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**Datasheet for the decision  
of 29 April 2021**

**Case Number:** T 2317/15 - 3.3.02

**Application Number:** 06024289.8

**Publication Number:** 1777289

**IPC:** C12C3/12, C12C5/02, C12C7/20,  
C07C45/78, C07C49/603

**Language of the proceedings:** EN

**Title of invention:**  
Rho-isoalpha acid hop products and methods

**Patent Proprietor:**  
S.S. STEINER, INC.

**Opponent:**  
John I. Haas, Inc.

**Headword:**

**Relevant legal provisions:**  
EPC Art. 56

**Keyword:**  
Inventive step - (no)

**Decisions cited:**

**Catchword:**



**Beschwerdekammern**

**Boards of Appeal**

**Chambres de recours**

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Case Number: T 2317/15 - 3.3.02

**D E C I S I O N**  
**of Technical Board of Appeal 3.3.02**  
**of 29 April 2021**

**Appellant:** John I. Haas, Inc.  
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**Decision under appeal:** **Decision of the Opposition Division of the  
European Patent Office posted on 20 October 2015  
rejecting the opposition filed against European  
patent No. 1 777 289 pursuant to  
Article 101(2) EPC**

**Composition of the Board:**

**Chairman** M. O. Müller  
**Members:** P. O'Sullivan  
M. Blasi

## Summary of Facts and Submissions

- I. The appeal of the opponent (appellant) lies from the decision of the opposition division to reject the opposition against European patent 1 777 289.
- II. The patent was opposed under Article 100(a) EPC on the grounds that its subject-matter lacked novelty and inventive step.
- III. Among the documents cited in opposition proceedings, the following were invoked by the parties during appeal proceedings:
  - D6: US 3,798,332
  - D7: US 3,044,879
- IV. With the statement of grounds of appeal the appellant submitted the following document:
  - D9: Journal of Institute of Brewing, 1967, vol. 73, page 255-257
- V. With letter dated 13 May 2020 a summons to oral proceedings on 16 March 2021 was issued in view of the corresponding requests of the parties.
- VI. With the communication of the board pursuant to Article 15(1) RPBA, the board informed the parties how it had understood their requests as submitted in writing and provided *inter alia* the preliminary opinion that D6 disclosed an alkali metal salt of rho-iso- $\alpha$ -acids as recited in claim 1 at issue. The board further commented on inventive step starting from D6 as the closest prior art.

VII. With the letter dated 15 February 2021 the respondent stated that it would not attend oral proceedings scheduled for 16 March 2021, and withdrew its request for oral proceedings. It also requested that the board decide according to the facts of the file.

VIII. Requests as understood by the board

The appellant requests that the contested decision be set aside and the patent be revoked in its entirety.

The respondent requests that the appeal be dismissed, i.e. that the opposition be rejected and the contested patent be maintained as granted. It furthermore requests not to admit D9 into the appeal proceedings and to exclude the subject-matter of claim 4 and its dependent claims from the scope of the present appeal proceedings.

IX. Independent claim 1 of the main request (patent as granted) reads as follows:

*"1. An aqueous concentrated composition of an alkali metal salt of rho-iso- $\alpha$ -acids having a concentration of rho-iso- $\alpha$ -acids of between 55 and 85 weight percent by HPLC."*

- X. The arguments of the appellant, insofar as relevant to the present decision, may be summarised as follows:

Inventive step

D6 was the closest prior art.

If it were to be assumed that the subject-matter of claim 1 was distinguished from the disclosure in D6 by the concentration of rho-iso- $\alpha$ -acids recited therein, then the following applied with regard to inventive step:

The objective technical problem to be solved could not be based on an alleged effect of improved stability, since this problem was already solved by D6 (column 4, lines 4-7 and column 13, lines 46-50). Rather, the technical effect of the higher concentration recited in claim 1 was a reduced packaging size and reduced transportation weight.

The problem was thus the provision of an aqueous composition of an alkali metal salt of rho-iso- $\alpha$ -acids with better transportation and storage characteristics.

To solve this problem, the skilled person would have continued the evaporation disclosed in the example of D6 until the desired concentration was obtained. There was no bar to the skilled person from doing so in D6; to the contrary, the skilled person was taught to concentrate further if desired by the statement in D6 that *"if it is concentrated, for example, under reduced pressure, to at least 30%, and preferably to 35-38% solids or higher, it then becomes stable"*, and the indication in table 6 that the percentage concentrate

of the potassium salt may be within a "typical broad range" of 30-80%.

XI. The arguments of the respondent, insofar as relevant to the present decision, may be summarised as follows:

Inventive step

D6 was the closest prior art.

The subject-matter of claim 1 was distinguished from the disclosure in D6 by the presence of

- (i) an alkali metal salt of rho-iso- $\alpha$ -acids
- (ii) in a concentration of between 55 and 85 weight percent by HPLC.

Concerning (i), there was no indication in D6 that "reduced" isohumulones (cf. D6, claim 1) referred to "rho" iso- $\alpha$ -acids as defined in structure VI of the patent (page 4), because the isohumulones, i.e. iso- $\alpha$ -acids (structure III of the patent, page 2), contained several other targets within the molecule that were likely to be reduced when exposed to a reducing agent in addition to the site (the carbonyl group) reduced in order to obtain the claimed rho-iso- $\alpha$ -acids. No evidence had been provided that the teaching of D6 or D7 was unambiguously directed to the preparation of rho-iso- $\alpha$ -acids. The patent (paragraph [0007]) did not refer to D7 to enable the skilled person to obtain rho-iso- $\alpha$ -acids but rather as background information. This statement did not imply that the synthesis route of D7 led to rho-iso- $\alpha$ -acids, least of all to those compounds exclusively in the absence of other reduced derivatives such as e.g. tetrahydroiso- $\alpha$ -acids ("THIAAs") or hexahydroiso- $\alpha$ -acids

("HHIAAs") depicted in the patent (paragraph [0005] and structures IV and V). Rather, the preparation of the claimed composition according to example 1 of the patent started with the free acid rho-iso- $\alpha$ -acids resin with a rho-iso- $\alpha$ -acids content of 83.4% HPLC (paragraph [0029]), a product which was readily available to the person skilled in the art, and was not obtainable by the process of D7, which led to products having concentrations of 0.1 to 10% (e.g. D7, column 7, lines 20-21).

Even if it were to be concluded that D6 disclosed rho-iso- $\alpha$ -acids according to feature (i) above, and feature (ii) were considered to be the distinguishing feature of the subject-matter of claim 1, then the following applied with regard to inventive step:

The effect of the higher concentration was that the solution did not form precipitates and could be used in combination with hop beta acids and hop aromatic oils (cf. example 2 of the patent).

The objective technical problem was the provision of an improved isohumulone solution that was advantageous to the overall beer brewing process and had good storage properties.

The solution was not obvious in view of D6.

XII. As set out above, the respondent withdrew the request for oral proceedings and requested that the board decide according to the facts of the file. In view of the present decision in favour of the appellant, there was no need for the board to hold oral proceedings, even though a corresponding request had been submitted by the appellant.



## Reasons for the Decision

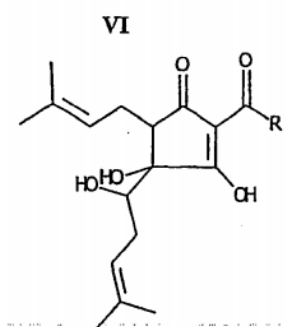
Main request (patent as granted)

Inventive step - Article 100(a) and Article 56 EPC

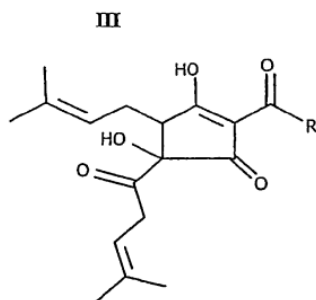
### 1. Background

As set out above, independent claim 1 is directed to an aqueous concentrated composition of an alkali metal salt of rho-iso- $\alpha$ -acids having a concentration of rho-iso- $\alpha$ -acids of between 55 and 85 weight percent by HPLC.

According to the patent, rho-iso- $\alpha$ -acids have the following structure VI:

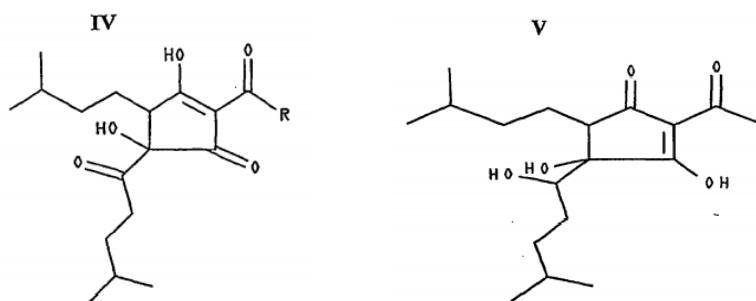


and are prepared by chemical reduction of the iso- $\alpha$ -acids of structure III using sodium borohydride (patent, paragraphs [0003] and [0007]):



In this reduction, the side chain carbonyl group is selectively reduced to a hydroxyl group in the presence of further side chain C=C double bonds (cf. structures above).

The patent also refers to prior art which discloses the reduction of *inter alia* iso- $\alpha$ -acids to tetrahydroiso- $\alpha$ -acids ("THIAAs") or hexahydroiso- $\alpha$ -acids ("HHIAAs") (paragraph [0005]) having structures IV and V respectively:



In these compounds, the C=C double bonds in the side chains of the iso- $\alpha$ -acids of formula III are fully reduced.

2. Closest prior art

Both parties agree that D6 represents the closest prior art, and the board sees no reason to differ.

3. Distinguishing features

3.1 Patent document D6 discloses a process during which a purified isohumulone fraction is recovered (column 1, lines 34-37). Claim 1 of D6 is directed to a method for treating a preisomerised hop extract containing reduced or unreduced isohumulone dissolved in a water-immiscible hop solvent which comprises *inter alia* a

step (B) of concentrating the resultant aqueous potassium isohumulate to at least 30% [reduced or unreduced] potassium isohumulate. The preparation of reduced potassium isohumulate according to D6 (example 1, part C, lines 40-41) includes the steps of isomerising and reducing humulones with sodium borohydride to yield a product from which "reduced isohumulones" were extracted (example 1, part A and B). The term "reduced" in "reduced humulone" is defined as referring to "*their reduced forms* (cf. U.S. Pat. 3,044,879)" (column 15, lines 65-66). US patent 3,044,879 is D7 in the present proceedings.

3.2 In its submissions, the respondent accepted that the term "isohumulones" was synonymous with "iso- $\alpha$ -acids" as depicted in structure III of the patent (paragraph [0003]) (e.g. reply to the statement of grounds of appeal, paragraph bridging pages 4 and 5), and thus that D6 disclosed "reduced" potassium iso- $\alpha$ -acids, i.e. an alkali metal salt of "reduced" iso- $\alpha$ -acids.

3.3 It is a matter of dispute between the parties whether D6 discloses

- (i) an alkali metal salt of rho-iso- $\alpha$ -acids
- (ii) in a concentration of between 55 and 85 weight percent by HPLC.

3.4 Concerning feature (i) - "Alkali metal salt of rho-iso- $\alpha$ -acids":

3.4.1 The sole matter of dispute with regard to feature (i) is whether the term "reduced" in D6 is synonymous with the term "rho". The respondent submitted that the former term, in the context of D6, was generic in

nature. Since the iso- $\alpha$ -acids of structure III (above) comprised several other moieties susceptible to reduction when exposed to a reducing agent, "reduced" referred not only to rho-iso- $\alpha$ -acids but also to THHIAs or HHIAAs of structures IV and V above, or mixtures thereof.

Consequently, to determine whether D6 discloses feature (i) above, the meaning of the term "reduced" employed therein in relation to the product of the reduction reaction must be established.

3.4.2 Both the contested patent (paragraph [0007]) and D6 (column 15, lines 58-67) refer to D7 for the preparation of "rho-iso- $\alpha$ -acids" and "reduced isohumulone", respectively. This preparation is disclosed in example 1 of D7.

3.4.3 Paragraph [0007] of the contested patent reads as follows:

*"The prior art also teaches that a light-stable beer can be produced from so-called rho-iso- $\alpha$ -acids (STRUCTURE VI), dihydrogenated derivatives that have been prepared by chemical reduction of iso- $\alpha$ -acids using sodium borohydride. U.S. Patent No. 3,044,879 describes an early, commercially workable process to achieve this transformation."*

Since the examples of the contested patent do not describe the preparation of rho-iso- $\alpha$ -acids, this paragraph is the sole information in the patent directing the skilled person to a method according to which said acids may be prepared.

- 3.4.4 Turning to D7, this patent document discloses the isomerisation of purified humulone and reduction of the resultant isohumulone (i.e. iso- $\alpha$ -acids, example 1). According to D7, the chemical reduction of the isohumulones is performed using potassium borohydride as reducing agent (D7, column 3, line 73 - column 4, line 4), providing as the product "reduced isohumulones" (column 4, line 10). Thus it must be determined whether the term "reduced" in D7 refers exclusively to dihydrogenated derivatives ("rho"), i.e. compounds wherein the carbonyl group in the side chain is reduced, but the side chain C=C double bonds remain intact (c.f. structure VI in the patent).
- 3.4.5 D7 discloses that soft resins contained in hops consist principally of *inter alia* "the alpha acids", and that said alpha acids are known as humulones (D7, column 2, lines 10-16). Consequently, according to D7, the term "isohumulones" prepared in example 1 thereof is synonymous with the term "iso-alpha acids". This was also acknowledged by the respondent, as set out above.
- 3.4.6 D7 does not explicitly state that the "reduced isohumulones" obtained according to example 1 thereof were exclusively the rho- or dihydro-iso- $\alpha$ -acids of structure VI, and did not include further reduced derivatives such as the tetra- and hexa-hydro THIAA and HHIAA derivatives mentioned in the patent (paragraph [0005], structures IV and V), or mixtures thereof with rho-iso- $\alpha$ -acids.
- 3.4.7 However, D7 is directed to the production of an anactinic malt product, i.e. a malt product stable to light (D7, column 1, lines 11-22). It was recognised in D7 that instability to light was caused by the isohumulones, and that those compounds comprised a side

chain containing a carbonyl group (column 2, lines 34-41). In the belief that it was this carbonyl group causing the light sensitivity, the authors of D7 decided to alter the reactive carbonyl group by means of reduction to a secondary alcohol by the addition of a borohydride (D7, column 2, lines 42-54). In the same section of D7, the text continues to describe how "*[i]n practicing our invention ... pure humulones are isomerized to their respective iso derivatives and subsequently reduced through the addition of sodium borohydride or potassium borohydride (Example 1)*" (D7, column 3, lines 55-59). Here, it is implicit that the reduction referred to is the reduction of the carbonyl group mentioned in the previous sentence. In the view of the board, in the absence of any indication to the contrary, it is not reasonable to assume that other different functional groups such as the side chain C=C double bonds are reduced simultaneously with the carbonyl group. Hence, the only conclusion that can reasonably be drawn is that D7 and by way of referring to it, D6, disclose rho-iso- $\alpha$ -acids as required by claim 1 at issue.

- 3.4.8 It is also significant to note that example 1 of the patent addresses the use of "*free-acid form, reduced (rho-) iso- $\alpha$ -acids resin*". In characterising "reduced" as "rho-" therefore, the patent itself appears to acknowledge the synonymity of the terms "reduced" and "rho" in the context of iso- $\alpha$ -acids.
- 3.4.9 It is also of note that in the contested patent (paragraph [0006], the preparation of the above-mentioned THIAA and HHIAA derivatives is described citing a different prior art to D7, namely US 5,013,571, serving as a further indication that said

compounds were not prepared, or could not be prepared, via the process disclosed in D7.

- 3.4.10 Furthermore, the patent itself in paragraph [0007], cited above, equates rho-iso- $\alpha$ -acids with the products of the process according to D7. It appears contradictory on the part of the respondent on the one hand to expressly state in the text of the patent that rho-iso- $\alpha$ -acids may be prepared according to the borohydride reduction method of D7, while at the same time arguing that the process of D7 will not necessarily yield said same rho-iso- $\alpha$ -acids. This holds in particular since, as noted above, example 1 of the patent itself equates "reduced" with "rho-" iso- $\alpha$ -acids.
- 3.4.11 Finally, the respondent also argued in this context that the reference in the patent to D7 was merely background information and did not imply that the synthesis route of D7 led to rho-iso- $\alpha$ -acids, least of all to the the compound of structure VI in isolation of other reduced iso- $\alpha$ -acids such as THIAAs and HHIAAs of structures IV and V addressed above. Thus, further purification steps may have been necessary to obtain pure rho-iso- $\alpha$ -acids. The starting material in example 1 of the patent was a "free-acid form, reduced (*rho*-) iso- $\alpha$ -acids resin" in a concentration of 83.4% HPLC (cf. patent, example 1). Since such a concentrated product could not be obtained by the process of D7, it was speculative to relate the examples of the patent to references to D7 which did not allow the preparation of the starting material.
- 3.4.12 In the view of the board, the fact that the examples of the patent may employ rho-iso- $\alpha$ -acids prepared in a manner different to that of D7 is irrelevant in the

present context. The relevant question for the purpose of novelty is whether D6 discloses feature (i), above. As noted above, this can be answered by determining whether the term "reduced" in D6 refers to "rho-", which in turn requires an examination of the disclosure of D7 cited in D6 in this context, as set out above.

- 3.4.13 In view of the foregoing the board considers that D6 discloses the rho-iso- $\alpha$ -acids recited in claim 1 at issue.
- 3.4.14 It follows therefore that D6 discloses feature (i), an alkali metal salt of rho-iso- $\alpha$ -acids as recited in claim 1 at issue.
- 3.4.15 Since this conclusion was reached without taking D9 into account, there is no need for the board to address the admittance thereof into the proceedings, contested by the respondent.
- 3.5 Concerning feature (ii) - "in a concentration of between 55 and 85 weight percent by HPLC"
  - 3.5.1 According to the single synthesis example in D6, the concentrated potassium salt of reduced isohumulone (which as set out above, is synonymous with rho-iso- $\alpha$ -acids) was isolated at a concentration of 37.4% (wt./wt.) in a purity of 93.7% (column 4, lines 41-42).
  - 3.5.2 Thus D6 fails to disclose in a specific embodiment a concentration of the desired alkali salt falling within the range recited in claim 1 (between 55 and 85 weight percent by HPLC). According to the general disclosure of D6, the potassium salt of the reduced isohumulone may be isolated via the process disclosed therein in a



"typical broad range (approx.)" of 30-80%, a "preferred" range of 35-45% and an optimal range of 35-38% (table 6, final row, first three entries).

3.5.3 Concentrations of the desired salt falling within the range of 55-85% by HPLC as recited in claim 1 thus overlap with the broadest concentration range disclosed in the description of D6 (30-80%). The question then arises whether this disclosure amounts to an unambiguous disclosure of concentration values within the range recited in contested claim 1.

3.5.4 The respondent argued that D6 did not disclose the desired metal salt in the claimed concentration.

3.5.5 To the benefit of the respondent, in the following it is assumed that the subject-matter of claim 1 at issue is indeed novel and differs from D6 only in feature (ii), i.e. that D6 fails to unambiguously disclose a concentration of alkali salt of rho-iso- $\alpha$ -acids of between 55 and 85% wt by HPLC, but rather discloses a lower concentration. In consequence, this feature is considered to be the distinguishing feature in the following.

3.6 Problem solved

3.6.1 According to the respondent, the technical effect of a concentration of alkali salt of rho-iso- $\alpha$ -acids of between 55 and 85% wt by HPLC is that the solution does not form precipitates and can be used in combination with hop beta acids and hop aromatic oils (e.g. in the preparation of "BARho" according to paragraph [0026] and example 2 of the patent). The objective technical problem was thus the provision of an improved isohumulone solution that is advantageous to the

overall beer brewing process and has good storage properties (letter of 26 March 2020, page 6, penultimate paragraph and paragraph bridging pages 6 and 7).

- 3.6.2 As noted by the appellant however, the technical effect of avoiding undesired precipitation has already been solved in D6 by increasing the concentration of the alkali metal salt solution. Specifically, the experimental section of D6, part B, discloses the preparation of extracts averaging 5 wt.% reduced potassium isohumulate (column 3, final sentence). In part C - "Concentrating the aqueous KOH extract" (D6, column 4, lines 2-7) it is stated that:

*"The stability of an aqueous extract prepared as aforesaid is poor. On standing, the isohumulone precipitates as an oil. Curiously enough, if it is concentrated, for example, under reduced pressure to at least 30%, and preferably to 35-38% solids or higher, it then becomes stable".*

- 3.6.3 The concentration process is then described in D6 and involves a re-conversion to the free acid isohumulone form (to avoid foaming) followed by concentration under reduced pressure and re-formation of the concentrated potassium salt by treatment with KOH to form reduced potassium isohumulate in a concentration of 37.4 wt.% (D6, column 4, lines 7-43). This concentrate according to D6 is said to be "*stable during storage for many weeks*" (column 4, lines 43-44).

Subsequently (D6, column 13, lines 46-50) it is also stated that:

*"The excellent transportation and storage characteristics of the potassium isohumulate concentrate permit its use months after its preparation and in brewing operations thousands of miles from its place of manufacture".*

- 3.6.4 Hence, the effect of providing stability to precipitation is already obtained in D6 and is thus not associated with the differentiating feature. This effect therefore cannot be invoked in the formulation of the objective technical problem.
- 3.6.5 Furthermore, the effect identified by the respondent that the concentrate of claim 1 may be *"used in combination with hop beta acids and hop aromatic oils"* (letter of 26 March 2020, page 6, final full paragraph) applies equally to the concentrates disclosed in D6.
- 3.6.6 In the view of the board, the only effect linked to the concentration range recited in contested claim 1 is that identified in the patent, paragraph [0024], namely that providing a more concentrated composition would lead to savings in packaging, storage and transportation costs.
- 3.6.7 The objective technical problem underlying the subject-matter of claim 1 may thus be formulated as the provision of an aqueous concentrated composition of an alkali metal salt of rho-iso- $\alpha$ -acids providing cost benefits.

3.7 Obviousness

3.7.1 The respondent argued that the skilled person would have lacked any incentive in D6 to increase the concentration of the solution disclosed therein to within the higher concentration range recited in contested claim 1. According to the respondent, the skilled person would have learned from D6 that concentration to between 35 and 38 wt.% would be optimal (citing D6, column 4, lines 5-6 and table 6, "Optimal" column) and that *"higher concentrations would not be as stable as the ones presented as being optimal"* (respondent's letter of 26 March 2020, page 7, penultimate paragraph).

3.7.2 The board disagrees with this assessment. As noted by the appellant (e.g. statement of grounds of appeal, paragraph 2.2), although D6 indeed discloses an optimal range for the concentration of the alkali metal salt of 35-38 wt.%, the teaching thereof is not limited exclusively to this range. In particular, it is stated in D6 that the preferred range is 35-38% or higher (column 4, lines 5-6), thus explicitly indicating that the advantages associated with the preferred range are also to be expected at higher concentrations. Furthermore, table 6 discloses that the "preferred" concentration range for the "K salt" (i.e. "reduced" potassium isohumulate) lies in the range of 35-45%, while the "typical broad range" is from 30-80% (table 6, first and second column, final row). Furthermore, in contrast to the respondent's statement, there is no indication in D6 that higher salt concentrations would be less stable than the concentrations disclosed as "optimal". There is therefore nothing in D6 which would have dissuaded the skilled person from increasing the

concentration of said salt to within the range recited in claim 1 at issue.

3.7.3 In view of the teaching of D6 therefore, and in line with the arguments of the appellant as set out above, wishing to solve the above-mentioned problem of providing cost benefits, the skilled person would have identified the link between an increased concentration - and thus reduced volume - of the desired alkali metal salt of rho-iso- $\alpha$ -acids disclosed in D6, and resultant cost savings in packaging, storage and transportation costs. In order to solve the problem, the skilled person would therefore have pursued the concentration step in D6 to within the concentration range recited in contested claim 1. This would have been achieved as taught by D6, specifically by concentration of isohumulone by evaporation until the desired concentration was achieved (column 4, lines 27-36). There is no indication in D6 that continued evaporation to higher concentrations within the "typical broad range" disclosed in table 6 would have posed any difficulty. After achieving the desired concentration, re-formation of the desired potassium salt would have been achieved as taught therein (D6, column 4, lines 35-41). In doing so the skilled person would have arrived at the subject-matter of contested claim 1.

3.7.4 This conclusion holds even accepting the respondent's argument according to which the weight percentage concentrations provided in D6 (e.g. 37.4% in example 1) were measured using spectrophotometric analysis, which would correspond to a lower concentration measured by HPLC, required by claim 1 at issue (e.g. reply to the statement of grounds of appeal, page 8, first full paragraph). Specifically, according to the patent, alkali salts of rho-iso- $\alpha$ -acids in a concentration of 55

weight percent by HPLC, corresponding to the lower limit of the range recited in contested claim 1, correspond to "*at least about 64% by Spectro*" (patent, page 6, line 7). As set out above, there is nothing in D6 which would have dissuaded the skilled person from preparing compositions comprising concentrations at or above this concentration level.

The subject-matter of contested claim 1 of the sole main request (patent as granted) consequently lacks an inventive step within the meaning of Article 56 EPC. Therefore, the ground for opposition pursuant to Article 100(a) and Article 56 EPC prejudices the maintenance of the patent as granted and the patent has to be revoked for this reason.

- 3.8 In view of this conclusion, there was no need for the board to address the request of the respondent to exclude the subject-matter of claim 4 from the scope of the present appeal proceedings.

## 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:



N. Maslin

M. O. Müller

Decision electronically authenticated