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Datasheet for the decision of 12 September 2022

Case Number: T 0007/18 - 3.3.07

Application Number: 10780472.6

Publication Number: 2436677

IPC: C07D251/34, C07D239/30, C07D239/34, C07D251/26

Language of the proceedings: EN

Title of invention:
TRIALLYLISOCYANURATE, TRIALLYLCYANURATE, AND PROCESS FOR PRODUCTION OF TRIALLYLISOCYANURATE

Applicant:
Shinryo Corporation

Headword:
Process for production of triallylisocyanurate / SHINRYO

Relevant legal provisions:
EPC Art. 123(2), 56, 83, 84

Keyword:
Amendments - allowable (yes)
Inventive step - (yes)
Claims - clarity (yes)
Sufficiency of disclosure - (yes)

Decisions cited:
T 0087/08

Europäisches Patentamt
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Beschwerdekammern

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Case Number: T 0007/18 - 3.3.07

D E C I S I O N
of Technical Board of Appeal 3.3.07
of 12 September 2022

Appellant: (Applicant)	Shinryo Corporation 3-9-22, Kurosaki Yahatanishi-ku Kitakyushu-City Fukuoka 806-0021 (JP)
Representative:	Hoffmann Eitle Patent- und Rechtsanwälte PartmbB Arabellastraße 30 81925 München (DE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 20 July 2017 refusing European patent application No. 10780472.6 pursuant to Article 97(2) EPC.**

Composition of the Board:

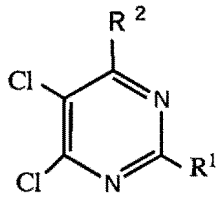
Chairwoman	J. Lécaillon
Members:	E. Duval
	Y. Podbielski

Summary of Facts and Submissions

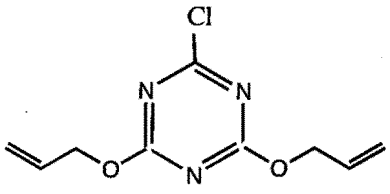
I. The appeal was filed by the applicant (appellant) against the decision of the examining division to refuse the European patent application No 10780472.6 (hereinafter "the application"). The decision was based on a main request filed during the oral proceedings before the examining division, and comprising seven claims.

Claim 1 of this main request read as follows:

"A process for producing triallyl isocyanurate, comprising the steps of:
reacting cyanuric chloride with allyl alcohol to obtain triallyl cyanurate;
subjecting the thus obtained triallyl cyanurate to stirring treatment in a strong base aqueous solution having a concentration of 0.5 to 10 % by weight at a temperature of 30 to 80°C for 0.5 to 10 hours; and
subjecting the thus treated triallyl cyanurate to rearrangement reaction,
wherein the triallyl cyanurate subjected to the stirring treatment comprises organic chlorine compounds represented by the following general formulae (I) and (II) in a total amount of not more than 800 ppm:



(I)



(II)

wherein R^1 and R^2 are respectively a chlorine atom or an allyoxy group with the proviso that at least one of R^1 and R^2 is a chlorine atom,
and wherein the triallyl isocyanurate comprises an organic chlorine compound represented by the general formula (I) as an impurity in an amount of not more than 100 ppm."

Dependent claims 2-5 further limited the amounts in organic chlorine compound.

II. The appealed decision cited in particular the following documents:

D4: WO 2008/006661 A2
D5: US 2 537 816 A

III. The examining division decided the following:

(a) The main request met the requirements of Article 123(2) EPC. Its subject-matter was novel.

(b) The objections under Articles 83 and 84 EPC raised in the annex to the summons to oral proceedings pertained to the main request. However, since the

main request contravened Article 56 EPC, no further discussion on Articles 83 and 84 EPC had taken place.

(c) Regarding inventive step, D5 disclosed the preparation of triallyl cyanurate (TAC) from cyanuric chloride and allyl alcohol, and additionally the purification of TAC by an aqueous wash of crude TAC under basic conditions at room temperature. D4 disclosed the rearrangement of TAC into triallyl isocyanurate (TAIC) of very high purity.

Starting from the combined teachings of D4 and D5, the objective technical problem was the provision of a process to synthesize TAIC with very low content of organic chloro-containing impurities of formulas (I) and (II).

Both D4 and D5 were silent about impurities (I) and (II) formed in the preparation of TAC, and the importance of having low levels of these impurities in TAIC in view of its use in electronic applications. However, these were discoveries made by the applicant. It was obvious to remove these impurities from TAC before the rearrangement step to prepare TAIC with low levels of impurities (I) and (II).

The only feature differentiating the purification of TAC in claim 1 from the teachings of D5 was the temperature of 30-80 °C. However, the applicant had not shown that the purification was effective at 30 °C. Since it had not been proven that the process of claim 1 solved the objective technical problem over the whole range of the reaction

parameters claimed, inventive step could not be acknowledged.

IV. With the statement setting out the grounds of appeal, the appellant defended its case on the basis of the same main request as underlying the appealed decision, and filed auxiliary requests 1-8. The appellant further submitted document D9:

D9: Experimental results filed with the grounds of appeal

V. The Board summoned the appellant to oral proceedings, and issued a communication under Article 15(1) RPBA 2020. In this communication, the Board invited the appellant to address issues of added subject-matter in dependent claims 2-5 of the main request.

VI. By letter dated 19 August 2022, the appellant filed an amended main request, which differed from the main request underlying the appealed decision in that:
- the term "allyoxy" was amended to "allyloxy" in claim 1, and
- dependent claims 2-3 and 4-5 additionally specified that the amounts in organic chlorine compound defined therein were, respectively, "in the triallyl isocyanurate" or "in the triallyl cyanurate".

VII. The Board cancelled the oral proceedings.

VIII. The appellant's arguments may be summarised as follows:

The examining division had not raised any objection concerning Article 123(2) EPC and had acknowledged novelty for the subject-matter of the main request.

With respect to Articles 83 and 84 EPC, the question whether a concentration of compounds (I) and (II) below the detection limit of 10 ppm could be determined did not mean that the application lacked an enabling disclosure. This was because, according to the application, the upper limits in compounds (I) and (II) were decisive. Furthermore, the term "strong base" was not a relative term but a term with a well-recognized meaning in the art.

Regarding inventive step, D4 disclosed a process for preparing TAIC by a rearrangement of TAC, but was silent on how to produce TAC and the nature and concentration of impurities in TAC.

D5 was directed to a method of preparing TAC from allyl alcohol and cyanuric chloride, including a purification step by stirring with 5% aqueous NaOH (see example 12). D5 did not indicate any stirring time, said nothing about impurities (I) and (II), and did not address the problem of metal corrosion by producing TAIC by rearrangement of TAC.

In the present invention, the skilled person had to adjust the conditions of the TAC alkaline washing treatment (temperature range, alkaline concentration and treatment time) so that the claimed reduction in the concentration of compounds (I)/(II) was achieved. As shown in the experimental results D9, the treatment conditions shown in D5 (example 12) did not suffice to reduce the concentration of compounds (I) and (II) within the claimed limits.

Therefore, the decision was incorrect in concluding that the person skilled in the art would select the TAC produced in accordance with example 12 of D5, would

arrive at the idea that this TAC contained the claimed low levels of impurities (I)/(II) and that therefore such a TAC should be employed as a starting material for the rearrangement reaction known from D4. This reasoning of the examining division was made with hindsight. Accordingly, the claimed subject-matter involved an inventive step.

IX. The appellant requested that the decision under appeal be set aside and that the case be remitted to the examining division, with the order to grant a patent on the basis of the main request filed on 19 August 2022 and a description to be adapted thereto, or, in the alternative, on the basis of one of the auxiliary requests 1-8 filed with the grounds of appeal.

Reasons for the Decision

1. Article 123(2) EPC

Claim 1 derives from claim 6 as filed, in combination with paragraph [0030] (page 12, line 7, regarding the stirring time of 0.5 to 10 hours), paragraph [0021] (regarding the total amount of compounds (I) and (II) in the TAC subjected to the stirring treatment) and paragraphs [0019] and [0020] (regarding the amount of compound (I) in the TAIC) of the description as filed. The correction of the obviously erroneous "allyoxy" into "allyloxy" complies with Rule 139 EPC and is supported by paragraph [0012] of the application as filed.

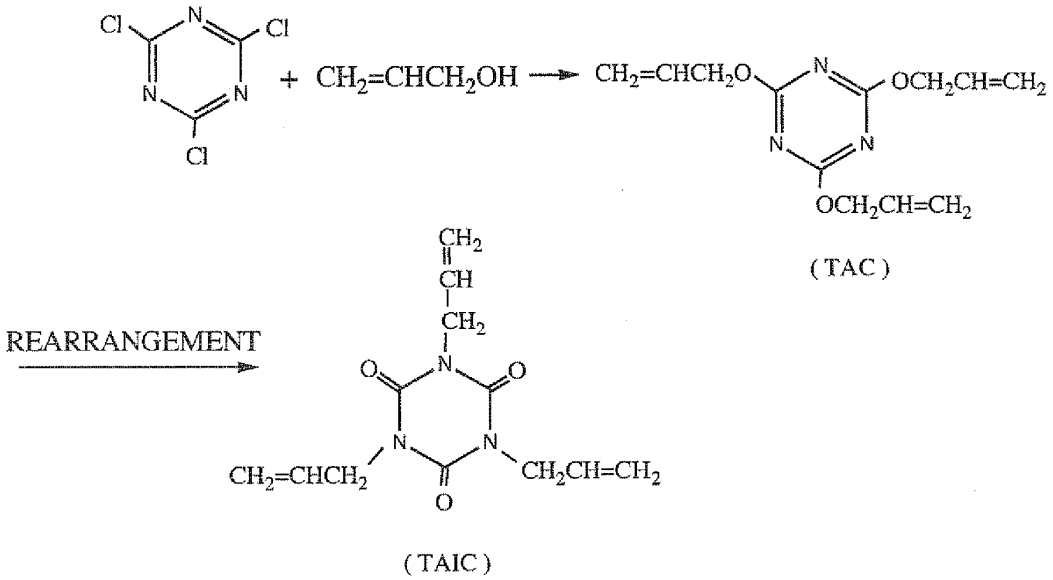
Claims 2 and 3 are based on paragraph [0035] (lines 8 and 9) of the description as filed. Claims 4 and 5

derive from paragraph [0034] of the description as filed. Lastly, claims 6 and 7 are based on the second half of paragraph [0035].

Accordingly, the criteria of Article 123(2) EPC are met.

2. Inventive step

2.1 The application relates to a process for producing triallyl isocyanurate (TAIC) comprising essentially the steps of
- reacting cyanuric chloride with allyl alcohol to obtain triallyl cyanurate (TAC), and
- subjecting TAC to rearrangement reaction to obtain TAIC (see the reaction scheme of paragraph [0003], reproduced below).



The purpose of the invention is to provide TAIC with a lower content in corrosive impurities (see paragraph [0008]), which the inventors identified to be the organic chlorine compounds (I) and (II) (see paragraphs [0011] and [0016]). To this end, the claimed process

comprises a step of subjecting the intermediate, crude TAC to a stirring treatment in a strong base aqueous solution (see also paragraphs [0029] and [0030]).

2.2 The examining division acknowledged novelty, but found the claimed subject-matter to lack an inventive step over documents D4 and D5.

D4 discloses a process for producing TAIC by subjecting TAC to a rearrangement reaction (see the abstract). D4 is however silent with regard to the source of the starting material TAC. Nothing is said in D4 either about impurities (I) and (II) and their amounts in the starting TAC or the final TAIC.

D5 describes the preparation of TAC from cyanuric chloride and allyl alcohol, followed by a step of stirring the crude TAC with a 5% NaOH aqueous solution (see example 12). D5 is silent about the temperature and duration of this step of stirring TAC with the strong base aqueous solution. Furthermore, D5 neither mentions the impurities (I) and (II) and their amounts in the obtained TAC, nor any subsequent conversion into TAIC.

2.3 The Board finds that the examining division's reasoning regarding inventive step suffers from the following deficiencies.

2.3.1 Firstly, the examining division took as a starting point the combined teaching of the patent documents D4 and D5.

However, D4 and D5 are separate items of the prior art, none of which refers to the other. There is no objective ground for reading D4 and D5 together. The

skilled person reading D4 might equally choose to prepare TAC by any process other than the process of D5, or even use commercially available TAC. The examining division's reading of D4 and D5 together is based on hindsight, i.e. on the knowledge that the claimed process combines steps known from, or analogous to, those separately shown in D4 and D5.

2.3.2 Having started from this fictitious piece of prior art resulting from the combination of D4 and D5, the examining division further considered the aspects relating to impurities (I) and (II) to be mere discoveries.

However, the levels of these impurities in TAC and TAIC cannot be regarded as mere discovered properties of a known process or material without practical use. The steps of the process of claim 1 are not known in combination. Furthermore, the practical use of these properties, i.e. the importance of lowering the level of these corrosive impurities for latter uses of TAIC, is explained in the application. The examining division's disregard of these features of claim 1 is therefore not justified.

2.3.3 Lastly, the examining division defined the objective technical problem as the provision of a process to synthesize TAIC with very low content of organic chloro-containing impurities of formulas (I) and (II). It then found that the effectiveness of the purification at 30 °C had not been proven. It concluded that, since the applicant had not been able to provide proof that the objective technical problem has been solved over the whole breadth of the scope of claim 1, inventive step could not be acknowledged.

This part of the reasoning on inventive step is deficient in that it merely states that the technical problem had not been solved, without reformulating the problem in a less ambitious way and without assessing obviousness of the claimed solution to that reformulated problem in the light of the prior art (see in this respect T 87/08, headnote). In addition, it fails to take into account that the subject-matter of claim 1 is precisely limited by features setting upper limits for the impurities (I) and (II). Accordingly, claim 1 does not cover any process which fails to achieve these levels of impurities.

2.4 Assessment of inventive step

2.4.1 The closest prior art for assessing inventive step is normally a prior art document disclosing subject-matter conceived for the same purpose or aiming at the same objective as the claimed invention and having the most relevant technical features in common. Since claim 1 pertains to a process for producing TAIC, the Board considers D4 to represent the closest prior art. D4 discloses a process for producing TAIC by subjecting TAC to a rearrangement reaction.

2.4.2 The subject-matter of claim 1 of the main request differs from the process of D4 by the steps of producing TAC by reaction of cyanuric chloride with allyl alcohol followed by the stirring treatment as defined in claim 1. The subject-matter of claim 1 additionally differs from the process of D4 in that the total amount of compounds (I) and (II) in TAC is not more than 800 ppm, and in that the amount of compound (I) in TAIC is not more than 100 ppm.

2.4.3 The application as filed shows that the stirring treatment leads to TAC with contents in impurities (I) and (II) within the claimed ranges, and that the use of this purified TAC leads to TAIC with low amounts of both (I) and (II). Thus, in comparative example 1, without stirring treatment, TAC with a total amount of compounds (I) and (II) of 910 ppm is obtained, and its rearrangement produces TAIC with 120 ppm compounds (I) and 10 ppm compound (II). In contrast, in example 1, the addition of a stirring treatment at 50 °C using 5% aqueous NaOH for 2 hours leads to less than 10 ppm of the compounds (I) and (II) both in the intermediate TAC and the final TAIC. In example 2, conducting the stirring treatment at 50 °C using 1% aqueous NaOH for 6 hours afforded TAC with 50 ppm compounds (I) and (II), and TAIC with 10 ppm or less for each impurity.

2.4.4 Starting from D4, the objective technical problem is the provision of a process to synthesize TAIC with low content of organic chloro-containing impurities of formulas (I) and (II).

2.4.5 This problem is solved by the process of claim 1 over its whole scope. As explained above (see 2.3.3), claim 1 mandates that the total amount of impurities (I) and (II) in TAC be at most 800 ppm, and there is no reason to doubt that reduced levels of these contaminants in TAC will lead to a final TAIC with also a low level in compounds (I) and (II).

2.4.6 The claimed solution is not hinted at by the prior art. Firstly, the problem of lowering the corrosive impurities in TAIC is not mentioned in the starting point D4. Furthermore, the skilled person could combine D4 and D5, but would not do so in the expectation of lowering the level of compounds (I) and (II) in TAIC,

since no information about these impurities is given in D5 either. In addition, D5 gives no indication as to the temperature and duration of the step of stirring TAC with a 5% NaOH aqueous solution, and there is no incentive in D5 to select these parameters so as to obtain the claimed low amounts in compounds (I) and (II) in TAC. Consequently, the combination of D4 and D5 would not lead to the claimed invention.

Accordingly, the criteria of inventive step are met.

3. Articles 83 and 84 EPC

3.1 According to claim 1, the stirring step may take place in a strong base aqueous solution having a concentration of 0.5 to 10 % by weight, at a temperature of 30 to 80°C for 0.5 to 10 hours. The examining division questioned whether, at a temperature of 30°C, the step of stirring TAC in a strong base aqueous solution effectively led to low contents in impurities (I) and (II). Since the low amounts in compounds (I) and (II) in TAC are features of claim 1, this question is properly one of sufficiency of disclosure.

It is established that the application discloses at least one way of carrying out the claimed invention (see the stirring step at 50°C, using 1% aqueous NaOH for 6 hours, or 5% aqueous NaOH for 2 hours, in examples 1 and 2).

D9 shows that the mere selection of a temperature of 30°C does not necessarily lead to the claimed low level in impurities. Stirring crude TAC with 5% aqueous NaOH at 30°C for 5 minutes twice, or 1 hour twice, produces

TAC with a total amount of compounds (I) and (II) in excess of 800 ppm.

Nonetheless, the Board agrees with the appellant that the skilled person, based on the application as a whole (see paragraph [0030] and the example) and equipped with common general knowledge, would know that the combination of conditions (base concentration, temperature, duration) must be selected from within the three claimed ranges in order to obtain low concentrations of the undesired compounds. For a temperature of 30°C, the skilled person may use longer treating time, or alternatively increase the concentration of the alkaline agent, in order to obtain the low levels of impurities. Thus the application enables the skilled person to perform the invention in the whole range of temperature claimed.

3.2 In the appealed decision (see paragraph 23), the examining division further referred to the objections under Articles 83 and 84 EPC raised in the annex to the summons to oral proceedings.

3.2.1 The objections pertain firstly to the term "comprises" used in claim 1 only in combination with an upper limit for compounds (I) and (II). As a result, it would be unclear whether TAC and TAIC completely free of impurities (I) and (II) would be covered by claim 1. In addition, the examining division considered that the analytical method mentioned in the application (see paragraph [0037]) could not detect impurities (I) and (II) below the level of 10 ppm, and that the application gave no method that could quantify 0 ppm impurity levels as well as impurity levels less than 10 ppm but greater than 0 ppm.

However, analytical methods are part of the common general knowledge, and the skilled reader is well aware that these methods are characterised by detection limits. The difference made by the examining division between a content in compounds (I) and (II) below such detection limits and a complete absence thereof is in this context not technically meaningful, and does not affect the understanding of claim 1, which only sets much higher upper limits for these contents. Furthermore, the steps of the process of claim 1 are clear and comprise in particular a step of reacting cyanuric chloride with allyl alcohol, which produces TAC contaminated with compounds (I) and (II), and a stirring treatment which will remove these contaminants to the extent allowed by the conditions specified. Accordingly, the process of claim 1 is clear.

3.2.2 Secondly, the examining division considered the expression "strong base aqueous solution" to be unclear, because the term strong base was a relative term. Additionally, the expression included a base like tetrabutylammonium hydroxide with higher molecular weight, and it was highly doubtful if the process of claim 1 would lead to the desired result in such as case.

The Board does not share this opinion. While the term "strong" may in some contexts be a relative term, the expression "strong base" is well-known in the field and is defined as a base which dissociates completely in the solution (here the aqueous solution). Furthermore, the examining division did not substantiate why the use of tetrabutylammonium hydroxide would not lead to the desired purity under any of the claimed conditions.

Accordingly, the subject-matter of claim 1 is clear and sufficiently disclosed.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the examining division with the order to grant a patent with the claims corresponding to the main request filed on 19 August 2022 and a description to be adapted thereto.

The Registrar: The Chairwoman:

B. Atienza Vivancos J. Lécaillon

Decision electronically authenticated