomly repeating monomer unit.

7. An absorbent article comprising:
- a) a liquid pervious topsheet;
 - b) a liquid impervious backsheet comprising a film said film comprising a biodegradable copolymer, characterized in that the biodegradable copolymer comprises at least two randomly repeating monomer units wherein the first randomly repeating monomer unit has the structure



wherein R¹ is H, C₁ or C₂ alkyl, and n is 1 or 2;
the second monomer unit has the structure



and wherein at least 50% of the random repeating monomer units have the structure of the first randomly repeating monomer unit; and

- c) an absorbent core positioned between the topsheet and the backsheet."

Claims 2 to 6, and Claims 8 to 11 were dependent on Claims 1 and 7 respectively

Claim 1 of the first auxiliary request differed from Claim 1 of the main request in that it had further been indicated that the biodegradable copolymer had a melt temperature of from 30°C to 160°C and a crystallinity of from 2% to 65% as measured by x-ray diffraction.

Independent Claim 6 read as follows:

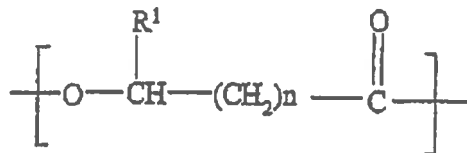
"An absorbent article comprising:

- a) a liquid pervious topsheet;
- b) a liquid impervious backsheet comprising a film according to Claim 1; and
- c) an absorbent core positioned between the topsheet and the backsheet."

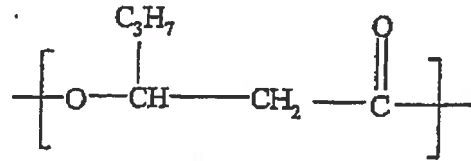
Claims 2 to 5 and Claims 7 to 10 were dependent on Claims 1 and 6 respectively.

Claim 1 of the second auxiliary request read as follows:

"Use of a biodegradable copolymer comprising at least two randomly repeating monomer units wherein the first randomly repeating monomer unit has the structure



wherein R¹ is H, C₁ or C₂ alkyl, and n is 1 or 2; the second randomly repeating monomer unit has the structure



and wherein at least 50% of the randomly repeating monomer units have the structure of the first randomly repeating monomer unit, and wherein said biodegradable copolymer has a melt temperature of from 30°C to 160°C and a crystallinity of from 2% to 65% as measured by x-ray diffraction, for manufacturing a film which is produced by melt processing."

Claims 2 to 5 were dependent on Claim 1.

Dependent Claim 6 read as follows:

"Use of Claim 1, wherein the film is comprised in a liquid impervious backsheet, said backsheet being comprised in an absorbent article further comprising a liquid pervious topsheet and an absorbent core positioned between the topsheet and the backsheet."

Claim 7 to 9 were dependent on Claim 6.

Independent Claim 10 read as follows:

"An absorbent article according to Claim 6, wherein said article is in the form of a disposable diaper, sanitary napkin or pantiliner."

Claim 1 of the third auxiliary request differed from Claim 1 of the first auxiliary request in that the definition of R¹ had been restricted to C₁ alkyl, and in that n had been limited to 1 in the formula of the first repeating monomer.

Independent Claim 3 corresponded to Claim 6 of the first auxiliary request.

Claims 2, and 4 to 7 were dependent on Claims 1 and 3 respectively.

Claim 1 to 10 of the fourth auxiliary request differed from Claims 1 to 10 of the first auxiliary request in that it had further been indicated in Claim 1 that the film has a machine direction (MD) tensile modulus from about 6.895×10^8 dynes/sq.cm to 6.895×10^9 dynes/sp.cm and a 60°C modulus of at least 5.52×10^7 dynes/sq.cm.

VIII. With its letter dated 11 September 2003, the Appellant submitted experimental comparative data. According to the Appellant, these data demonstrated that films made from 3HB3HH copolymers exhibited superior properties (heat resistance) compared to films made of 3HB or 3HB3HV.

IX. Oral proceedings were held on 18 September 2003.

Following preliminary observations of the Board under Articles 123(2), and 84 EPC concerning the main request and the auxiliary requests submitted with letter of 22 July 2003, the Appellant submitted a set of 9 claims as new main request, a set of 9 claims as first auxiliary request, a set of 8 claims as second auxiliary request, and two sets of 5 claims

representing a third and a fourth auxiliary request, respectively.

In the course of the proceedings it further submitted a fifth auxiliary request (called No. 5 final), which consists of a single claim.

Independent Claims 1 and 7 of the main request are the same as Claims 1 and 7 of the main request submitted with letter of 22 July 2003.

Claims 2 to 6 are dependent on Claim 1, wherein Claim 3 reads as follows:

"The film of Claim 1, characterized in that R^1 is a C_1 alkyl and n is 1."

Claims 8 to 9 are dependent on Claim 7.

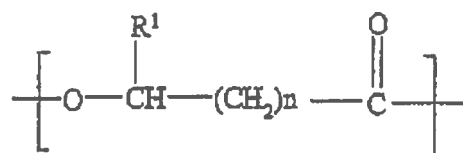
Independent Claims 1 and 7, and dependent Claims 2, 4, 5, 8 and 9 of the first auxiliary request are the same as those of the main request. Dependent Claim 3 reads as follows:

"The film of Claim 1, characterized in that R^1 is a C_1 alkyl and n is 1, and wherein the biodegradable copolymer comprises between 50% and 95% of the first randomly repeating monomer unit, and between 50% and 5% of the second randomly repeating monomer unit."

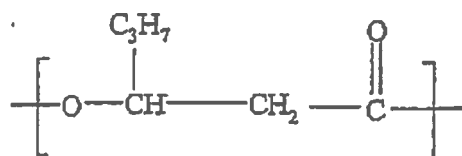
The second auxiliary request differs from the main request in that Claim 3 of the main request has been deleted and the remaining claims have been renumbered accordingly.

Independent Claim 1 of the third auxiliary request reads as follows:

"1. Use of a biodegradable copolymer, comprising at least two randomly repeating monomer units wherein the first randomly repeating monomer unit has the structure



wherein R^1 is H, C_1 or C_2 alkyl, and n is 1 or 2; the second randomly repeating monomer unit has the structure

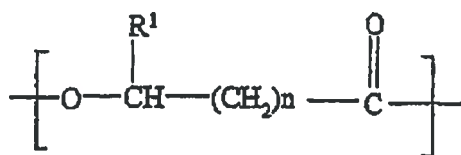


and wherein at least 50% of the randomly repeating monomer units have the structure of the first randomly repeating monomer unit, and wherein said biodegradable copolymer has melt temperature of from 30°C to 160°C and a crystallinity of from 2% to 65% as measured by X-ray diffraction, for manufacturing a film which is produced by melt processing."

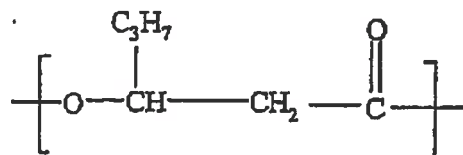
Claims 2 to 5 are dependent on Claim 1.

Independent Claims 1 and 3 of the fourth auxiliary request read as follows:

"1. A film comprising a biodegradable copolymer, characterized in that the biodegradable copolymer comprises at least two randomly repeating monomer units wherein the first randomly repeating monomer unit has the structure



wherein R^1 is C_1 alkyl, and n is 1; the second randomly repeating monomer unit has the structure



wherein said biodegradable copolymer has a melt temperature of from 30°C to 160°C and a crystallinity of from 2% to 65% as measured by X-ray diffraction, and wherein the biodegradable copolymer comprises between 50% and 95% of the first randomly repeating monomer unit, and between 50% and 5% of the second randomly repeating monomer unit.

3. An absorbent article comprising:
 - a) a liquid pervious topsheet;
 - b) a liquid impervious backsheet comprising a film according to Claim 1; and
 - c) an absorbent core positioned between the topsheet and the backsheet."

Claims 2, and 4 to 5 are dependent on Claims 1 and 3, respectively

The Claim of the fifth auxiliary request reads as follows:

"A 92:8 molar poly(3-hydroxybutyrate-co-hydroxyhexanoate)random copolymer film".

The arguments presented by the Appellant may be summarized as follows:

- (i) The statement on passage on page 7, line 31 of the application as originally filed only defines 6 possibilities of combining the meaning of R^1 with that of n . This rather limited number of combination and the Examples 3, 4, 5 would provide support for dependent Claim 3 of the main request.
- (ii) The same conclusion would apply to dependent Claim 3 of the first auxiliary request in view of the combination of page 7, line 31 and Examples 3, 4, 5, 16, and 17 and to Claim 1 of the fourth auxiliary request in view of the combination of the statement on page 7, line 31, of the statement on page 13, lines 27 to 29, of the statement on

page 14, lines 17 to 19 and Examples 3, 4, 5, 16, and 17.

(iii) None of the cited documents D1 to D8 discloses a film comprising a polyhydroxyalkanoate copolymer having 3-hydroxyhexanoate units or use of such copolymer for making a film. Thus, the subject-matter of the requests was novel.

(iv) Concerning inventive step:

- (1) Documents D5 and D2 were the only documents mentioning the manufacture of films of biodegradable polyesters by melt processing.
- (2) Document D5 clearly stated that it was not possible to directly produce thin films from biodegradable polyesters such as polyhydroxybutyric acid and copolymers thereof with hydroxyvaleric acid by extrusion, since these polymers were very tacky. According to D5, this problem could be solved by using a coextrusion technique comprising the extrusion of the biodegradable polyester film between two layers of sacrificial films.
- (3) The method of D5 necessitated, however, drastic and cumbersome processing measures.
- (4) Document D2 was a document of 41 pages and the only mention of the use of the biodegradable polyesters described therein in the production of films was on page 15,

lines 20 to 21. In fact D2 was essentially concerned with the manufacture of biodegradable polyesters by a microbiological process.

(5) It was, furthermore, clear that the use of these biodegradable polyesters in the preparation of melt-fabricated articles was as processing aid in vinyl chloride compositions, as shown by page 15, lines 10 to 12 and Example 21.

(6) While document D6 described copolymers of 3HB3HH containing 11% and 17% of 3HH units it was totally silent on their possible use as films. The mere fact that a polymer was known did not imply that it would be suitable for manufacturing films.

(7) Furthermore the teaching of D6 was not clear, since the curve representing the melting points of the 3HB3HH copolymers showed that the depressing of the melting point by increasing the amount of 3HH units was not continuous.

(8) This curve further showed that a 3HB3HV copolymer containing about 17% 3HV units had a low melting point of about 130°C. This type of copolymer, as shown by Example 1 of D5 could not however be directly extruded into a film.

(9) The comparative Examples submitted with the letter of 11 September 2003 demonstrated that, in contrast to 3HB homopolymers and 3HB3HV copolymers, the 3HB3HH copolymers could be directly extruded into valuable films at a temperature 25°C above their melting point.

(10) Thus, none of the cited documents could have suggested that the specific copolymers would render the film processing of biodegradable films easier, as compared to 3HB or 3HBHV copolymers.

X. The Appellant requested that the decision of the Examining Division be set aside, and a patent be granted on the basis of the main request or in the alternative on the basis of the auxiliary request 1, 2, 3, 4, or 5 "final" all filed at the oral proceedings.

Reasons for the Decision

1. The appeal is admissible.

Main request, first auxiliary request, and fourth auxiliary request

2. *Procedural matters*

2.1 These requests have been submitted at a very late stage, i.e. in the course of the oral proceedings held on 18 September 2003.

- 2.2 According to the decision T 153/85 (OJ EPO 1988, 1), a Board may justifiably refuse to consider in examining proceedings alternative claims which have been filed at a very late stage, if such alternative claims are not clearly allowable.
- 2.3 Dependent Claims 3 of both the main request and the first auxiliary request, and Claim 1 of the fourth auxiliary request incorporate the use of 3HB units (i.e. R^1 is C_1 and n is 1 in the formula set out for the first repeating unit) in the biodegradable copolymer comprised in the claimed film.
- 2.4 While the passage on page 7, line 30 of the application as originally filed mentions that R^1 can be selected from H, C_1 and C_2 and that n can be 1 or 2, it is however evident from the application as originally filed that, in contrast to the specific combinations set out on page 8, lines 22 to 27, i.e. $R^1 = C_2$ and $n = 1$, $R^1 = H$ and $n = 2$, and $R^1 = H$ and $n = 1$) the combination $R^1 = C_1$ and $n = 1$ was not as such explicitly disclosed or claimed.
- 2.5 In the Board's view, this feature was only disclosed in relation to films in the application as filed in the context of specific examples i.e. films made from copolymers consisting of specific amounts of 3HB and 3HH units (i.e. 3HB3HH (95:5) in Examples 3, 4, and 5; 3HB3HH (50:50) in Example 5; 3HB3HH (92:8) in Examples 6 and 7; and 3HB 3-Hydroxydecanoate 3HH (94:4:4) in Example 9) and not as a general feature in isolation.

- 2.6 Nor would these examples provide a support for the additional feature incorporated in Claim 3 of the first auxiliary request and in Claim 1 of the fourth auxiliary request, according to which the copolymer comprises between 50% and 95% of this first randomly repeating unit (i.e. 3HB) and between 50% and 5% of the second randomly repeating monomer unit.
- 2.7 Thus, no adequate support for the generalisation made by the Appellant in Claims 3 of the main request and of the first auxiliary and in Claim 1 of the fourth auxiliary request can be found in the application as originally filed, so that the wording of both Claims 3 of the main request and the first auxiliary request and of Claim 1 of the fourth auxiliary request is objectionable under Article 123(2) EPC, and therefore these requests are certainly not clearly allowable within the meaning of the decision T 153/85.
- 2.8 Following the principles set out in Decision T 153/85 regarding the filing of alternative claims at a late stage (points 2.1 and 2.2 of the decision), this situation justifies the Board to exercise its discretion not to admit these late filed requests (Rule 86(3) EPC).

Second auxiliary request

3. *Wording of the Claims*

3.1 Article 123(2) EPC

- 3.1.1 Claim 1 is supported by the passage on page 7, line 25 to page 8, line 3 of the application as originally filed.

3.1.2 Claims 2, 3, 4 and 5 find their support on page 8, lines 19 to page 9, line 2 of the application as originally filed.

3.1.3 Claims 6, 7 and 8 are supported by the passage on page 34, lines 21 to 29 and the passage on page 35, lines 1 to 8, and on page 37, lines 20 to 22 of the application as originally filed.

3.1.4 Thus, it follows from the above that Claims 1 to 8 meet the requirements of Article 123(2) EPC.

3.2 Article 84 EPC

No objection under Article 84 EPC arises from the wording of Claims 1 to 8.

4. Novelty

4.1 Document D1 relates to copolymers containing a 3HB unit and a 3HH unit and, in particular, to copolymers comprising 50 mol% to 98 mol% of a 3HB unit and 50 mol% to 2 mol% of a 3HH unit and copolymers containing at least a 3HB unit, a 3HH unit, and a third component selected from a 4HB unit, a 3HV unit or a 3HP unit (cf. D1, page 4, lines 4 to 9). Although D1 mentions that it would be possible to produce a wide variety of plastic materials ranging from rigid plastics to elastic plastics by selecting copolymer components and adjusting their composition (cf. D1, 9, lines 6 to 8), it does not disclose a film made from such copolymers, let alone an absorbent article made therefrom. Thus, D1

cannot destroy the novelty of the subject matter of Claims 1 to 8.

4.2 Document D2 discloses copolymers having a weight average molecular weight above 10,000 and containing repeating units

(I) $-O.CH(CH_3).CH_2.CO-$ and repeating units

(II) $-O.CR^1R^2(CR^3R^4)_n.CO-$,

where n is 0 or an integer and R^1 , R^2 , R^3 , and R^4 are each selected from hydrocarbon radicals; halo- and hydroxy- substituted hydro- carbon radicals; hydroxy radicals; halogen atoms; and hydrogen atoms, provided that, where n is 1 and R^2 , R^3 , and R^4 are each hydrogen atoms, R^1 is not methyl and not all of the groups R are ethyl; said repeat units II constituting 0.1 to 50 mol% of the total repeat units in said copolymer.

These copolymers are said to be of particular utility in making films by melt extrusion (cf. D2; Claims 1, 11, page 15, lines 6 to 9 and 20 to 25).

D2, however, does not disclose a film made from a copolymer having 3HH units as unit II.

Thus, D2 is not a novelty destroying document for the subject-matter of Claims 1 to 8.

4.3 While document D3 generally refers to blends comprising poly(3-hydroxyalkanoates) polymers or copolymers and to their use as films for diapers (cf. D3, Claim 1; page 28, lines 9 to 15), it is, however, totally silent on the use of 3HH units in the polyhydroxyalkanoate polymers. At least for this reason D3 does not destroy the novelty of the subject-matter of Claims 1 to 8.

4.4 Document D4 is not relevant at all for the assessment of novelty, since it merely relates to hot melt adhesive compositions comprising a linear copolymer of 3-hydroxybutyric acid and 3-hydroxyvaleric acid (cf. D4, Claim 1).

4.5 Document D5 discloses the manufacture of films of biodegradable polyesters by coextrusion. The biodegradable polymer is formed of recurring units of which at least 50% molar are units of Formula 1 $-OC_nH_{2n}CO-$, where n is 3, 4 or 5. Preferably the group C_nH_{2n} has the formula $-CH(C_mH_{2m+1})-CH_2-$, where m is 1, 2 or 3 and preferably all the groups of Formula 1 have m equals 1 or 2. For instance all the groups may have m equals 1 (polyhydroxy butyric acid) or at least 50% molar of the groups may have m equals 1 with the remainder of the groups having m equals 2 (polyhydroxy butyric-hydroxy valeric acid). Recurring units other than those of Formula 1 and which are in the polymer are generally units of other hydroxy carboxylic acids of the general Formula 2 $-OCR^1R^2(CR^3R^4)_pCO-$, where p is zero or an integer and R^1 , R^2 , R^3 , and R^4 may be hydrogen, hydrocarbon, halo substituted hydrocarbon, hydroxy substituted hydrocarbon, hydroxyl or halogen, provided that the values of R^1 , R^2 , R^3 , and R^4 and p are not such that the unit of Formula 2 is a unit of Formula 1. As indicated in D5 these films may be used as diaper backsheets. D5, however, only exemplifies films made from 3HB3HV copolymers, and does not disclose copolymers comprising 3HH as unit of Formula 2 (cf. D5, column 3, line 26 to column 4, line 15; column 5, lines 1 to 9; column 7, lines 36 to 53; Examples 1 to 7). Thus, D5 is not a novelty destroying document for the subject-matter of Claims 1 to 8.

4.6 Document D6 refers to random copolymers of 3HB and 3HH. It discloses in particular the influence of the amount of 3HH units on the melting point and the crystallinity of the copolymers and it compares these properties with those of 3HB homopolymers and copolymers thereof with 3HV but it contains no reference to the manufacture of films.

It cannot therefore destroy the novelty of the subject-matter of Claims 1 to 8.

4.7 Documents D7 and D8 are not concerned with the manufacture of films, since they relate only to the manufacture of biodegradable polyesters by microbiological process, using specific microorganisms.

4.8 It thus follows from the above that the subject-matter of Claims 1 to 8 is novel over the cited prior art (Article 54 EPC).

5. *Problem and solution*

5.1 The application in suit concerns films made from biodegradable polyesters.

5.2 The manufacture of films from biodegradable polyesters is known from documents D2 and D5.

5.3 As can be understood from the application in suit, its aim is to provide films made of copolymers which, in comparison to 3HB homopolymers or 3HB3HV copolymers, can be easily processed into films.

5.4 While D5 relies on process features (i.e. coextrusion process) for obtaining films from polyesters such as 3HB homopolymers and 3HB3HV copolymers, D2 put the emphasis on the properties of the copolymers since it discloses that copolymers of 3HB having a melting point and a crystallinity lower than 3HB homopolymers are of particular utility in the manufacture of films by melt extrusion. Therefore, D2 qualifies, in the Board's view as a closer state of the art than D5.

5.5 Starting from D2 the technical problem might be seen in the selection of biodegradable polyesters which can be easily processed into films by melt extrusion.

5.6 According to the application in suit, this problem is solved by using the polyester copolymers as defined in Claim 1 for the manufacture of films.

5.7 In view of Examples 3 and 4 which disclose the direct extrusion into films of copolymers at temperatures at least 20°C above the melting point of the copolymers used, the Board is satisfied that the problem is effectively solved.

6. *Inventive step*

6.1 It remains to be decided whether the proposed solution was obvious in respect of the cited prior art.

6.2 As indicated above in paragraph 4.2, document D2 discloses copolymers comprising 3HB units and up to 50 mole% of units of the formula:



wherein n is 0 or an integer, and R^1 , R^2 , R^3 and R^4 may be *inter alia* hydrocarbon groups or hydrogen. While document D2 states that copolymers of this general formula, which exhibit a melting point lower than 3HB homopolymers and a low crystallinity, would be of particular utility in the production of films by melt extrusion, it does not further specify which copolymers would fulfil the requirements of low crystallinity and low melting point. Thus, D2 alone could not suggest the solution proposed in the application in suit.

6.3 Random 3HB3HH copolymers containing at least 50 mol% of 3HB units and falling under the general formula disclosed in D2 were however known in the art (cf. document D6) before the priority date of the application in suit. It was further known from D6 that 3HB3HH copolymers comprising 11 or 17 mol% of 3HH units exhibited, in contrast to 3HB homopolymer and to 3HB3HV copolymers, a reduced crystallinity and a melting point (i.e. 136°C and 130°C respectively) well below 160°C which is the degradation temperature reported in the art for polyhydroxyalkanoate polymers as acknowledged in the declaration of Mr Noda annexed to the letter of 3 June 2002 of the Appellant.

6.4 While it is true, as submitted by the Appellant, that D6 also shows that 3HB3HV copolymers containing more than 17% of 3HV have a low melting point, their crystallinity remains very high in contrast to that of 3HB3HH copolymers, so that, it is, however, evident from D6 that only copolymers of 3HB3HH such as those containing 11% or 17% 3HH units exhibit an adequate combination of low melt temperature and low crystallinity.

6.5 Thus, in view of the combined teachings of D2 and D6, it would have been obvious for the skilled person to use 3HB3HH copolymers such as those containing 11 or 17% 3HH disclosed in D6 in order to overcome the difficulties occurring with the use of 3HB homopolymers and 3HB3HV copolymers in the manufacture of films by melt extrusion methods, since they exhibit a low crystallinity and a melt temperature well below the expected degradation temperature (i.e. 160°C), and can be thus be processed into films at temperatures such as 20°C above their melting points.

6.6 The fact, as shown by the comparative examples submitted by the Appellant with its letter dated 11 September 2003, that a 3HB3HH copolymer comprising 8% of 3HH units and exhibiting a melting point of 145°C might be processed into films at a temperature well above 160°C (i.e. 175°C) without thermal degradation, is not in this case pertinent for demonstrating the presence of inventive step, even if it might be true that the person skilled in the art could not have expected that such a copolymer could be easily made into films by melt extrusion in view of its rather high melting temperature. This is because Claim 1 is not limited to films comprising such copolymers since it encompasses films made of copolymers having up to 50% of 3HH units i.e. by way of consequence including those made of 3HB3HH copolymers having 11 or 17% of 3HH units as disclosed in D6, which represent an obvious solution of the technical problem.

- 6.7 It thus follows from the above that the subject-matter of Claim 1 of the second auxiliary request arises in an obvious manner from the cited prior art. Consequently, the second auxiliary request, as a whole, must be rejected.

Third auxiliary request

7. *Wording of the Claims*

- 7.1 Claim 1 of the third auxiliary request distinguishes from Claim 1 of the second auxiliary request only in that it is directed to the use of the biodegradable copolymer for manufacturing a film by melt processing and in that the copolymer has a melt temperature of from 30°C to 160°C and a crystallinity of from 2 to 65% as measured by x-ray diffraction. The remaining dependent Claims 2 to 5 result from the reformulation of Claims 2 to 5 of the second auxiliary request as use claims.
- 7.2 On the one hand the feature that the copolymers have a melt temperature of from 30°C to 160°C and a crystallinity of 2 to 65% as measured by x-ray diffraction is supported by the passages on page 13, lines 27 to 30 and on page 14, lines 17 to 19 of the application as originally filed, and on the other hand the feature that the film is manufactured by melt processing is disclosed on page 20, lines 3 to 5.
- 7.3 It thus follows that no objection under Article 123(2) EPC arises from the wording of the claims of the third auxiliary request. The same conclusion is valid in respect of Article 84 EPC.

8. *Novelty*

Since the subject-matter of Claims 1 to 5 has been further restricted in comparison to that of the second auxiliary request, the requirements of Article 54 EPC are *a fortiori* met.

9. *Inventive step*

9.1 In paragraph 6.6 above it has been stated that it would have been obvious for the skilled person to use copolymers such as the copolymers 3HB3HH containing 11 and 17% of 3HH units for the manufacture of films by melt extrusion.

9.2 The further indication in Claim 1 that the copolymers have a melt temperature between 30°C and 160°C and a crystallinity of 2 to 65% cannot change this conclusion since the copolymers containing 11 and 17% of 3HH units disclosed in D6 indeed exhibit a melt temperature of 136°C and 130°C and a crystallinity of 40% and 29%, respectively.

9.3 It thus follows that the subject-matter of Claim 1 of the third auxiliary request lacks inventive step. The third auxiliary request must be therefore rejected.

Fifth auxiliary request

10. *Wording of the Claim.*

10.1 The Claim finds its support in original Example 7.

10.2 The Claim is also clear and concise.

10.3 Thus, the Board is satisfied that the requirements of Article 123(2) and 84 EPC.

11. *Article 83 EPC:*

No objection under Article 83 EPC arises since the application teaches the skilled person how to obtain such copolymer (cf. Examples 7 and 1) and how to carry out the manufacture of a film by extrusion (cf. page 20, lines 3 to 26).

12. *Novelty*

The subject-matter of the claim has been further restricted in comparison to that of Claim 1 of the second auxiliary request. Consequently, it meets the requirements of Article 54 EPC.

13. *Inventive step*

13.1 The assessment of inventive step of the subject matter of the claim can be carried out on the same basis (closest prior art, technical problem to be solved) as for the second auxiliary request.

13.2 In view of the experimental data submitted by the Appellant with its letter of 11 September 2003, the Board is satisfied that the problem is effectively solved by the specific 92:8 3HB 3HH copolymer, since it shows that a film can be directly formed by extrusion from this specific copolymer at temperature well above its melting point. Thus, it remains to be decided whether the solution proposed according to the claim arises in an obvious way from the cited prior art.

- 13.3 While it would have been obvious in view of document D6 to use copolymers of 3HB3HH having a melt temperature in the range of 130 to 136°C and a low crystallinity for making films, it is, however, evident that the skilled person looking for copolymers which could be easily manufactured into films without risk of degradation, would normally not choose those having a melting point near to the expected degradation temperature of about 160°C, but would, in contrast select those having a melting temperature as low as possible and compatible with the further use of the film, i.e. resulting in a processing temperature well below 160°C.
- 13.4 At least for this reason, document D6 would not provide a hint for the skilled person to use a 92:8 3HB3HH copolymer for making films by melt extrusion since this copolymer would exhibit a melt temperature in the range of 145°C and therefore a processing temperature (e.g. 20°C above the melting point) above the expected degradation temperature. Furthermore, it could not have been foreseen from D6, that the specific copolymer 92:8 3HB3HH could be formed into films at temperature much higher than 160°C (i.e. 175°C) without thermal degradation as shown with the comparative data submitted with the letter of 11 September 2003.
- 13.5 Documents D1, D4, D7 and D8 are of no assistance in the solution of the technical problem since they are not concerned at all with film extrusion.
- 13.6 Document D3 which relates to films is however totally silent on the use of hydroxyhexanoate units in biodegradable polyesters and cannot suggest the solution proposed.

13.7 Document D5 solves the problem of film extrusion of biodegradable polyesters by a using a specific coextrusion process. It cannot therefore provide any hint to the solution proposed.

13.8 Thus, it follows that the subject-matter of the claim of the fifth auxiliary request involves an inventive step over the cited prior art (Article 56 EPC).

13.9 Consequently, the fifth auxiliary request is allowable.

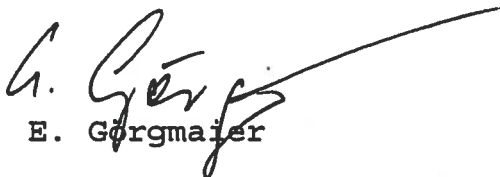
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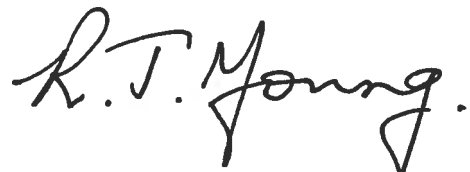
For these reasons it is decided that:

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 sole claim of the auxiliary request 5 "final" filed at the oral proceedings, and after any consequential amendment of the description.

The Registrar:

The Chairman:


E. Gorgmaier


R. Young