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**Datasheet for the decision
of 12 November 2024**

Case Number: T 2219/22 - 3.3.02

Application Number: 17772252.7

Publication Number: 3319949

IPC: C07D291/06

Language of the proceedings: EN

Title of invention:

ACESULFAME POTASSIUM COMPOSITIONS AND PROCESSES FOR PRODUCING
SAME

Patent Proprietor:

Celanese International Corporation

Opponents:

Hammer, Jens
Anhui Jinhe Industrial Co., Ltd.

Relevant legal provisions:

EPC Art. 56

Keyword:

Inventive step

Decisions cited:

G 0002/21



Beschwerdekammern
Boards of Appeal
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Case Number: T 2219/22 - 3.3.02

D E C I S I O N
of Technical Board of Appeal 3.3.02
of 12 November 2024

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Decision under appeal: **Decision of the Opposition Division of the
European Patent Office posted on 18 July 2022
rejecting the opposition filed against European
patent No. 3319949 pursuant to Article 101(2)
EPC.**

Composition of the Board:

Chairman M. O. Müller
Members: A. Lenzen
 B. Burm-Herregodts

Summary of Facts and Submissions

I. This decision concerns the appeals filed by opponents 1 and 2 (appellants 1 and 2) against the opposition division's decision (decision under appeal) to reject the oppositions against European patent No. 3 319 949 (patent).

II. Reference is made in the present decision to the following documents filed with the opposition division:

D4 US 4,804,755

D5 EP 0 218 076 A1

D6 "Schulungsunterlagen Destillation mit Rotationsverdampfer", Büchi Labortechnik AG, 1998

D8a English translation of CN 101 124 981 A (= D8)

III. With the statement of grounds of appeal, appellant 2 filed the following document:

D12 "Experimental report (Re EP 3 319 949 B1)"
(four pages)

IV. With the reply to the statements of grounds of appeal, the patent proprietor (respondent) filed, *inter alia*, the following documents:

D13 "Demystifying the Chromatographic Process",
Agilent Technologies, Inc., 19 February 2014

D14 "Pore Size vs. Particle Size
in HPLC Columns", Chrom Tech website, 2023

V. In preparation for the oral proceedings, arranged at the parties' request, the board issued a communication under Article 15(1) RPBA.

VI. With the letter dated 9 October 2024, the respondent filed the sets of claims of a main request and auxiliary requests 1 and 2, replacing all previously filed claim requests.

VII. Oral proceedings before the board were held on 12 November 2024 by videoconference in the presence of all parties.

VIII. The parties' requests relevant to the present decision at the end of the oral proceedings were as follows.

The appellants requested that the decision under appeal be set aside and the patent be revoked in its entirety.

Appellant 2 also requested:

- that the main request and auxiliary requests 1 and 2 not be admitted
- that D12 be admitted
- that D13 and D14 not be admitted

The respondent requested that the patent be maintained in amended form based on one of the sets of claims of the main request or auxiliary request 1 or 2, filed with the letter dated 9 October 2024.

The respondent also requested:

- that D12 not be admitted
- that D13 and D14 be admitted

IX. Summaries of the parties' submissions, where relevant to the present decision, are set out in the reasons for the decision below.

Reasons for the Decision

Auxiliary request 1 - Inventive step (Article 56 EPC)

1. Acesulfame potassium (ASK) has an intense, sweet taste and has been used in many food-related applications as a sweetener.

The patent seeks to solve the problem whereby ASK obtained by conventional production methods still contains undesirable impurities such as in particular acetoacetamide (AAA). The process of claim 1 of auxiliary request 1 is offered as a solution to this problem. It reads as follows:

"A process for producing a finished acesulfame potassium composition, the process comprising the steps of:

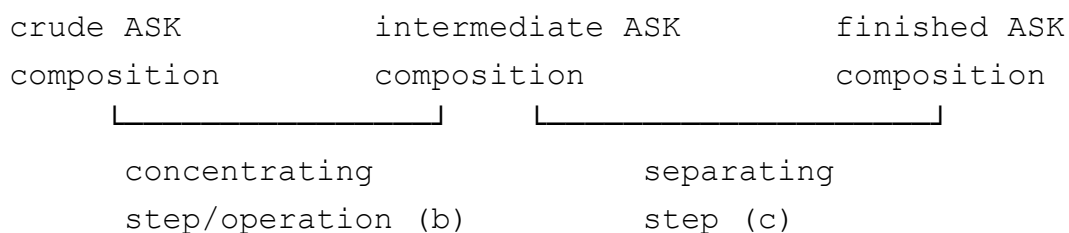
- (a) providing a crude acesulfame potassium composition comprising acesulfame potassium, acetoacetamide and water;*
- (b) concentrating the crude acesulfame potassium composition to form a water stream and an intermediate acesulfame potassium composition comprising acesulfame potassium and less than 33 wppm acetoacetamide; and*
- (c) separating the intermediate acesulfame potassium composition to form the finished acesulfame potassium composition comprising acesulfame potassium and less than 33 wppm acetoacetamide;*

wherein the concentrating step (b) is conducted at a temperature below 46°C, and wherein the

separating step (c) is conducted at a temperature at or below 6°C and wherein the concentrating operation is conducted at or maintained at a residence time of less than 30 minutes."

Claim 1 refers to both a "concentrating step (b)" and a "concentrating operation". As the respondent never identified any meaningful difference between them, they will be referred to collectively below as 'concentrating step/operation (b)'.

Thus, claim 1 does not relate to the chemical synthesis of ASK as such but to the work-up of an immediate synthesis product, i.e. the crude ASK composition:



The work-up involves the concentrating step/operation (b), giving an intermediate ASK composition, and the separating step (c), resulting in the finished ASK composition. Essentially, the crude ASK composition is concentrated at a temperature below 46°C and for a period of time ("residence time") of less than 30 minutes. The intermediate ASK composition is separated at a temperature at or below 6°C.

In the example section of the patent, a crude ASK composition is concentrated on a rotary evaporator at a certain temperature and for a certain period of time. This corresponds to the concentrating step/operation (b) of claim 1 and its temperature and residence time. The resulting intermediate ASK

composition is placed in a refrigerator at 5°C to initiate crystallisation of ASK. This corresponds to the separating step (c) of claim 1 and its temperature.

2. Closest prior art

Example 3 of D5 also relates to the work-up of a composition comprising ASK. It was common ground between the parties that this example was suitable as the closest prior art in the case in hand.

3. Distinguishing features

3.1 In example 3 of D5, a solution of acesulfame-H in dichloromethane is neutralised with an aqueous solution of potassium hydroxide. The aqueous phase contains ASK and is separated from the organic phase. From this aqueous solution of ASK, 490 g of water are distilled off under vacuum at 60 mbar. The residual solution is stored at 0°C to give solid ASK.

3.2 With regard to this example, the parties agreed:

- that the aqueous solution of ASK corresponded to the crude ASK composition of claim 1, comprising ASK, AAA and water
- that the distillation of water from the aqueous solution of ASK corresponded to the concentrating step/operation (b), and the residual solution corresponded to the intermediate ASK composition of claim 1
- that the storage of the residual solution corresponded to the separating step (c) and was conducted at a temperature (0°C) as required for this step in claim 1 ("at or below 6°C")

- that the solid ASK corresponded to the finished ASK composition of claim 1

3.3 The appellants argued, and the respondent accepted, that water has a boiling point of 38°C at the distillation pressure used in example 3 of D5 (60 mbar). However, the parties disagreed on the consequence of this. According to the appellants, the distillation also had to be carried out at a temperature of 38°C. The respondent, on the other hand, took the view that the distillation could also be carried out at a temperature lower than 38°C. Irrespective of the parties' different views on the temperature at which the distillation in example 3 of D5 is actually conducted, it can nevertheless be concluded that the distillation must be carried out at a temperature of $\leq 38^\circ\text{C}$ and must therefore be in accordance with the temperature given in claim 1 for the concentrating step/operation (b) ("below 46°C").

3.4 On the basis of the two preceding points, the subject-matter of claim 1 of auxiliary request 1 differs from example 3 of D5 on account of the following.

- (i) The concentrating step/operation (b) is conducted at or maintained at a residence time of less than 30 minutes.
- (ii) The intermediate ASK composition comprises less than 33 wppm AAA.
- (iii) The finished ASK composition comprises less than 33 wppm AAA.

4. Technical effect, objective technical problem

4.1 Contrary to the respondent's argument, the onus to show that a distinguishing feature is associated with a

technical effect lies, at least initially, with the patent proprietor (G 2/21, point 26 of the Reasons).

- 4.2 As regards technical effects associated with distinguishing feature (i) (residence time of less than 30 minutes) and the objective technical problem, the respondent relied on example 1 and comparative example A of the patent (paragraphs [0115] to [0126]).

In example 1, a crude ASK composition is concentrated on a rotary evaporator at 45°C for approximately 20 minutes, i.e. within the range defined by claim 1. In comparative example A, a second portion of the same crude ASK composition is concentrated at 90°C for approximately 180 minutes, i.e. outside the range defined in claim 1. In both cases, the amount of water removed by evaporation is the same and the residue is cooled to 5°C in a refrigerator. The solid ASK obtained in each case is analysed for its AAA content. The results are as follows:

Example 1	(45°C, 20 min):	5 wppm AAA
Comparative example A	(90°C, 180 min):	37 wppm AAA

- 4.3 The respondent argued that the short residence time with which the concentrating step/operation (b) was conducted as required by claim 1 (see (i) under point 3.4 above) reduced or eliminated the further formation of AAA compared with the amount of AAA contained in the crude ASK composition. The low levels of AAA (see (ii) and (iii) under point 3.4 above) were the direct result of this short residence time.

Therefore, according to the respondent, the objective technical problem was to provide an improved process for producing high-purity ASK compositions in which the

formation of AAA in the concentrating step/operation (b) was reduced or eliminated. Below, it is assumed in the respondent's favour that this is correct.

4.4 Appellant 2 did not agree. It filed, *inter alia*, D12 to show that the technical effect relied on by the respondent was in fact not achieved. The respondent in turn filed D13 and D14 to cast doubt on the results in D12. Each party requested the non-admittance of the other party's document(s). Ultimately, it was not necessary to decide on the admittance of D12 to D14, as the respondent's arguments were not convincing, even when its objective technical problem was accepted in its favour.

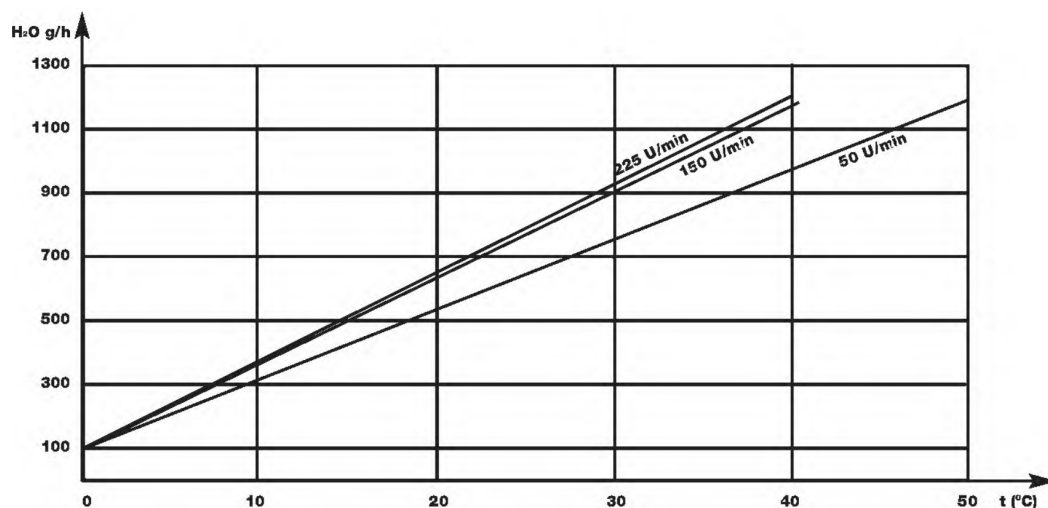
5. Obviousness

It is common general knowledge that the longer a substance is exposed to an elevated temperature, the more it decomposes. For this reason, the skilled person - at least if they are interested in obtaining a distillation residue that is as undecomposed as possible - would be interested in separating a solvent as quickly as possible by distillation at an elevated temperature. The board agrees with the appellants' submissions in this respect.

Applying this common general knowledge to the process of D5, the skilled person would have conducted the distillation as quickly as possible in order to avoid the decomposition of ASK and the formation of further impurities such as AAA. In this way, the skilled person would have arrived at distillation times falling within the range indicated in claim 1 of auxiliary request 1 for the residence time of the concentrating step/operation (b). Following the respondent's logic, the

skilled person would have obtained an ASK composition with significantly reduced levels of AAA that satisfied the levels provided in claim 1 for the intermediate and finished ASK compositions ("less than 33 wppm").

5.1 The respondent pointed to D6 (figure on page 15), a training document for rotary evaporators. For the three rotation speeds 50, 150 and 225 rpm ("U/min" in the figure below), it shows the rate in g/h (y-axis) at which water is evaporated as a function of the temperature in °C (x-axis):



5.2 The respondent essentially argued as follows.

In example 3 of D5, 490 g of water were distilled off. To conduct this distillation within the time period required for this step in claim 1 ("at a residence time of less than 30 minutes"), water had to be removed at a rate of > 980 g/h. However, if the appellants' submissions - suggesting the use of a rotary evaporator for the distillation in example 3 of D5 - were correct, such a rate could not be achieved at the distillation pressure used in this example (60 mbar). Only lower evaporation rates were possible, resulting in longer evaporation times and higher levels of AAA.

More specifically, at a pressure of 60 mbar water had a boiling point of 38°C. As was evident from the figure above, at this temperature an evaporation rate of 980 g/h could not be achieved with an evaporator flask rotating at a speed of 50 rpm. At 38°C and 50 rpm, the evaporation rate was lower than 980 g/h. Furthermore, D8a (paragraph [0025]) showed that evaporation could also be conducted below the boiling point. Therefore, the evaporation in example 3 of D5 could conceivably also be conducted at a temperature below 38°C. For example, at 7°C the evaporation rate was only 245 g/h. This evaporation rate was also too low.

This showed that the subject-matter of claim 1 involved an inventive step.

- 5.3 The respondent's argument actually implies that the skilled person would not have thought of evaporating less water or reducing the distillation pressure when trying to solve the respondent's more ambitious objective technical problem, and that they would have instead adhered to the values disclosed in example 3 of D5 (490 g water, 60 mbar). Even if this is assumed to be correct in the respondent's favour, the respondent's argument is still not convincing for the following reasons.

When trying to reduce the evaporation time as set out above (see point 5), the skilled person would have chosen:

- rotation speeds higher than 50 rpm, such as 150 and 225 rpm and
- an evaporation temperature that is just about possible at 60 mbar, i.e. the boiling point of

water at this pressure (38°C) or a temperature just below this

The simple reason for this is that, as argued by the appellants, such rotation speeds and such an evaporation temperature are associated with higher evaporation rates when compared with lower rotation speeds and lower evaporation temperatures (see the course of the three lines in the figure above). Selecting these values for the rotation speed and evaporation temperature would have resulted in the shortest evaporation times. Contrary to the respondent's argument, it can be seen from the figure above that evaporation rates of > 980 g/h are perfectly achievable at rotation speeds of 150 and 225 rpm and an evaporation temperature of 38°C (or a temperature just below this).

6. It follows that the subject-matter of claim 1 of auxiliary request 1 does not involve an inventive step. Auxiliary request 1 is not allowable.

Main request - Inventive step (Article 56 EPC)

7. Claim 1 of the main request differs from claim 1 of auxiliary request 1 on account of the following.
 - (a) The upper limit for the temperature in the concentrating step/operation (b) is higher ("*below 83°C*" in claim 1 of the main request vs "*below 46°C*" in claim 1 of auxiliary request 1).
 - (b) The upper limit for the residence time in the concentrating step/operation (b) is higher ("*less than 120 minutes*" in claim 1 of the main request vs "*less than 30 minutes*" in claim 1 of auxiliary request 1).

(c) The upper limit for the temperature in the separating step (c) is higher ("*below 20°C*" in claim 1 of the main request vs "*below 6°C*" in claim 1 of auxiliary request 1).

8. In example 3 of D5, the distillation is conducted at a temperature of $\leq 38^{\circ}\text{C}$ and the residual solution is subsequently stored at a temperature of 0°C . As these steps correspond to the concentrating step/operation (b) and the separating step (c) of claim 1, respectively, amendments (a) and (c) do not result in any additional distinguishing features.
9. Amendment (b) only sets a higher upper limit for the residence time in the concentrating step/operation (b). However, since the respondent's entire case was based on the argument that a technical effect, if any, was the result of a low residence time in the concentrating step/operation (b), the reasoning for the subject-matter of claim 1 of auxiliary request 1 above must also apply, *a fortiori*, to that of claim 1 of the main request.
10. The subject-matter of claim 1 of the main request does not involve an inventive step and the main request is not allowable.

Auxiliary request 2 - Inventive step (Article 56 EPC)

11. Compared with claim 1 of auxiliary request 1, claim 1 of auxiliary request 2 contains the following additional feature:

"and wherein the process yields at least 10 kilograms per hour of the finished acesulfame potassium composition"

12. Distinguishing features

In the respondent's favour, it is assumed below that the additional feature set out in the previous point is an additional distinguishing feature. Thus, the subject-matter of claim 1 of auxiliary request 2 is distinguished from example 3 of D5 on account of the following.

- (i) The concentrating step/operation (b) is conducted at or maintained at a residence time of less than 30 minutes.
- (ii) The intermediate ASK composition comprises less than 33 wppm AAA.
- (iii) The finished ASK composition comprises less than 33 wppm AAA.
- (iv) The process yields at least 10 kilograms per hour of the finished ASK composition.

13. Effects and objective technical problem

13.1 According to the respondent, a yield of 10 kg per hour meant that the process was run on a large scale. The short residence time with which the concentrating step/operation (b) was conducted (see (i) under point 12 above) reduced or eliminated the further formation of AAA compared with the amount of AAA contained in the crude ASK composition. As a result, the high purity levels required in claim 1 of auxiliary request 2 (see (ii) and (iii) under point 12 above) were still achieved even though the process was carried out on a large scale.

In other words, the respondent considered that the technical effect relied on for the subject-matter of

claim 1 of auxiliary request 1 was still achieved if the process was carried out on a large scale.

In the respondent's view, the objective technical problem was to provide an improved process for producing high-purity ASK compositions on a large scale in which the formation of AAA in the concentrating step/operation (b) was reduced or eliminated.

13.2 However, no yield per time is indicated in the example section of the patent. Therefore, it cannot be determined whether one of the examples is consistent with claim 1, let alone whether the technical effect relied on by the respondent is actually achieved on a large scale. Nor has the respondent pointed to any other evidence in this regard. The board therefore agrees with the appellants' submissions that the achievement of the technical effect on a large scale has not in fact been demonstrated.

13.3 The objective technical problem, therefore, is the same as that set out above for the subject-matter of claim 1 of auxiliary request 1, namely to provide an improved process for producing high-purity ASK compositions in which the formation of AAA in concentrating step/operation (b) is reduced or eliminated.

14. Obviousness

As explained above, in an attempt to solve this objective technical problem the skilled person would have arrived at the distinguishing features (i) to (iii) in an obvious manner.

As pointed out by the appellants with reference to D8a (paragraph [0029]), which discloses a process for the

synthesis of ASK with a yield of 250 kg/h, scaling up a reaction in general, and scaling up ASK synthesis in particular, is routine for the skilled person. The skilled person would therefore also have arrived at distinguishing feature (iv) in an obvious manner.

15. The respondent submitted that a rotary evaporator was only suitable for working on a small scale, not on a large scale. Therefore, if the appellants' submission - suggesting the use of a rotary evaporator for the distillation in example 3 of D5 - were correct, the skilled person would not have arrived at the subject-matter of claim 1 in an obvious manner. Nor would they have thought of applying the teaching of D6 to example 3 of D5.

However, as argued by the appellants with reference to D4 (columns 13 and 14) and not contested by the respondent, the skilled person is aware of devices that are generally suitable for working on a large scale and, in particular, for evaporating large quantities of water quickly and gently. The skilled person would simply have used one of these devices instead of a rotary evaporator.

16. The subject-matter of claim 1 of auxiliary request 2 does not involve an inventive step and auxiliary request 2 is not allowable.

Admittance of the main request and auxiliary requests 1 and 2

17. In view of the non-allowability of the main request and auxiliary requests 1 and 2, there was no need at the oral proceedings to decide on their admittance into the 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:



U. Bultmann

M. O. Müller

Decision electronically authenticated