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Datasheet for the decision of 28 January 2025

Case Number: T 2073/22 - 3.3.02

Application Number: 13834617.6

Publication Number: 2848694

IPC: C12P7/62, C12N1/20, C12N9/10

Language of the proceedings: EN

Title of invention:
METHOD FOR PRODUCING METHACRYLIC ACID ESTER

Patent Proprietor:
Mitsubishi Chemical Corporation

Opponent:
Forresters IP LLP

Headword:
MITSUBISHI CHEMICAL / METHACRYLATE ESTERS

Relevant legal provisions:
EPC Art. 100(a), 100(b), 100(c), 54, 56
RPBA 2020 Art. 12(4), 12(6)

Keyword:

Grounds for opposition - added subject-matter (no) - insufficiency of disclosure (no)
Evidence filed with grounds of appeal - admitted (no)
Novelty - (yes)
Inventive step - (yes)

Decisions cited:

Catchword:

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Case Number: T 2073/22 - 3.3.02

D E C I S I O N
of Technical Board of Appeal 3.3.02
of 28 January 2025

Appellant: (Opponent)	Forresters IP LLP Skygarden Erika-Mann-Strasse 11 80636 München (DE)
Representative:	Forresters IP LLP Skygarden Erika-Mann-Straße 11 80636 München (DE)
Respondent: (Patent Proprietor)	Mitsubishi Chemical Corporation 1-1, Marunouchi 1-chome Chiyoda-ku Tokyo 100-8251 (JP)
Representative:	Hoffmann Eitle Patent- und Rechtsanwälte PartmbB Arabellastraße 30 81925 München (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 13 July 2022 rejecting the opposition filed against European patent No. 2848694 pursuant to Article 101(2) EPC.**

Composition of the Board:

Chairman	M. O. Müller
Members:	M. Maremonti
	L. Bühler

Summary of Facts and Submissions

I. The appeal by the opponent ("appellant") lies from the opposition division's decision to reject the opposition against European patent No. 2 848 694 ("the patent").

II. Claim 1 as granted reads as follows:

"*1. A method for producing methacrylic acid ester comprising:*

a step of producing methacrylyl-CoA from isobutyryl-CoA or 3-hydroxyisobutyryl-CoA, and

a step of synthesizing methacrylic acid ester by causing an alcohol or phenol having the formula R-OH to act on methacrylyl-CoA under the presence of an alcohol acyltransferase, wherein R represents a linear or branched C1-20 hydrocarbon group of a saturated or unsaturated non-cyclic type or of a saturated or unsaturated cyclic type."

III. The opposition was based on the grounds under Article 100(a) to (c) EPC. Reference was made, *inter alia*, to the following documents:

P1: priority application JP 2012198840

P2: priority application JP 2013160300

D1: WO 2012/135789 A2

D4: English translation of P1

D5: English translation of P2

D6: WO 2007/039415 A1

D7: WO 2009/135074 A2

D9: Ozcan, G., "*Effect of Enzymes on Strawberry Volatiles During Storage, at Different Ripeness Level, in Different Cultivars and During Eating*", Master Thesis, The Ohio State University, 2010

D11: US 2010/0291644 A1

D16: WO 02/042418 A2

IV. The opposition division came, *inter alia*, to the following conclusions.

- The claimed subject-matter enjoyed priority from document P1.
- None of the grounds for opposition invoked by the appellant prejudiced maintenance of the patent as granted.
- In particular, the subject-matter of claim 1 as granted was novel over the disclosure in D1 and D6 and involved an inventive step in view of D6 taken as closest prior art.

V. In the statement of grounds of appeal, the appellant contested the opposition division's reasoning and argued, *inter alia*, that the subject-matter of the claims as granted extended beyond the content of the application as filed, was not sufficiently disclosed, lacked novelty over the disclosures in D1 and D6 and lacked inventive step. The appellant further submitted that the claimed subject-matter might at best enjoy a partial priority from document P1. The appellant corroborated its arguments by filing the following new items of evidence (numbered by the board):

A18: Schematic representation of figures 2 and 21 of D1

A19: Zhang *et al.*, Microbiology, 145, 1999, pages 2323-34

VI. In its reply to the appeal and a subsequent letter, the patent proprietor ("respondent") rebutted the appellant's arguments, arguing, *inter alia*, that the grounds for opposition under Article 100(a) to (c) EPC did not prejudice maintenance of the patent as granted. The respondent also contested the admittance of A18, A19 and specific objections raised by the appellant (see below). It corroborated its arguments by filing the following new items of evidence:

A20: Alber and Fuchs, The Journal of Chemistry, 277(14), Issue of April 5, 2002, pages 12137-43

A21: Teufel *et al.*, Journal of Bacteriology, 191(14), 2009, pages 4572-81

VII. The parties were summoned to oral proceedings as per their requests. In preparation for the oral proceedings, the board issued a communication under Article 15(1) RPBA. In this communication, the board, *inter alia*, expressed the preliminary opinion that the subject-matter of the claims as granted did not extend beyond the content of the application as filed, was sufficiently disclosed and was novel over the disclosures in D1 and D6.

VIII. Oral proceedings before the board were held by videoconference on 28 January 2025 in the presence of both parties.

IX. Final requests relevant to the decision

The appellant requested that the appealed decision be set aside and that the patent be revoked.
Alternatively, should the board conclude that the main request was not allowable, the appellant requested that the case be remitted to the opposition division for further prosecution.

The respondent requested that the appeal be dismissed, implying that the patent be maintained as granted. The respondent also requested that A18, A19 and the appellant's submissions alleging lack of priority and lack of inventive step starting from D1 as the closest prior art not be admitted.

X. As regards the parties' submissions that are relevant to the decision, reference is made to them in the reasons for the decision below.

Reasons for the Decision

Main request - patent as granted - claims 9 and 10 - ground for opposition under Article 100(c) EPC - added subject-matter

1. Claims 1, 9 and 10 as granted read as follows, the amendments to claims 1, 10 and 11 of the application as filed having been highlighted by the board:

"*1. A method for producing methacrylic acid ester comprising:*

- ***a step of producing methacrylyl-CoA from isobutyryl-CoA or 3-hydroxyisobutyryl-CoA, and***
- *a step of synthesizing methacrylic acid ester by causing an alcohol or phenol* ***having the formula R-OH*** *to act on methacrylyl-CoA under the presence of an alcohol acyltransferase,* ***wherein R represents a linear or branched C1-20 hydrocarbon group of a saturated or unsaturated non-cyclic type or of a saturated or unsaturated cyclic type.***" (bullet squares introduced by the board)

"~~*10*~~ ***9.*** *The method for producing methacrylic acid ester according to any one of claims 1 to* ~~*9*~~ ***8,*** *using a*

genetically modified microorganism that has been gene transferred so as to express alcohol acyltransferase.

*~~11~~ **10**. The method for producing methacrylic acid ester according to claim ~~10~~ **9**, using a microorganism belonging to Rhodococcus genus as the genetically modified microorganism that has been gene transferred so as to express alcohol acyltransferase*".

The two steps of claim 1 (see above the bullet squares introduced by the board) will be referred to hereinafter as "the first step" and "the second step". The alcohol acyltransferase used in the second step of the claimed process will be denoted "AAT" hereinafter.

1.1 The appellant argued that in the context of a method as defined in granted claims 9 and 10, i.e. occurring in microorganisms, the application as filed disclosed in paragraphs [0050] and [0051] only microorganisms genetically modified to express acyl-CoA dehydrogenase (ACD) or enoyl-CoA hydratase (ECH) in addition to AAT. ACD or ECH were needed to carry out the first step of granted claim 1 while AAT catalysed the second step. While claims 10 and 11 as filed defined the addition of an AAT expressing gene without explicitly reciting the addition of an ACD or ECH expressing gene, there was no enabling disclosure in respect of a microorganism having the AAT expressing gene added without also adding either an ACD or an ECH expressing gene. Hence, the latter was an essential feature of the claimed method because without it, the claims did not contain the necessary technical features for an enabling disclosure. Thus, the appellant concluded that claims 9 and 10 as granted constituted an intermediate generalisation of the disclosure in paragraphs [0050] and [0051] of the application as filed without any basis.

1.2 The board finds these arguments unconvincing for the following reasons.

1.2.1 The addition in claim 1 as granted of "*a step of producing methacrylyl-CoA from isobutyryl-CoA or 3-hydroxyisobutyryl-CoA*" finds its basis, *inter alia*, in claim 3 as filed. This addition has not been contested by the appellant.

1.2.2 The addition in claim 1 as granted of the definition of the alcohol or phenol of formula R-OH finds its basis, *inter alia*, in paragraphs [0026] and [0027] of the application as filed. This addition has not been contested by the appellant, either.

1.2.3 As submitted by the respondent and accepted by the appellant, granted claims 9 and 10 are identical in wording to claims 10 and 11 as filed. These claims define, by means of their back reference to, *inter alia*, claim 3 as filed, a method for producing methacrylic acid esters comprising the two steps recited in claim 1 as granted and carried out using a genetically modified microorganism (further specified to belong to Rhodococcus genus in claim 11 as filed) that has been gene-transferred so as to express AAT. No other modifications, e.g. to express ACD or ECH, are defined in claims 10 and 11 as filed.

1.2.4 Therefore, the two-step method defined in claims 9 and 10 as granted (see above) is identical to the method disclosed in claims 10 and 11 as filed, by way of their reference to claim 3 as filed in combination with the disclosure in paragraphs [0026] and [0027] of the application as filed for the definition of the alcohol or phenol.

1.2.5 For this reason, the subject-matter defined in claims 9 and 10 as granted does not extend beyond the content of the application as filed.

1.2.6 The appellant's argument that further genetic modification to also express ACD or ECH was essential for providing an enabling disclosure of the method defined in granted claims 9 and 10 concerns the requirements of clarity and sufficiency of disclosure of claimed subject-matter. As such, this argument is not relevant to the assessment of added subject-matter within the meaning of Article 100(c) EPC.

1.3 For these reasons, the board concludes that the ground for opposition under Article 100(c) EPC does not prejudice maintenance of the patent as granted.

Main request - patent as granted - claim 1 - ground for opposition under Article 100(b) EPC - sufficiency of disclosure

2. The appellant argued that, as regards the first step, claim 1 as granted encompassed any method of producing methyl acrylyl-CoA from isobutyryl-CoA or 3-hydroxyisobutyryl-CoA. However, the whole patent disclosure was limited to the use of ACD or ECH in order to carry out this conversion. As a result, an undue burden was placed on the skilled person trying to identify suitable enzymes other than ACD and ECH for the first step of claim 1 as granted. Additionally, as regards the second step, claim 1 as granted did not specify the nature of the AAT to be used. It was known that not all AATs were able to catalyse the production of methacrylic acid ester. The patent showed some plant AATs catalysing the production of methacrylic acid ester, but, at the same time, disclosed that yeast AAT did not work. This left the skilled person with an undue burden when it came to identifying AATs that would fall within the scope of granted claim 1 because the claim placed no structural limitation on the AAT which would guide the skilled person towards suitable AATs. The fact that yeast AAT was found not to work in the second step of the method cast serious doubts on

which AATs would work. A research project was needed in order to identify suitable AATs. The appellant thus concluded that the subject-matter of claim 1 as granted was not sufficiently disclosed.

3. These arguments are not convincing.

3.1 As pointed out by the respondent, the patent contains numerous working examples which, together with the general information in the description, provide the skilled person with concrete guidance on different ways to carry out the two-step method of granted claim 1. In particular, different combinations of substrates, enzymes and conditions are disclosed. Concrete implementations of the first step of granted claim 1 are provided e.g. in examples 10 to 14, while the second step is shown e.g. in examples 1 to 5, 8, 9A, 9B and 12. Example 14 shows the combination of steps 1 and 2 by using cellular extracts, examples 19 and 20 by using a recombinant microorganism expressing the relevant enzymes. Moreover, paragraphs [0032] to [0034], [0058] to [0062], [0070], [0074] to [0076] and [0088] to [0092] provide the skilled person with sufficient guidance for carrying out the first step of granted claim 1, while guidance for performing the second step, especially as regards the selection of suitable AATs, is given e.g. in paragraphs [0036] to [0045] and [0046] to [0056].

3.2 Furthermore, granted claim 1 provides a functional definition of the AAT to be used, namely an AAT suitable for catalysing the synthesis of methacrylic acid esters by causing an alcohol or phenol to act on methacrylyl-CoA. Based on the teaching of the patent, the skilled person would know how to identify such suitable AATs. Paragraph [0038] of the patent discloses how this function can be experimentally verified.

3.3 For these reasons, the board concludes that the subject-matter of claim 1 as granted is sufficiently disclosed in the patent. No further objections of lack of sufficiency have been raised. Therefore, the ground for opposition under Article 100(b) EPC does not prejudice maintenance of the patent as granted.

Main request - patent as granted - claim 1 - ground for opposition under Article 100(a) EPC - novelty under Article 54 EPC

4. The appellant objected to the novelty of the subject-matter of claim 1 as granted in view of the disclosures in D1 and D6.

Document D1

4.1 The appellant argued that pathways for the formation of methacrylate esters were disclosed in claims 1(p) and 4 of D1. These pathways were respectively shown in figures 21 and 2 of D1 and comprised the step of producing methacrylyl-CoA from 3-hydroxyisobutyryl-CoA (step 8 of figure 21) and the step of synthesising methacrylic acid ester using methacrylyl-CoA in the presence of an AAT (figure 2). These corresponded respectively to the first and second steps as defined in claim 1 as granted. The appellant corroborated this objection by filing A18, a schematic representation of figures 2 and 21 of D1, the admittance of which was contested by the respondent.

The appellant further submitted that figure 2 was described in more detail in paragraphs [0306] to [0314] of D1, which disclosed that various enzymes with alcohol transferase activity could be applied to form methacrylate esters directly from methacrylate and alcohols. AAT from *Fragaria x ananassa* (Strawberry) was given as an example of a methacrylate ester-forming enzyme useful in this step, which corresponded to the

enzyme used in the second step of claim 1 as granted. Moreover, paragraphs [0142] and [0356] of D1 disclosed that dehydration of 3-hydroxyisobutyryl-CoA to methacrylyl-CoA could be accomplished by a reversible 3-hydroxyacyl-CoA dehydratase such as crotonase (also called 3-hydroxybutyryl-CoA dehydratase, EC 4.2.1.55) or enoyl-CoA hydratase, this corresponding to the first step of the claimed method.

At the oral proceedings, the appellant referred specifically to example IV of D1, especially paragraph [0312] of D1, which, in its view, disclosed in combination both steps required by granted claim 1. Indeed, by referring to figure 2 of D1, this paragraph disclosed the second step of the claimed method. The same paragraph further taught that gene encoding enzymes with methacrylate ester-forming activity could be expressed in microorganisms containing methacrylate synthesis pathways as disclosed in D1 itself and in D7, which was thus incorporated by reference. An example of such a methacrylate synthesis pathway was illustrated in figure 5 of D1, identical to figure 6 of D7, showing that 3-hydroxyisobutyryl-CoA was a precursor in the pathway leading to methacrylic acid, as required by the first step of claim 1 as granted. Another methacrylate synthesis pathway was illustrated in figure 21 of D1, showing that 3-hydroxyisobutyryl-CoA was converted to methacrylyl-CoA as required by the first step of claim 1 as granted.

The appellant thus concluded that the subject-matter of claim 1 as granted was anticipated by D1.

4.2 These arguments are not convincing.

4.2.1 Claim 1 of D1 defines a non-naturally occurring microorganism, which is genetically modified to express

an enzyme able to catalyse the production of methacrylic acid via a methacrylic acid pathway.

4.2.2 As pointed out by the respondent, claim 1 of D1 defines a large number of alternatives for the above-mentioned enzyme, these alternatives being recited under items (a) to (p) of claim 1. Further alternatives are defined within each of items (a) to (p).

4.2.3 Even though, as pointed out by the appellant, 3-hydroxyisobutyryl-CoA dehydratase is recited under item (p) of claim 1, this merely represents one of many alternatives for the enzyme defined in claim 1 of D1. Moreover, this enzyme, while suggesting the presence of 3-hydroxyisobutyryl-CoA as an intermediate compound, is stated in claim 1 of D1 to catalyse the production of methacrylic acid and not of methacrylyl-CoA as required by claim 1 as granted.

4.2.4 Therefore, even assuming that the skilled person would have selected 3-hydroxyisobutyryl-CoA dehydratase from among the numerous alternative enzymes mentioned in claim 1 of D1, this choice would not have expressed in the microorganism of D1 a pathway necessarily corresponding to the first step of claim 1 as granted.

4.2.5 The same observation applies when figure 21 and paragraphs [0142], [0356] and [0536] of D1, referred to by the appellant, are considered. Here too, a large number of alternative enzymes stated to catalyse the production of methacrylic acid are mentioned. A pathway in which methacrylyl-CoA is also formed as an intermediate from 3-hydroxyisobutyryl-CoA is only one (see figure 21, pathways 8 and 9) of the various alternatives shown.

4.2.6 Even assuming that the skilled person would have selected a microorganism genetically modified to express an enzyme able to specifically catalyse these

pathways 8 and 9 of figure 21 of D1, D1 contains no disclosure that the same microorganism would also express an AAT able to convert methacrylyl-CoA, formed by way of these pathways, to methacrylate ester as required by the second step of claim 1 as granted.

4.2.7 Indeed, although claim 4 of D1, referred to by the appellant, does refer back to claim 1, it does not specifically refer to item (p) thereof, let alone specifically to the enzyme 3-hydroxyisobutyryl-CoA dehydratase. Moreover, claim 4 also recites several alternative enzymes, with the alcohol transferase indicated by the appellant being only one of them. Additionally, this enzyme is stated in claim 4 to catalyse the production of methacrylate ester from methacrylic acid and not from methacrylyl-CoA.

4.2.8 The same observation applies when figure 2 and paragraphs [0306] to [0314] of D1, invoked by the appellant, are considered. It is acknowledged that here D1 discloses the reaction of methacrylyl-CoA with an alcohol to methacrylate ester under the action of an alcohol transferase. However, as submitted by the respondent, this is only one of three possible pathways illustrated in figure 2 of D1, with all three pathways starting from methacrylic acid, i.e. neither from isobutyryl-CoA nor from 3-hydroxyisobutyryl-CoA as required by granted claim 1. Moreover, paragraphs [0306] to [0314] of D1 mention several alternative enzymes capable of catalysing the conversion from methacrylyl-CoA to methacrylate esters, with AAT being only one of them (see paragraphs [0310] and [0314] mentioning "*Fragaria x ananassa AAT*").

4.2.9 At the oral proceedings, the appellant referred especially to paragraph [0312] of D1, which, in the appellant's view, disclosed both steps of claim 1 as granted in combination. However, this paragraph of D1

concerns enzymes capable of forming methacrylate esters from methacrylic acid and alcohols as illustrated by one of the pathways in figure 2 of D1 (see above). AATs are not mentioned in this paragraph. Moreover, as argued by the respondent, the general statement made in this paragraph that genes encoding such enzymes can be expressed in microorganisms containing a methacrylate synthesis pathway as disclosed in D1 and D7 does not constitute direct and unambiguous disclosure of the first step of granted claim 1, let alone in combination with the second step. In fact, both D1 and D7 disclose numerous pathways and paragraph [0312] of D1 does not refer to any of them in particular, let alone the ones shown in figures 5 and 21 of D1 or figure 6 of D7, invoked by the appellant. It is further noted that identical figures 5 of D1 and 6 of D7 disclose pathways which, although involving 3-hydroxyisobutyryl-CoA, lead to methacrylic acid and not to methacrylate esters as required by claim 1 as granted.

4.3 In view of the above, the board concurs with the respondent's view that multiple selections within the disclosure in D1 without any pointer would have been necessary to arrive at the first and second steps of granted claim 1 and that D1 contains no disclosure of the combination of these two steps. Therefore, the subject-matter of claim 1 as granted is novel over the disclosure in D1.

4.4 The respondent had requested that neither A18 nor the appellant's submission made at the oral proceedings on the basis of paragraph [0312] of D1, especially the cross-reference to D7 contained in this paragraph, be admitted. Since the board concluded at the oral proceedings that the subject-matter of claim 1 as granted is novel over D1 even taking A18 and this submission by the appellant into account, there was no

need for the board to make a decision about this request by the respondent.

Document D6

4.5 The appellant argued that D6 disclosed, on pages 15 and 29, the engineering of a microbial organism firstly to include a nucleic acid enabling it to biocatalytically convert a biomass starting material to methacrylyl-CoA and secondly to include a nucleic acid enabling the microbial organism to code for an enzyme capable of effecting the transfer of an alcohol moiety from an alcohol starting material to methacrylyl-CoA under removal of the CoA moiety, thus producing methacrylate esters. According to D6, this enzyme was a transferase (enzyme class EC 2) or hydrolase (enzyme class EC 3). AATs as required by the second step of claim 1 as granted were a sub-class of transferases.

The same disclosure was also present in Scheme IV on page 11 of D6, showing the production of methacrylyl-CoA from various starting materials and a step N, namely converting methacrylyl-CoA to methacrylate esters, stated to be carried out under the action of a biocatalyst capable of effecting the transfer of an alcohol moiety from an alcohol starting material to methacrylyl-CoA under removal of the CoA moiety. The appellant further referred to page 21 of D6, where transferases were specifically singled out as preferred enzymes for this conversion. Therefore, contrary to what had been stated by the opposition division, there was no need for the skilled person to select from a large list since transferases were indicated as preferred enzymes.

As regards the first step of claim 1 as granted, the appellant acknowledged that Scheme IV of D6 showed that methacrylyl-CoA was obtained from propionate via

propionyl-CoA (step K). However, D6 disclosed on page 12, line 10 that for the synthesis of methacrylate esters, isobutyric acid or precursor thereof could be used in Scheme IV instead of propionic acid as a point of junction or starting material. It was part of the common general knowledge of the skilled person that isobutyric acid might be converted to isobutyryl-CoA and from this to methacrylyl-CoA using appropriate enzymes as catalysts. This was the first step of claim 1 as granted. The appellant mentioned D7, especially examples V, XIII and XXIV, and D11, especially paragraphs [0340], [0401], [0420], [0426], [0427] and figures 19 and 20 as being representative of this common general knowledge. In particular, figure 20 of D11 showed a pathway starting from valine, a starting material also used in the patent (see e.g. paragraphs [0032] and [0075] of the patent). Moreover, the patent itself acknowledged in paragraph [0070] that the first step of granted claim 1 was known. The same was stated in priority applications P1 and P2 (the appellant referred to D4 and D5, English translations of P1 and P2). Therefore, in the appellant's view, the skilled person having this common general knowledge in mind would have regarded the first step of granted claim 1 as being disclosed in D6. It followed that Scheme IV of D6 in combination with the general teaching of D6 concerning transferase enzymes anticipated the claimed subject-matter.

4.6 The board disagrees.

4.6.1 As indicated by the appellant, D6 discloses, e.g. on page 15, lines 7 to 24, a microorganism which has been genetically modified to include a biosynthetic route for producing methacrylate esters. In particular, the microorganism is genetically modified to enable the microorganism to convert a biomass starting material to

methacrylyl-CoA in combination with a further genetic modification enabling the expression of an enzyme capable of effecting the transfer of an alcohol moiety from an alcohol starting material to methacrylyl-CoA under removal of the CoA moiety so that methacrylate esters are produced.

4.6.2 Examples of possible metabolic pathways according to the above disclosure are shown in Scheme IV on page 11 of D6, which illustrates various alternative routes for producing acrylyl-CoA and, from that, acrylic esters. Possible enzymes catalysing these routes are also indicated. However, as submitted by the respondent, none of the pathways shown in Scheme IV corresponds to the first step of claim 1 as granted. In particular, in the second pathway from the bottom of Scheme IV, specifically referred to by the appellant, propionyl-CoA is produced from propionate. This is different from the first step of claim 1 where methacrylyl-CoA is produced from isobutyryl-CoA or 3-hydroxyisobutyryl-CoA.

4.6.3 While D6 discloses on page 12, lines 10 to 12 that, in said Scheme IV, methacrylate esters can be produced using isobutyric acid instead of propionic acid (corresponding to propionate in Scheme IV) as a point of junction or starting material, this possibility is not concretely shown in D6. As noted by the respondent, the intermediate steps leading from isobutyric acid to methacrylate esters are not exemplified, whether on page 12, lines 10 to 12 or in any other passage of D6, let alone a step involving the conversion from isobutyryl-CoA to methacrylyl-CoA as required by the first step of claim 1 as granted. Nor is there any indication of possible enzymes which would allow this conversion.

4.6.4 In fact, only a propionyl CoA-reductase is mentioned on page 12, lines 2 to 3 of D6 as enzyme K to be used in Scheme IV. This enzyme is stated to be part of an enzyme complex labelled OS17 and defined in D16. As pointed out by the respondent, D16 discloses (page 66, lines 4 to 7; page 68, lines 16 to 18) that enzyme complex OS17 catalyses the reaction sequence

3-hydroxypropionate -> 3-hydroxypropyl-CoA

3-hydroxypropyl-CoA -> acrylyl-CoA

acrylyl-CoA -> propionyl-CoA

No indication is given either in D6 or D16 that this enzyme would also have an activity on isobutyric acid, let alone be able to catalyse its conversion to methacrylate esters with isobutyryl-CoA and methacrylyl-CoA as intermediates, as required by the first step of claim 1 as granted.

4.6.5 The appellant argued that D7 and D11 were representative of common general knowledge and could be read into the disclosure of D6 when considering novelty over this document. Even if this argument were accepted for sake of discussion, the passages of these documents invoked by the appellant do not disclose the conversion from isobutyric acid to methacrylate esters, let alone such a conversion involving isobutyryl-CoA and methacrylyl-CoA as intermediates.

4.6.6 In fact, example V of D7 (page 65 and figure 6) concerns pathways leading from 4-hydroxybutyryl-CoA to 3-hydroxyisobutyric acid via 3-hydroxyisobutyryl-CoA, with 3-hydroxyisobutyric acid being either recovered as a product or dehydrated to methacrylic acid. Example XIII of D7 (page 91 and figure 13) concerns a pathway leading from acetyl-CoA to methacrylic acid via 3-hydroxyisobutyryl-CoA, crotonyl-CoA, butyryl-CoA,

isobutyryl-CoA and methacrylyl-CoA. Example XXIV of D7 (page 115) also concerns the production of methacrylic acid. Therefore, the examples of D7 invoked by the appellant do not concern the production of methacrylate esters nor do they disclose isobutyric acid as starting material or intermediate.

4.6.7 Figures 19 and 20 of D11, and related paragraphs [0401] to [0430], disclose pathways leading to methacrylyl-CoA from 3-hydroxyisobutyric acid or valine. However, as noted by the respondent, the illustrated pathways do not involve isobutyric acid as starting material or intermediate.

4.6.8 Therefore, the above-mentioned passage on page 12, lines 10 to 12 of D6, even when combined with the alleged common general knowledge of D7 and D11, neither explicitly nor implicitly discloses the first step of claim 1 as granted.

4.6.9 The appellant also argued that it was acknowledged in the patent and priority applications P1 and P2 themselves that the first step of the claimed method was commonly known. However, statements contained in the patent or in the priority applications cannot be used as proof of common general knowledge.

4.6.10 Scheme IV of D6 shows that the conversion from acrylyl-CoA to acrylic esters is catalysed by an enzyme N, stated (page 12, lines 6 to 8) to be a biocatalyst capable of effecting the transfer of an alcohol moiety from an alcohol starting material to methacrylyl-CoA under removal of the CoA moiety. On page 15, lines 23 to 24, and on page 21, lines 14 to 17, D6 discloses that this enzyme can be for example a transferase, i.e. belonging to enzyme class EC 2, or a hydrolase, e.g. a lipase, esterase, acylase or protease, i.e. belonging to enzyme class EC 3. As confirmed by the appellant at

the oral proceedings, AATs belong to a sub-class of transferases. As noted by the respondent, D6 discloses transaminases, transamidases, transketolases, transphosphorylases or choline acetyl transferase when specifying possible transferases on page 22, lines 2 to 4. Moreover, on page 22, lines 2 to 12, D6 discloses that hydrolases are just as preferred as transferases and, indeed, all the examples of D6 (pages 30 to 33), use hydrolases (lipase, L-aminoacylase or protease). Therefore, contrary to the appellant's view, the examples of D6 point towards selecting hydrolases rather than transferases. Therefore, multiple selections without any pointer would have been needed to arrive at an AAT as required by the second step of claim 1 as granted.

4.7 For the reasons set out above, neither D1 nor D6 anticipate the subject-matter of claim 1 as granted (Article 54 EPC). The ground for opposition under Article 100(a) EPC in combination with Article 54 EPC does not prejudice maintenance of the patent as granted.

4.8 The respondent had filed documents A20 and A21 in support of the novelty of the claimed subject-matter over D6. In arriving at the above conclusion on novelty in view of D6, the board took no account of A20 and A21. Therefore, a decision by the board on the admittance of these documents was not needed.

Document A19 - admittance into the proceedings under Article 12(4) and (6) RPBA

5. Document A19 was filed by the appellant with the statement of grounds of appeal to show that the first step defined in claim 1 as granted (point II above) was known to the skilled person.

The respondent requested that A19 not be admitted.

5.1 Since the appealed decision is not based on A19, the filing of this document represents an amendment to the appellant's case within the meaning of Article 12(4) RPBA.

5.2 Contrary to the requirements of Article 12(4) RPBA, the appellant has not provided any reason for submitting this amendment in the appeal proceedings. Any amendment is admitted only at the board's discretion, exercised in view of *inter alia* the amendment's complexity and the need for procedural economy.

5.3 The appellant used A19 as a secondary document for some of its inventive step objections to demonstrate that the first step defined in granted claim 1 was known to the skilled person. The admittance of D19 would thus have led to a fresh case on the issue of inventive step to be discussed on appeal for the first time. This would have been detrimental to procedural economy and contrary to the primary object of the appeal proceedings, namely reviewing the appealed decision in a judicial manner (Article 12(2) RPBA).

5.4 Moreover, under Article 12(6) RPBA, the board should not admit *inter alia* items of evidence which should have been submitted before the opposition division. A19 is cited in paragraph [0070] of the patent. No reasons are apparent, nor were any submitted by the appellant, as to why A19 was not filed before the opposition division.

5.5 For these reasons, the board decided not to admit A19 into the proceedings, pursuant to Article 12(4) and (6) RPBA.

Main request - patent as granted - claim 1 - ground for opposition under Article 100(a) EPC - inventive step under Article 56 EPC

6. Closest prior art

6.1 In agreement with the appealed decision (page 6), both parties indicated document D6 as the possible closest prior art. In view of the above-mentioned disclosure in D6 (see discussion on novelty), the board has no reason to take a different stance.

6.2 In particular, the parties argued inventive step starting from the embodiment disclosed in Scheme IV on page 11 of D6, already discussed above.

7. Distinguishing features

As concluded above in respect of novelty of the claimed method over the disclosure in D6, the subject-matter of claim 1 as granted differs from the embodiment shown in Scheme IV of D6 in that

- methacrylyl-CoA is produced from isobutyryl-CoA or 3-hydroxyisobutyryl-CoA, and in that
- an AAT is used to catalyse the reaction between methacrylyl-CoA and an alcohol or phenol to synthesise a methacrylate ester.

8. Objective technical problem

8.1 The appellant submitted that the wording of claim 1 as granted did not exclude the inclusion of further steps, notably a step in which methacrylic acid was produced. No technical effect could be derived from the distinguishing features mentioned above. Therefore, the objective technical problem was, at best, the provision of an alternative method for producing methacrylic acid esters.

8.2 For the sake of argument and in the appellant's favour, the board accepts this formulation of the objective technical problem.

9. Obviousness of the claimed solution

9.1 The appellant referred to page 12, lines 10 to 12 of D6, which suggested replacing propionic acid in Scheme IV with isobutyric acid or its metabolic precursors to produce methacrylate esters. As already argued in respect of novelty, the appellant submitted that it was common general knowledge that isobutyric acid might be converted to isobutyryl-CoA and from this to methacrylyl-CoA using appropriate enzymes as catalysts. This was the first step of claim 1 as granted. The appellant referred again to the same passages of D7 and D11 cited in respect of novelty, and also to A19 as being representative of this common general knowledge. Furthermore, the appellant reiterated that the patent itself and priority applications P1 and P2 acknowledged that the first step of granted claim 1 was known. The skilled person would have been aware that propionyl CoA-reductase as indicated as enzyme K in Scheme IV of D6 could not have been used if propionic acid was replaced by isobutyric acid and that another enzyme had to be employed. It was common general knowledge that ACD catalysed the conversion from isobutyric acid to methacrylic-CoA. Therefore, the skilled person using common general knowledge would have known the enzymes to be used when replacing propionic acid with isobutyric acid. Therefore, in view of common general knowledge, the above-mentioned disclosure on page 12, lines 10 to 12 of D6 in conjunction with its Scheme IV rendered the first step of claim 1 as granted obvious.

9.2 As regards the second step of granted claim 2, the appellant argued that D6 indicated possible enzymes N to be used in Scheme IV of D6. Among these enzymes,

transferases belonging to enzyme class EC 2 were explicitly mentioned and AATs were a sub-class of these. Thus, selection of the particular transferase as required by the second step of the claimed method, whilst tedious, was a matter of experimental routine for the skilled person and did not require any inventive skill. The appellant further referred to D9, which disclosed on page 17 that strawberry AAT accelerated the esterification reaction between acyl-CoA and alcohol, thus pointing to the second step of claim 1 as granted.

9.3 The appellant further submitted that document D1 might also be used as a secondary document to be combined with D6 to render the first and second steps of the claimed method obvious. In this respect, the appellant referred to the passages of D1 already mentioned above in the discussion of novelty.

The appellant concluded that the claimed method merely amounted to the combination of two known steps, which combination, in the absence of any technical effect, did not involve an inventive step.

9.4 The board does not find the appellant's arguments convincing for the following reasons.

9.4.1 As already noted above in the discussion concerning novelty over D6, the passage on page 12, lines 10 to 12 of D6 merely states that, in Scheme IV, isobutyric acid can replace propionic acid as a point of junction or starting material for producing methacrylate esters. However, this possibility is not concretely shown in D6. In particular, D6 does not exemplify the intermediate steps that would lead from isobutyric acid to methacrylate esters, let alone a step involving the conversion from isobutyryl-CoA to methacrylyl-CoA as required by the first step of claim 1 as granted. Nor

is there any indication of possible enzymes which would allow this conversion.

9.4.2 The appellant alleged that the first step of the claimed method as well as the enzymes catalysing this step were common general knowledge. It referred to A19, D7 and D11.

9.4.3 However, A19 was not admitted into the proceedings. Therefore, all arguments based on A19 as a secondary document or evidence of common general knowledge must be disregarded.

9.4.4 Even if it were accepted that D7 and D11 were representative of common general knowledge, as set out above in respect of novelty over D6, the passages of these documents invoked by the appellant do not disclose the conversion from isobutyric acid to methacrylate esters, let alone such a conversion involving isobutyryl-CoA and methacrylyl-CoA as intermediates. D7 and D11 instead concern the production of methacrylic acid. Reference is made to the above discussion of novelty for further details.

9.4.5 As regards statements contained in the patent or in the priority applications, these cannot be used as proof of common general knowledge.

9.4.6 Therefore, the first step of claim 1 as granted is not rendered obvious by the above-mentioned passage on page 12, lines 10 to 12 of D6, either alone or in combination with D7 or D11.

9.4.7 As regards the second step defined in claim 1 as granted, as already mentioned above in respect of novelty, D6 discloses transferases or hydrolases as being equally suitable for effecting the transfer of an alcohol moiety from an alcohol starting material to methacrylyl-CoA under removal of the CoA moiety No

reference is made to AATs all the examples of D6, on the contrary, making use of hydrolases (lipase, L-aminoacylase or protease). Reference is again made to the above discussion of novelty for further details.

9.4.8 As regards document D9, this document (see page iii) is a study concerning the refrigerated storage of fruit, especially strawberries, with the aim of determining the best edible time of strawberries during storage, based on their fruity and fresh flavour. The board concurs with the respondent's view that D9 belongs to a technical field remote from that of D6. The skilled person confronted with the objective technical problem would thus not have consulted D9.

9.4.9 Even if it were assumed that the skilled person facing the posed objective technical problem had consulted D9, the passage on page 17 indicated by the appellant concerns the formation of esters in strawberries stated to be catalysed by an AAT. This generic passage would not have directed the skilled person to use an AAT in Scheme IV of D6 to effect the conversion of methacrylyl-CoA to methacrylate esters since D9 is entirely silent on methacrylyl-CoA and methacrylate ester production, let alone on methacrylyl-CoA being produced from isobutyryl-CoA or 3-hydroxyisobutyryl-CoA.

9.5 As stated above, the appellant also indicated document D1 as a possible secondary document to be combined with D6. Moreover, it also raised an inventive step objection starting from D1 as the closest prior art.

9.6 However, the board notes that D1 was published on 4 October 2012, i.e. after the earliest priority date (10 September 2012) claimed by the patent from application P1 and before the filing date (10 September 2013) of the patent.

9.6.1 As such, document D1 can be used as prior art in the assessment of inventive step only against claimed subject-matter not enjoying the earliest priority date from P1.

9.6.2 The appellant argued that the alternative of claim 1 as granted in which a phenol was caused to act on methacrylyl-CoA did not enjoy the claimed earliest priority date. D1 was thus prior art under Article 54(2) EPC for this subject-matter covered by claim 1 as granted and might be used for objecting to inventive step.

9.6.3 However, the board notes that, as pointed out by the respondent, the appellant explicitly stated in its grounds of appeal (page 30, point 10.96) that it "*made no inventive step objection to phenols specifically*". Indeed, the inventive step objection raised by the appellant involving D1 as secondary document and the objection starting from D1 as closest prior art (statement of grounds of appeal, pages 28 and 29, points 10.70 to 10.85) are directed against the alternative of claim 1 as granted, in which an alcohol is caused to act on methacrylyl-CoA. However, the appellant itself acknowledged that the subject-matter of claim 1 enjoyed a partial priority from P1 for this alternative in which an alcohol was caused to act on methacrylyl-CoA.

9.6.4 Therefore, D1 is prior art under Article 54(3) EPC for the subject-matter of claim 1 as granted objected to by the appellant. As such, D1 can be used only against novelty. As regards inventive step, D1 and all the appellant's objections based on it as closest prior art or as a secondary document must remain unconsidered.

9.6.5 It is observed that this conclusion had already been provisionally expressed by the board in its

communication issued under Article 15(1) RPBA in preparation for the oral proceedings. The appellant did not reply to this communication nor make any comment in respect of the board's observation at the oral proceedings.

9.7 The respondent had requested that the appellant's submissions on lack of priority and lack of inventive step in view of D1 as closest prior art not be admitted. In view of the board's above-mentioned conclusion that D1 cannot be used for objecting to inventive step, there was no need for a decision by the board on this request by the respondent.

10. For these reasons, the board concludes that the subject-matter of claim 1 as granted involves an inventive step in view of document D6 taken as closest prior art (Article 56 EPC). The ground for opposition under Article 100(a) EPC in combination with Article 56 EPC does not prejudice maintenance of the patent as granted.

Conclusions

11. None of the appellant's objections is convincing. Therefore the appeal against the opposition division's decision rejecting the opposition is not allowable and must be dismissed, so meaning that the patent is maintained as granted.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

A. Wille M. O. Müller

Decision electronically authenticated