Internal distribution code:

(A) [-] Publication in OJ
(B) [-] To Chairmen and Members
(C) [-] To Chairmen
(D) [X] No distribution

Datasheet for the decision of 1 October 2020

Case Number: T 2487/19 - 3.3.06

Application Number: 12729489.0

Publication Number: 2736632

IPC: B01J20/00, B01J21/04, B01J29/70, B01J29/90, C07C2/12, C07C7/12

Language of the proceedings: EN

Title of invention:
INTEGRATED NITRILE POISON ADSORPTION AND DESORPTION SYSTEM

Patent Proprietor:
ExxonMobil Chemical Patents Inc.

Opponent:
Evonik Operations GmbH

Headword:
Nitrile adsorption/ExxonMobil

Relevant legal provisions:
EPC Art. 100(a), 100(b), 56

Keyword:
Grounds for opposition - insufficiency of disclosure (no) - lack of patentability (no)
Inventive step - (yes)

Decisions cited:

Catchword:

Europäisches Patentamt
European Patent Office
Office européen des brevets

Beschwerdekammern

Boards of Appeal

Chambres de recours

Boards of Appeal of the
European Patent Office
Richard-Reitzner-Allee 8
85540 Haar
GERMANY
Tel. +49 (0)89 2399-0
Fax +49 (0)89 2399-4465

Case Number: T 2487/19 - 3.3.06

D E C I S I O N
of Technical Board of Appeal 3.3.06
of 1 October 2020

Appellant: (Opponent)	Evonik Operations GmbH Rellinghauserstrasse 1-11 45128 Essen (DE)
Representative:	Evonik Patent Association c/o Evonik Industries AG IP Management Bau 1042A/PB 15 Paul-Baumann-Straße 1 45772 Marl (DE)
Respondent: (Patent Proprietor)	ExxonMobil Chemical Patents Inc. 5200 Bayway Drive Baytown, TX 77520 (US)
Representative:	Uexküll & Stolberg Partnerschaft von Patent- und Rechtsanwälten mbB Beselerstraße 4 22607 Hamburg (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 9 August 2019 rejecting the opposition filed against European patent No. 2736632 pursuant to Article 101(2) EPC.**

Composition of the Board:

Chairman	J.-M. Schwaller
Members:	S. Arrojo
	C. Heath

Summary of Facts and Submissions

I. The present appeal from the opponent (hereinafter "the appellant") lies against the decision of the opposition division to reject the opposition against European patent No. 2 736 632.

II. With its grounds of appeal the appellant requested to set aside the decision and to revoke the patent in its entirety under the grounds for opposition pursuant to Articles 100(b) and 100(a)/56 EPC.

III. In its reply, the patentee and respondent requested to dismiss the appeal or, as an auxiliary measure, to maintain the patent on the basis of one of auxiliary requests A-K filed therewith.

IV. Claim 1 as granted reads as follows:

"A continuous process for converting a hydrocarbon feed comprising olefins having from 2 to 6 carbon atoms contaminated with nitrile into a hydrocarbon product by olefin oligomerization, the process comprising the steps of:

i. in a first adsorber, contacting the hydrocarbon feed comprising nitriles with at least one adsorbent comprising a zeolite with a faujasite structure in order to remove nitriles from the feed;

ii. converting the feed with reduced level of nitriles into a hydrocarbon product by olefin oligomerization;

iii. switching the flow of hydrocarbon feed comprising nitriles from the first adsorber to a second adsorber, and contacting the hydrocarbon feed comprising nitriles with at least one adsorbent in said

second adsorber comprising a zeolite with a faujasite structure in order to remove nitriles from the feed; and

iv. while step iii) is taking place, desorbing the nitriles adsorbed on the at least one adsorbent of the first adsorber with a portion of the hydrocarbon product obtained in step ii)."

V. The documents on which this decision is based are the the following:

D3: US 2008/0029437 A1

D4: US 5 352 848

D6: DE 10 2008 007 081 A1

D7: US 6 019 887

D8: US 5 271 835

D9: G. Busca et al, "*Removal and recovery of nitriles from gaseous streams: An IR study of acetonitrile adsorption on and desorption from inorganic solids*", Colloids and Surfaces A: Physiochem. Eng. Aspects, 320 (2008), p. 205-212

D10: M. Ramirez-Corredores, "*Options for Nitriles Removal from C4-C5 Cuts: 1. Via Adsorption*"

D16: "*Conversion processes*", Petroleum Refining. Vol. 3, Editions TECHNIP (France), Chapter 8 Olefin Etherification.

VI. Since none of the grounds for opposition prejudices the maintenance of the patent as granted and as the

appellant has not requested oral proceedings, the board is in a position to issue a written decision without holding oral proceedings.

Reasons for the Decision

1. Sufficiency of disclosure (Article 100(b) EPC)

The board has concluded that the ground for opposition under Article 100(b) EPC does not prejudice the maintenance of the patent as granted.

1.1 The appellant argued that, while the description of the patent clearly disclosed upper and lower limits for the nitrile contaminants (par. [0033] and [0044]), claim 1 was not restricted to any specific maximum/minimum nitrile concentration or to a particular degree of removal of this contaminant in step i). Consequently, the claim encompassed processes with high amounts of nitriles and with a minimal decrease of their concentration. Such embodiments were in contradiction with the indication in the patent (par. [0032]-[0033]) that even small amounts of nitriles would quickly poison the oligomerisation catalyst. Consequently, the claimed invention was broader than the one according to the description of the patent, which implied that the invention could not be carried out throughout its entire scope.

1.2 The board does not agree with this argumentation because sufficiency of disclosure requires that a skilled person be capable of reproducing the invention as defined in the claims in view of the information in the patent as a whole. The appellant's argument that claim 1 can be interpreted in ways which would contradict the teachings of the patent is at odds with

the above requirement, because the skilled person would carry out the invention in the light of the information in the patent and not in contradiction with it.

In the underlying case, the description of the patent explicitly indicates (par. [0032]) that the process involves removing the nitriles to an acceptable level in order to prevent the poisoning of the catalyst (par. [0002] and [0004]). The patent also discloses exemplary nitrile concentrations upstream (par. [0033]) and downstream (par. [0044]) of the adsorbent. It is thus apparent that a skilled reader trying to reproduce the invention in the claims in the light of the description would not consider reproducing the process of the claims by configuring step i) to remove only a minimal amount of nitriles, as the appellant suggests.

For the sake of completeness, the board notes that although explicit definitions (in the claims) of non-functional embodiments may lead to objections of insufficient disclosure, if these non-functional embodiments result from the omission of certain features in the claims, it cannot be directly assumed that a skilled reader would be induced to reproduce such embodiments when executing the invention. In particular, there is no reason to conclude that a skilled person would select combinations of features which, in the light of its common general knowledge or of the contents of the patent, would lead to technical problems.

The board therefore concludes that the invention is sufficiently disclosed.

2. Main request - Inventive step

The board has concluded that the ground for opposition under Article 100(a) EPC in relation to Article 56 EPC does not prejudice the maintenance of the patent as granted.

2.1 Closest prior art

2.1.1 Both parties consider document D3 as the closest prior art. This document describes a process based on the same general idea as the contested patent, namely using a guard bed in order to remove (adsorb) contaminants from a hydrocarbon feed prior to a step of catalytic oligomerisation in order to prevent poisoning of the catalyst.

In particular, D3 proposes (par. [0026]) using a guard bed (i.e. adsorbent) made of a reactive material, wherein, for convenience, the same material used as catalyst can be used (i.e. par. [0024] discloses molecular sieves of the MWW family of zeolites as preferred catalysts). Alternatively, D3 proposes a guard bed comprising "a used catalyst from another process" or "a non-reactive sorbent such as alumina or silica-alumina".

D3 also indicates (par. [0026]) that "The contaminants which are normally encountered are sulfur compounds such as thiols, sulfides, thiophenes and disulfides; in processing light aromatics stream, nitrogen contaminants may also be encountered, for example, nitrogen-based organic species derived from aromatics extraction operations using solvents such as N-methylpyrrolidone (NMP), dimethylformamide (DMF), N-formyl morpholine (NFM) and similar materials".

Moreover, "sulphur compounds including mercaptans, thiophenes and substituted thiophenes, as well as compounds containing other heteroatoms such as nitrogen" are mentioned (par. [0012]) as typical contaminants in olefinic streams obtained from cracking processes.

It is thus apparent that D3 does not disclose guard beds comprising zeolites with a faujasite structure, and does not explicitly mention the presence of nitriles as contaminants (i.e. nitrogen-containing contaminants are mentioned, with no specific reference to nitriles).

2.1.2 The appellant argued that the presence of nitriles in the feed of D3 was implicitly disclosed because this document referred (par. [0012] and par. [0026]) to nitrogen containing compounds, such group clearly encompassing nitriles. While the document did not explicitly refer to nitriles, the presence of these contaminants was implicit because it was part of the common general knowledge (see section 8.3.1 of document D16 and par. [0002] of the contested patent) that this contaminant resulted from the catalytic processes used to obtain the hydrocarbon mixtures and/or from the extraction of butadiene performed before the oligomerisation step (see [0030] of the patent in suit). Moreover, in view of the contested patent (par. [0031]-[0032]), it was apparent that the formation of these contaminants in fluidised bed cracking processes (FCC) took place even in the absence of an extraction step. The fact that hydrocarbons produced by FCC necessarily included nitriles as contaminants was furthermore demonstrated by D4 (col. 2, lines 39 et seq.), D7 (col. 1, lines 16 et seq.), D8 (col. 4, lines 9-16), D9 (page 205) and D10 (abstract).

Consequently, since the hydrocarbon mixture in D3 was obtained with an FCC cracking process (par. [0012], [0020] and [0023]), the presence of nitriles as contaminants was implicitly anticipated in this document. The only differentiating feature of claim 1 was therefore the use of faujasite zeolites as guard bed.

2.1.3 The board does not agree with this argumentation because the reference in D3 to nitrogen containing compounds is broader than the specific sub-group of "nitriles", and does therefore not anticipate it. Furthermore, none of the contaminants explicitly described as typically present in the feedstocks of D3 belongs to the sub-group of nitriles.

While it is apparent that the presence of nitrile contaminants in olefin containing hydrocarbon mixtures of the type described in document D3 is known and probably common, this does not imply that these contaminants are necessarily present in the processes described in this document. In particular, as indicated by the opposition division, the removal of butadienes can take place by hydrogenation instead of by extraction. Furthermore, butadiene could also be extracted with solvents different from nitriles. D3 does also not discard a pre-treatment step to remove nitriles (e.g. using known methods such as water washing).

Furthermore neither the cited paragraphs of the patent (par. [0031]-[0032]) nor the documents cited by the applicant (D4, D7, D8, D9 and D10) demonstrate that nitriles are necessarily found in FCC hydrocarbon mixtures, but simply that they can be present.

Consequently, document D3 does not clearly and unambiguously disclose that the hydrocarbon feed includes nitriles, and, consequently, does also not anticipate a step of removal of the nitriles from the feed.

2.1.4 The subject-matter of claim 1 therefore differs from D3 in that:

- The hydrocarbon feed is contaminated with nitriles, and said nitriles are at least partially removed by the first adsorber (i.e. the guard bed) in step i); and

- a zeolite with a faujasite structure is used as guard bed.

2.2 Problem solved by the invention

2.2.1 The appellant claimed that there was no evidence that the use of faujasite provided any particular technical effect. In particular, while the patent in suit compared (table 1) faujasite with other adsorbents, it did not provide any direct comparison with the bed guards proposed in D3. Since - according to its opinion - claim 1 only differed from D3 in that faujasite was used as bed guard, the only problem solved by the invention was the provision of an alternative.

2.2.2 The board disagrees with this argumentation because, as indicated above, claim 1 does not only differ from D3 in the use of faujasite but also in that the hydrocarbon feed includes nitriles and in that the nitriles are at least partially removed by the faujasite bed guard. Furthermore, while in the absence of a direct comparison with D3 it cannot be concluded that faujasite necessarily ensures a longer life (i.e.

less frequent regeneration requirements) than any of the adsorbents disclosed in D3, the tests in table 1 of the patent at least demonstrate that, within the context of adsorbents used to remove nitriles, the alternative proposed in claim 1 requires less frequent regeneration cycles, which in turn ensures a comparatively cost-effective process. Thus, claim 1 is considered to provide the effect of providing a cost-effective alternative (rather than an arbitrary one, as the appellant suggests).

2.2.3 The board therefore concludes that the problem solved by the invention is the provision of a cost-effective (i.e. requiring less frequent regeneration of the guard bed) alternative process to prevent poisoning of the oligomerisation catalyst.

2.3 Obviousness

2.3.1 The appellant argued that in par. [0026] of D3 it was indicated that any material which would undergo a surface reaction with the contaminants in the feed could be used as guard bed. Documents D6-D10 disclosed the use of faujasite zeolites to remove nitrogen, sulfur and oxygen containing contaminants, and D7-D10 referred explicitly to the removal of nitrile contaminants. In particular, D8 referred solely to faujasite zeolites as the preferred adsorbent to remove nitriles (column 9, line 20) and also other substances such as mercaptans (column 9, lines 32-42).

Thus, when looking for alternatives, the skilled person would have learned from these documents that faujasite can be used to remove nitriles. Moreover, document D8 did not only mention nitriles but also mercaptans, a

contaminant which was explicitly mentioned in document D3 (see e.g. par. [0012]).

2.3.2 The board does not agree with this argumentation for the following reasons:

- It is not contested that, in view of the cited documents, it is known to use faujasite zeolites for removing nitriles from hydrocarbon feedstocks. However, since D3 does not refer to nitriles as a contaminant or as a substance to be removed, the skilled person would have no incentive to look for alternatives concerning this contaminant in particular when starting from D3 as closest prior art (note that, even if nitriles were considered to be implicitly present, this conclusion would still apply).

- Instead, a skilled person starting from D3 and looking for cost-effective alternatives, would consider those adsorbents regarded as cost-effective for the treatment of the contaminants disclosed in this document. In this respect, D3 provides two explicit hints which can be regarded as cost-effective alternatives:

i) a guard bed made of the same material as the oligomerisation catalyst (par. [0026]), which, in view of par. [0024] would lead to the selection of MWW zeolites; or
ii) cheaper guard bed sorbents such as a used catalyst from another process or a non-reactive sorbent like alumina or silica-alumina (par. [0026]).

- While both D3 and D8 consider the removal of mercaptans, in D8 this process is not performed with the faujasite zeolite but with a step of contacting the

feedstock with an alkaline scrubbing solution (see abstract and claim 1, step (b) of D8).

- In any case, it is further noted that even if a combination of D3 and any of the documents D7-D10 were considered, the resulting combination would still not render the process of claim 1 obvious, because it would not include nitrile contaminants and a step to remove them.

The subject-matter of claim 1 is thus considered not obvious in view of the cited prior art.

3. The ground for opposition under Article 100(c) EPC was raised during first instance proceedings but was not pursued by the appellant in the appeal proceedings (i.e. no argument in this respect was submitted in the statement of grounds of appeal). However, for the sake of completeness, it is noted that the board agrees with the argumentation of the opposition division in this respect (see page 3 of the decision) and with its conclusion that the requirements of Article 123(2) EPC are met.

4. The board therefore concludes that none of the grounds for opposition prejudices the maintenance of the patent as granted.

5. In view of this conclusion, there is no need to deal with the question of admittance and allowability of auxiliary requests A-K.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

A. Pinna J.-M. Schwaller

Decision electronically authenticated