Neutral Citation Number: [2026] EWCA Civ 136

Case Nos: CA-2025-001660, -001669

IN THE COURT OF APPEAL (CIVIL DIVISION)
ON APPEAL FROM THE HIGH COURT OF JUSTICE, BUSINESS AND PROPERTY COURTS OF ENGLAND AND WALES, INTELLECTUAL PROPERTY LIST (ChD), PATENTS COURT
Mr Justice Mellor
[2025] EWHC 675 (Pat)

Royal Courts of Justice
Strand, London, WC2A 2LL

Date: 24 February 2026

Before :

LORD JUSTICE MOYLAN
LORD JUSTICE ARNOLD
and
LORD JUSTICE MILES

- -

Between :

(1) DSM IP ASSETS BV **(2) DSM NUTRITIONAL PRODUCTS AG**	**Claimants**
- and -	
(1) ALGAL OMEGA 3 LIMITED (IN ADMINISTRATION) **(2) MARA RENEWABLES CORPORATION**	**Defendants**

- -
- -

James Abrahams KC and Kyra Nezami (instructed by **Powell Gilbert LLP**) for the **Claimants**
Adrian Speck KC and James Whyte (instructed by **Bristows LLP**) for the **Second Defendant**

Hearing dates : 10-11 February 2026

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Approved Judgment

This judgment was handed down remotely at 10.30am on 24 February 2026 by circulation to the parties or their representatives by e-mail and by release to the National Archives.

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Lord Justice Arnold:

Introduction

1. The Court has before it appeals by both the Claimants ("DSM") and the Second Defendant ("Mara") against different aspects of an order made by Mellor J on 18 June 2025 for the reasons given in the judge's judgment dated 20 March 2025 [2025] EWHC 625 (Pat).

2. DSM alleged that Mara had infringed three different patents ("the Patents") owned by DSM with three different priority or filing dates: (i) European Patent (UK) No. 2 921 155 entitled "Methods for producing high-quality lipids by enzymatic liberation from biomass" with a priority date of 3 May 2002 ("EP155"); (ii) European Patent (UK) No. 3 530 740 entitled "Thraustochytrids, fatty acid compositions, and methods of making and uses thereof" with a filing date of 19 March 2009 ("EP740"); and (iii) European Patent (UK) No. 2 576 801 entitled "Extraction of lipid from cells and products therefrom" with a priority date of 1 June 2010 ("EP801"). Mara denied infringement and counterclaimed for revocation of the Patents.

3. The judge heard the trial of the dispute over nine days in October 2024. In a meticulous judgment running to 893 paragraphs the judge concluded that: (i) EP155 was valid, infringement being admitted if it was valid; (ii) EP740 was invalid on several grounds; and (iii) EP801 was invalid for obviousness, but would have been infringed by some of Mara's processes if it were valid. Mara appeals with permission granted by the judge against the finding that EP155 was valid. DSM appeal with permission granted by myself against the finding that EP801 was invalid. DSM also contend that the judge should have found that more of Mara's processes infringed EP801 if valid.

4. As is often the case, this Court is required to consider far fewer issues than the judge was burdened with. Furthermore, as I will explain, three of the issues argued on DSM's appeal are contingent upon the determination of earlier issues.

Technical background

5. The Patents relate to microbial oils and their production. These oils can contain a high level of polyunsaturated fatty acids ("PUFAs"), such as an omega-3 PUFA called docosahexaenoic acid ("DHA"), which traditionally has been sourced from fish, and which is an important component of infant formula. Fish do not themselves produce PUFAs such as DHA. Instead, they obtain them from oils produced by single-cell microbes in their diet. It has long been possible to cultivate such microbes and to extract and purify oils containing high levels of PUFAs from lipids in their cells. These are known as single-cell oils ("SCOs"). Processes for producing SCOs can be divided into "upstream" and "downstream" processing. Upstream processing covers strain selection, media development and process design to enable the production of a lipid-rich biomass, while downstream processing covers cell inactivation, extracting the oil from the cells, recovering the crude oil and refining the oil.

The skilled person or team

6. It was common ground at trial that the Patents were addressed to a skilled person or team with expertise in both upstream processing and downstream processing. The judge

generally referred to the skilled team, and I will follow his example. The judge found that the skilled team would have experience not only of processing at commercial scale, but also of experimenting in the laboratory and then scaling up. Thus the skilled team would have the (non-inventive) ability to develop processes, not just run them.

The expert witnesses

7. DSM called two expert witnesses: Dr James Wynn, a microbiologist, i.e. a person skilled in upstream processing; and Daniel Dueppen, a bioprocessing engineer, i.e. a person skilled in downstream processing. The judge's assessment was that both Dr Wynn and Mr Dueppen were good witnesses, but considered that their focus was very much on commercial scale production processes with little or no attention being paid to anything outside that. He also gained the impression that both Dr Wynn and Mr Dueppen had a tendency to stick to the party line, as expressed in their written evidence, but nevertheless considered that, for the most part, he could rely upon their oral evidence.

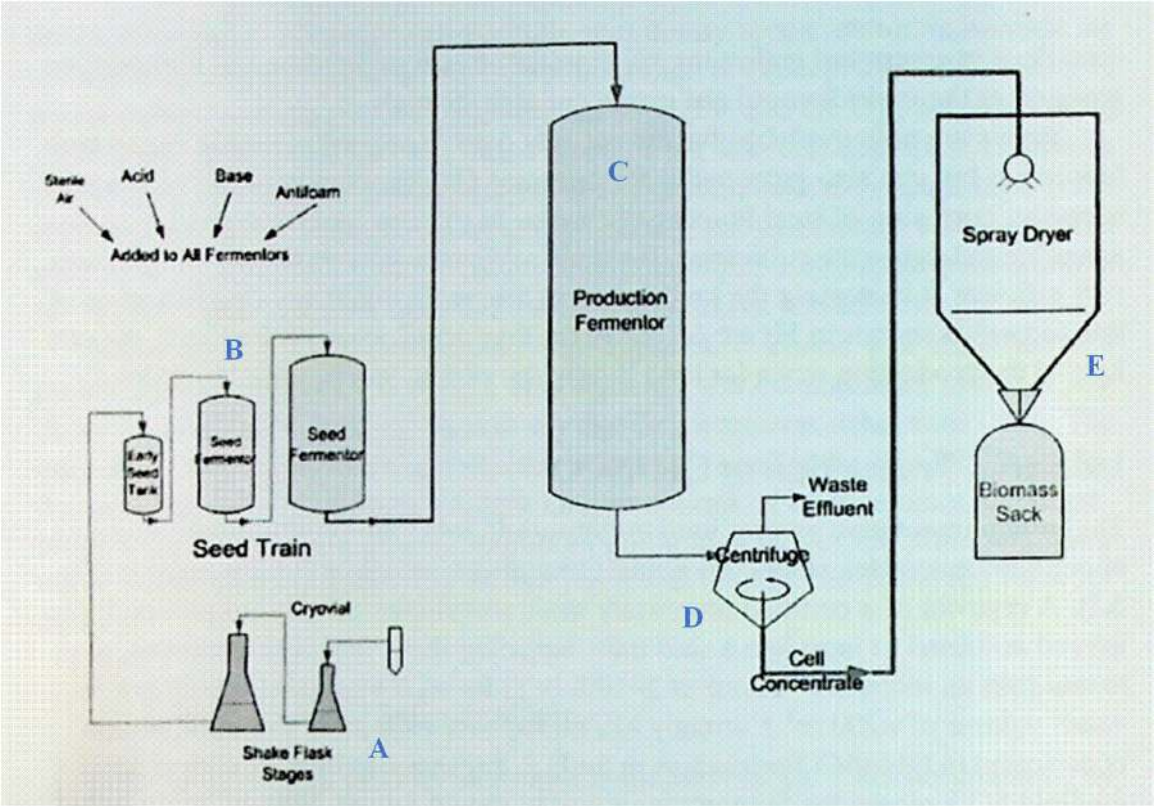
8. Mara called a single expert witness, Dr David Kyle. The judge found that Dr Kyle's evidence was unsatisfactory in a number of respects. Parts of Dr Kyle's evidence were not challenged, but where it was challenged the judge did not consider that he could rely upon it unless either Dr Wynn or Mr Dueppen agreed with it in cross-examination.

Agreed common general knowledge as at the priority date of EP155

9. The parties agreed a statement of common general knowledge. The judge set out the agreed common general knowledge as at the priority date of EP155, supplemented with some findings based on the expert evidence, at [54]-[147]. For the purposes of the appeal, it is sufficient to highlight the passages reproduced below.

Overview of microbial oil production process

10. The diagrams below summarise how a microbial oil was made, mainly by reference to the process used by a company called Martek to produce DHASCO oil (DHA from *Crypthecodinium cohnii*), using annotated figures from *Single Cell Oils; Microbial and Algal Oils*, edited by Zvi Cohen and Colin Ratledge ("the SCO Book"). (The SCO Book was published in 2005, but arose from a symposium organised by Dr Kyle in May 2003 and was agreed to reflect the common general knowledge as at May 2002.)



11. Steps A, B and C marked on the first diagram involve:

i) Initial inoculation: The cell line (often stored in vials at -80°C until needed) is used to inoculate small volume shake flasks containing starter medium (containing nutrients for growth, and optimised in terms of salinity, pH etc.), and a series of shake flasks of increasing volume are used as the cells multiply (often referred to as the biomass increasing).

ii) Seed train: As the cells multiply, and the biomass increases further, the composition is transferred to a moderately-sized seed fermenter, generally made from stainless steel, and medium to encourage growth continues to be supplied. Again, usually a series of seed fermenters of increasing volume would be used. The fermentation growth medium contains a low-cost carbon substrate (typically glucose) as well as a nitrogen source (typically ammonia, ammonium sulphate, yeast extract or yeast peptone) and other micronutrients and essential vitamins.

iii) Production: The growing biomass is then transferred to a larger production fermenter (e.g. 100m^3, and about 10 times the size of the final seed train fermenter), again usually made from stainless steel. The fermentation tank which is used to grow the microbes is sparged with air, which provides the necessary oxygen to drive the cellular aerobic metabolism and flushes away any carbon dioxide in the exhaust. The contents of the tanks are typically mixed during fermentation to break up the sparging air bubbles, thereby improving the oxygen transfer to the cells and maximizing growth. This also helps avoid the cells aggregating (clumping together). However, these processes of sparging

> and mixing can in turn lead to foaming, which if left unchecked could even cause the fermenter to overflow. Consequently, an antifoaming agent is always added to the fermenter. Surfactants were (and still are) commonly used as antifoaming agents, as they decrease the surface tension thus reducing the formation of bubbles and therefore foam.

12. Under ideal growth conditions, the culture will grow exponentially, and in this phase the cells are not producing significant levels of triglyceride lipids. Once the biomass has increased to target volume, the conditions are altered to encourage the accumulation of lipids (instead of the cells continuing to multiply). In particular, it was well known that limiting available nitrogen will slow down growth and, when provided at the same time with excess energy (e.g. glucose), oil producing organisms will typically switch their metabolism from growth to accumulation of oil as an energy store.

13. Next, at step D, the biomass (microbial cells) can be heat-treated to pasteurise the cells to stabilise them, by inactivating the cell's natural metabolic processes that may damage or consume the intracellular lipid. The biomass is then concentrated and separated from the growth media (called "harvesting" the cells).

14. In the production of DHASCO, this harvesting was through centrifugation. In general (i.e. not limited to the production of DHASCO), centrifugation involves spinning a solution at high speed in order to separate components of different densities through the use of centrifugal force. A simple bench-top centrifuge involves spinning test-tube like vials, leaving the lighter, less dense phase at the top of the vial and the heavier, denser phase at the bottom of the vial. On a small or laboratory scale, centrifugation was typically performed using a swinging bucket or fixed-angle centrifuge, where discrete volumes of the sample are spun simultaneously, and the supernatants and pellets are pooled after centrifugation. In large-scale operations, continuous flow centrifuges (e.g., bowl centrifuges, disc-stack centrifuges, or decanting centrifuges) were extensively used for liquid/liquid separations. In a disc-stack centrifuge, centrifugal force separates the heavier aqueous layer from the lighter oil layer in a horizontal mode, with the heavier water layer discharging farthest from the centrifuge's central axis of rotation and the lighter lipid layer discharging closest to the central axis. Adjustable dams allow fine-tuning of the separation point between the two phases. The main advantage of continuous flow centrifugation is its efficiency; the centrifuge does not need to be shut down during harvesting. Instead of gravity, centrifugal force - ranging from 4,000 to 14,000 times gravitational force in disc-stack centrifuges - drives the separation.

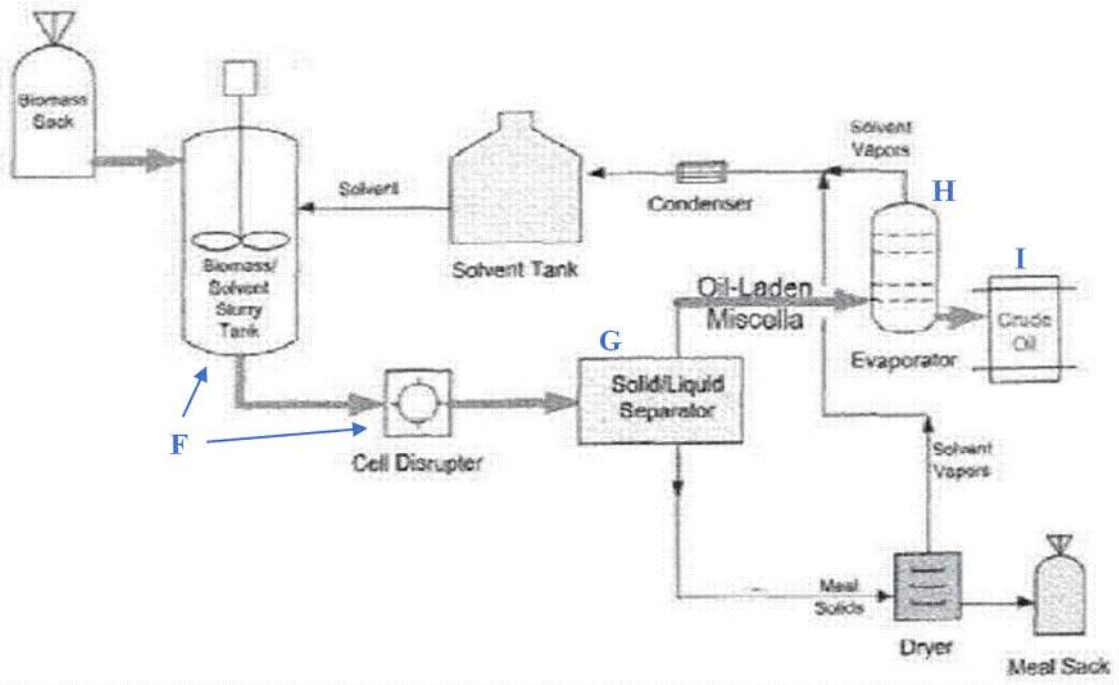
15. During the centrifugation of cells carried out for the production of DHASCO, most, but far from all, of the liquid media in the fermentation broth is separated off. The resulting biomass is dried as shown in step E. Spray drying was a common technique. The goal was to obtain a powder of mostly intact dried cells, as if the lipid remains within the cells, it is more (although not totally) protected from the effects of oxidation. This enables the biomass to be stored for a period of time if necessary.

16. The production of sunflower oil, vegetable oil, rape seed oil, etc. was many decades old by 2002, and there was a lot of knowledge on techniques for extracting those oils using hexane, which had been proven to work on industrial scale. The process of growing microorganisms in a broth of liquid medium is inevitably very different to growing plants, but the industry leveraged the very well-established oil extraction techniques

from plant/seed oil production. Therefore, one aim of the drying process in step E was to obtain a solid product which could then be treated in a similar way to plant matter or seeds.

17. The first extraction techniques used for microbial oils were adapted from this decades-old hexane extraction technology used in the vegetable/seed oil industries. However, hexane extraction still had certain drawbacks, as it is a hazardous substance in the factory due to its volatility and flammability. The downsides of hexane extraction were well known in 2002, but microbial oil production on a commercial scale was still relatively new at that date.

18. The next diagram from the SCO Book shows how the dried cells are treated, and the oil extracted, to produce crude DHASCO oil.



19. As shown at F, the next step in the production of DHASCO is to re-constitute the dried cells in a solvent (usually hexane) to make a slurry, and then use a "cell disrupter" to lyse the cells (i.e. to disrupt the cell walls to release the intracellular components).

20. A simple and effective means of disrupting cells is by the use of mechanical techniques. The two major mechanical techniques used to manufacture SCOs in May 2002 were:

    i) High pressure homogenisation: This type of homogenisation involves subjecting the cells to very high pressure, and forcing the hexane-cell slurry through a narrow gap into a lower pressure environment, thereby creating shear forces which burst the cells open. The stream of cells could also be directed at a blade or plate where the high-speed collision aids in cell lysis. This was the method used in the process to manufacture DHASCO by Martek.

    ii) Bead milling: This involves adding the hexane-cell slurry to a chamber containing beads (generally made of glass, ceramic or steel) and subjecting

them to high-speed agitation, such as vortexing. The cells are physically ground against the beads, causing the cell walls to be disrupted and the intracellular components to be released. This technique is generally effective in lysing even very tough cells (and was commonly used to grind seeds to make seed oils), but it is harsher than other methods. This was the method used in the process to manufacture S-type DHA by a company called OmegaTech.

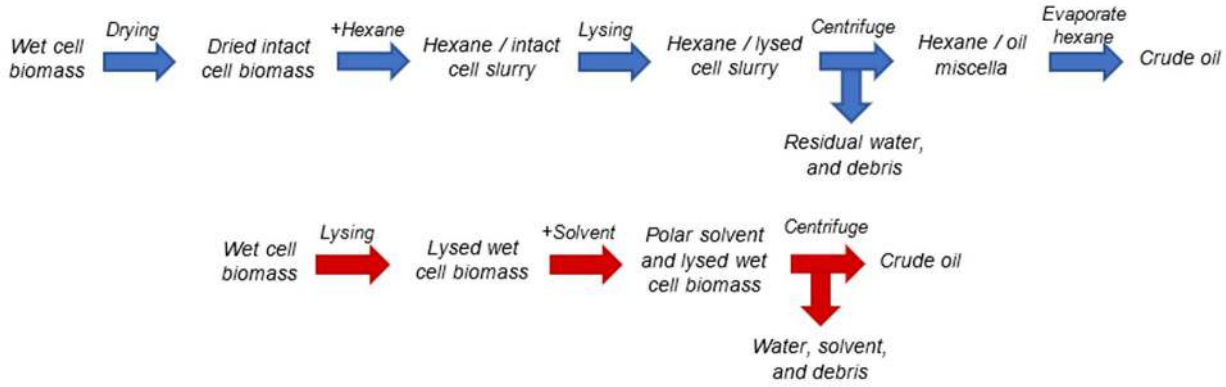
21. As mentioned above, as part of the extraction process for DHASCO, the dry cells were first mixed into a slurry with an organic solvent prior to lysis. Lipids are insoluble in water, but soluble in suitable organic solvents. This means that lipid in the cells dissolves into the solvent, extracting the lipid from the dried biomass and leaving behind the other components, allowing separation. Hexane was the preferred and most commonly used solvent in industrial extraction processes in 2002. Hexane is a non-polar organic solvent well suited to dissolving non-polar lipids such as triacylglycerides ("TAGs"), which are released when the cells are disrupted. Again, this built upon the established practice of using hexane to extract oil from plant matter/seeds. The hexane-oil mixture, called the "miscella", was then separated from the oil-depleted biomass, as shown in step G, using a centrifuge or decanter.

22. Finally, as shown in step H, the miscella (i.e. oil/hexane mixture) was passed on to an evaporator to remove the hexane (which is recovered and reused), leaving the crude oil as shown at I.

The FRIOLEX Process

23. The FRIOLEX process was first developed in 1998, in the plant/seed oil context, as an alternative to traditional hexane-based downstream oil extraction. The FRIOLEX process starts with wet biomass, following which the microbial cells are lysed in order to release the oil. The resulting water/lipid mixture (which takes the form of an emulsion) is treated with isopropanol (or a similar polar solvent) in water, agitated and then centrifuged. The water-miscible isopropanol makes the aqueous phase even more polar, and so less favoured by the non-polar lipids (such as TAGs). The small droplets of non-polar lipid therefore coalesce into larger lipid droplets, and the composition separates into a light oil phase and a heavy water/solvent phase, which can be separated using centrifugation. It was also known that salt could be added to increase the density of the heavy water/solvent phase and encourage better separation. The FRIOLEX process therefore offered a clear advantage, as hexane could be avoided. However, one disadvantage was that extraction tended to be less selective as compared to hexane. Moreover, the solvent needed to be recovered from the aqueous phase, which was challenging, as part of the point of the process was that the solvents were selected to be water-miscible.

24. The differences between traditional hexane extraction (blue arrows) and the FRIOLEX process (red arrows) are summarised below.



25. Although the skilled team would have been aware of the FRIOLEX process in 2002, it had not at that point been implemented in a commercial scale microbial oil production process. Nevertheless, there was increasing interest in the FRIOLEX process.

26. It had also long been appreciated that, in an ideal situation, the extraction process would be entirely aqueous. However, inherent in this was the likelihood that an emulsion would form between the lipid and water/other aqueous components. An emulsion is a mixture of two (or more) liquids that are normally immiscible, but where one liquid is present as microscopic droplets distributed throughout the other liquid(s). The more energetically stable the emulsion, the more difficult it will be to "break" and separate the liquids. In standard solvent extraction, one reason that the biomass had to be dried (typically one of the more expensive steps in the production process) was that hexane and wet cells form an extremely stable emulsion under certain conditions that is very challenging to break.

27. Once oil had been extracted and processed, any organic solvent used in the extraction process needed to be removed. Thus:

    i) Hexane was evaporated off.

    ii) Any solvent used had to be removed so that it was only there in very small quantities, particularly if the lipid was to be used in a foodstuff.

    iii) This applied equally to a polar organic solvent in the FRIOLEX process - the oil at the end of the process would be understood to be substantially free of both water and organic solvent.

Schizochytrium

28. *Schizochytrium limacinum* and *Thraustochytrium aureum* are closely related species of the taxonomic order Thraustochytrid. Dr Bill Barclay of OmegaTech had identified a *Schizochytrium* strain that was deposited as ATCC 20888. This strain was well known in May 2002 as a good source of DHA, since it was used by OmegaTech to produce S-type DHA.

29. It was common general knowledge by May 2002 that this *Schizochytrium* strain had certain advantages, as compared to the production of DHASCO from *C.cohnii*:

i) The *Schizochytrium* strain grew at low salinity - an advantage for growth in standard stainless steel tanks.

ii) Low dissolved oxygen levels had been shown to induce thraustochytrid DHA production. This meant that the *Schizochytrium* strain used to produce S-type DHA could be grown in larger culture vessels without a concern for depletion of oxygen in different parts of the tank. This was in contrast to *C.cohnii*, which required oxygen to produce DHA.

iii) The *Schizochytrium* strain grew to higher cell densities at a faster rate than *C.cohnii*.

Disputed common general knowledge as at the priority date of EP155

30. The judge determined two disputes concerning common general knowledge as at the priority date of EP155 at [148]-[166]. The first is no longer material, but the second is important. This is whether, and if so to what extent, enzymatic lysis was a common general knowledge technique. The judge considered the evidence on this topic in detail at [154]-[165], and concluded at [166]:

> "… although enzymatic lysis was CGK, it was another matter as to how the Skilled Team would approach a suggestion to use it. That depends on the context."

EP155

31. The judge considered the disclosure of EP155 in some detail at [214]-[246]. It is not necessary to repeat that exercise for the purposes of the appeal. The only claim in issue is claim 1:

> "A method for obtaining a polyunsaturated fatty acid-containing lipid, comprising the steps:
>
> a. providing a biomass which comprises microorganisms of the genus *Schizochytrium*, said biomass containing a polyunsaturated-containing fatty acid;
>
> b. contacting said biomass with an enzyme; and
>
> c. recovering said lipid,
>
> wherein said step of contacting said biomass with an enzyme comprises treating said biomass with a protease."

Bijl

32. Mara contends that claim 1 of EP155 is obvious in the light of European Patent Application No. 1 179 118 entitled "Isolation of microbial oils" ("Bijl"). Bijl was published on 6 February 2002, approximately three months before the priority date of EP155.

33. The abstract states:

> "The extraction of a microbial or single cell oil, for example comprising one or more polyunsaturated fatty acids (PUFAs), directly from microbial cells is disclosed which avoids the need for solvents. After fermentation, the microbial cells are pasteurised, washed and the cell walls lysed or disrupted by a mechanical (e.g. homogenisation), physical (boiling or drying), chemical (solvents) or enzymatic (cell wall degrading enzymes) technique. The oil (containing the PUFA) is then separated from the resulting cell wall debris. This is achieved by centrifugation, which results in an oily phase (top layer) that contains the oil which that can be separated from an aqueous phase (containing the cell wall debris). The oil can then be extracted and if necessary the PUFA can be purified or isolated from the oil."

34. The specification begins by stating at [0001]:

> "The present invention relates to the extraction (and then isolation) of a microbial (or single cell) oil, preferably comprising one or more polyunsaturated fatty acids (PUFAs), from single cell (or micro-) organisms. The process of the invention involves the disruption or lysis of microbial cell walls, followed by separating the oil from the resulting cell debris. The invention additionally relates to a microbial oil recovered by this process, preferably having a PUFA."

In context, it is clear that Bijl is using "extraction" to cover lysis of cells and "isolation" to cover recovery of the microbial oil.

35. It goes on:

> "[0003] In most microbial PUFA production processes a microorganism is first cultured in a fermenter in a suitable medium. The microbial biomass is then harvested and treated to enable subsequent extraction of a lipid from the biomass with a suitable solvent. The lipid is usually subjected to several refining steps. Care must be taken during the process because degradation can occur if the lipids are subjected to lipolysis or oxidising conditions, for example heating (in the presence of oxygen) and/or due to lipases or lipoxygenases. The art teaches that to avoid oxidation (such as resulting from breaking open the cells and so exposing the contents to oxygen) PUFAs can be extracted from whole intact cells using a solvent …. The use of solvents is a common way of removing lipids from microbial biomass …
>
> [0004] Although these extraction processes [i.e. using a solvent] have been used for several years, the solvent needs to be removed and this results in extra cost. In addition, if the lipid is to be used in a foodstuff, it is important that certain solvents, such as hexane, are removed completely, or only remain in very small quantities. If the hexane is removed by evaporation then this may involve heating and that not only adds to costs but can cause lipid

> degradation. Furthermore, with increasing environmental considerations, the use of solvents for the extraction of lipids is becoming increasingly expensive and unpopular.
>
> [0005] The present invention therefore seeks to solve or at least mitigate these problems. The Applicant has found that lipids, such as those comprising a PUFA, can be efficiently extracted from microbial cells without the need for solvent(s)."

36. At [0006] Bijl states that a "first aspect" of the invention provides:

> "…a process for obtaining an oil (or fat or lipid, the terms are used interchangeably) from microbial cells, the process comprising (a) disrupting (or lysing) the cell walls of the microbial cells to release the oil from the cells. The (microbial or single cell) oil can then be (b) separated from at least part of the resulting cell wall debris. One can then (c) recover, purify or isolate the microbial oil (or one or more PUFAs). A good yield of the oil can be achieved using this process without the need for a solvent. Preferably the oil will comprise one or more PUFAs."

37. At [0007] Bijl states:

> "Recent PUFA preparation processes advocate keeping the microbial cells intact … Throughout this process the cells are kept intact to prevent oxygen in the atmosphere contacting the PUFAs and causing undesirable oxidation. However, it has now been found that a good quality PUFA oil can be achieved if the cells are in fact lysed: any potential oxidation by the atmosphere is more than compensated by the advantage of avoiding the need for solvents."

38. Under the heading "PUFAs and microorganisms", Bijl discusses suitable organisms, noting at [0008] that the microbial cells may be bacteria, yeast, algae or fungi. This paragraph lists genera of preferred fungi including *Mortierella* and *Thraustochytrium*, which were both well known as sources of microbial oils, in particular those containing PUFAs, although the skilled team would know that by 2002 *Thraustochytrium* was classified as an algae. Among suitable algae listed in [0009] is the well-known source of DHASCO, *Crypthecodinium cohnii*.

39. In [0010] preferred PUFAs are listed, which include DHA, arachidonic acid ("ARA") and eicosapentanenoic acid ("EPA"), and in [0011] possible sources of these are listed, including *Mortierella* for ARA and *Crypthecodinium* or *Thraustochytrium* for DHA.

40. The next section is headed "Cell lysis". It begins:

> "[0014] The cell walls of the microbial cells can then be disrupted (or lysed). This can be achieved using one or more enzymatic, physical or mechanical methods or techniques, for example at high shear conditions. Physical techniques include heating

> and/or drying the cells to a sufficient temperature whereby the cell walls are ruptured. This may comprise boiling.
>
> [0015] Enzymatic methods include lysis by one or more enzymes, e.g. cell wall degrading enzymes. The cell wall degrading enzyme may be a lytic enzyme. Other enzymes include (e.g. alkaline) proteases, cellulases, hemicellulases, chitinases and/or pectinases. Other cell wall degrading substances may be used instead of or in combination with one or more enzymes, e.g. salts, alkali, and/or one or more surfactants or detergents. A combination of physical, mechanical and/or enzymatic methods is also contemplated."

41. Details of mechanical techniques are discussed in [0016], but the specification states at [0017] that homogenisation is the preferred method of disrupting the cell walls and gives details of the pressures that can be employed in, for example, a Gaulin homogeniser. It then says at [0018] that chemical lysis is preferably not employed, as the process is desirably solvent-free.

42. The next section is headed "Separation of oil from cell debris". It begins:

> "[0021] The microbial oil is then separated from at least part of the cell wall debris formed. At this stage the PUFA may be in an oily or lipid layer. This may be a top or upper layer, which is (or has risen) above an aqueous layer containing cell wall debris. The oily layer comprising the PUFA can then be separated from the aqueous phase. One or more surfactants or detergents may be present or added to assist this process.
>
> [0022] The separation of the oil from at least some of the cell wall debris is preferably achieved or assisted by using a mechanical method, in particular by centrifugation. … Centrifugation may result in either a 2-phase system (a fatty or oily top layer and a lower aqueous layer) or a 3-phase system (a fatty or oily top layer, a middle aqueous layer and a bottom layer, usually containing the cell debris)."

43. At [0024] Bijl states that one advantage of the process of the invention is that one can avoid the need for any solvents, and explains that in this context the term "solvents" excludes water. At [0025] it states that, preferably, the use of a surfactant can also be avoided.

44. The next section is headed "Overall protocol". In [0028] the specification sets out a preferred process comprising eight steps, some of which are optional. These include the following two steps:

> "(e) disrupting or lysing the cell walls of the microbial cells, for example by a physical, enzymatic or mechanical technique (such as homogenisation, e.g. with an homogeniser or a ball mill). This releases some of the oil and/or PUFA present in the microbial cells. The (mechanical) disruption may be supplemented with or

> substituted by chemical and/or enzymatic disruption. One can obtain an oil phase and an aqueous phase. The oil phase may contain the PUFA. The aqueous phase may contain cell debris;
>
> (f) separation of the microbial oil (or PUFA) from the cell wall debris, for example separation of the oil phase from the resultant cell wall debris and/or aqueous phase. This may comprise centrifugation, optionally with the addition of one or more salts, a pH shift (towards alkaline), and may involve the presence of one or more cell degrading enzymes, surfactants or emulsifiers".

45. Although (f) does not expressly refer to emulsions, it is common ground that at least centrifugation and the addition of salt were known methods of trying to break emulsions. Thus, to the extent that an emulsion forms upon lysis, Bijl mentions ways of trying to deal with it. (The reference to "emulsifiers" may be a typographical error, and perhaps should read "de-emulsifiers", but it is not necessary to determine this question.)

46. Further options are discussed at [0029]-[0032].

47. Bijl then describes two examples of solvent-free extraction. One uses *Mortierella* to produce ARA, and the other *Crypthecodinium* to produce DHA. Both examples use homogenisation as the means of lysis, followed by centrifugation to generate an oily top layer and a lower aqueous layer containing cell debris.

48. In more detail, Example 1 in Bijl is entitled "Preparation of crude PUFA (ARA) oil from a fermentation broth of *Mortierella alpina*." A pasteurized fermentation broth is subjected to homogenisation at 600 bar and then centrifuged at 8,000 rpm. The specification states at [0034] that this:

> "… result[ed] in an arachidonic acid-enriched oily top layer (that was recovered from the centrifuge) and a lower aqueous layer containing the cell debris. A crude PUFA oil was recovered: the yield of oil was 95% (based on the oil in the cell). The crude oil had the following approximate composition: 1 to 2% sterols and cell debris; 3 to 4% phospholipids; 4% monoglycerides; 6% diglycerides; and the remainder being triglycerides."

49. Example 2 is entitled "Preparation of crude PUFA (DHA) oil from a fermentation broth of *Crypthecodinium cohnii*". Lysis was carried out by homogenisation three times at 600 bar. Crude oil was recovered using a lab-scale centrifuge on 800ml portions. The specification states at [0035]:

> "… This resulted in a DHA-enriched fatty top layer (crude oil) and a lower aqueous layer. A crude PUFA oil was recovered from the fatty top layer."

The law as to obviousness

50. There was no dispute before the judge or in this Court as to the law. The principles are well established, and for the most part it is not necessary to set them out. I shall therefore confine myself to two points.

51. The first is that made by Lord Diplock in a much-cited passage in *Technograph Printed Circuits Ltd v Mills & Rockley (Electronics) Ltd* [1972] RPC 346 at 362:

> "The cross-examination of the respondents' expert followed with customary skill the familiar 'step by step' course. I do not find it persuasive. Once an invention has been made it is generally possible to postulate a combination of steps by which the inventor might have arrived at the invention that he claims in his specification if he started from something that was already known. But it is only because the invention has been made and has proved successful that it is possible to postulate from what starting point and by what particular combination of steps the inventor could have arrived at his invention. It may be that taken in isolation none of the steps which it is now possible to postulate, if taken in isolation, appears to call for any inventive ingenuity. It is improbable that this reconstruction *a posteriori* represents the mental process by which the inventor in fact arrived at his invention, but, even if it were, inventive ingenuity lay in perceiving that the final result which it was the object of the inventor to achieve was attainable from the particular starting point and in his selection of the particular combination of steps which would lead to that result."

52. The second is that caution is required before finding that a claimed invention is obvious over common general knowledge alone: see in particular *ratiopharm GmbH v NAPP Pharmaceutical Holdings Ltd* [2008] EWHC 3070 (Pat), [2009] RPC 11 at [158] (Pat) (Floyd J).

The judge's assessment as to obviousness of EP155

53. The judge considered whether EP155 was obvious over Bijl at [254]-[316]. Having considered some preliminary topics at [255]-[273], the judge set out his conclusions at [274]-[316]. His reasoning was as follows.

54. He began with the following assessments:

> "274. The Skilled Team reading Bijl at the priority date of EP155 (May 2002) would, in my view, regard it as a strange document for a number of reasons:
>
> i) First, whilst there was a line of processes in which oils were extracted from intact cells (discussed in the SCO Book), the Skilled Team would regard one of the key statements in Bijl '*it has now been found that a good quality PUFA oil can be achieved if the cells are in fact*

lysed' as significantly out of step with what the Skilled Team would know was happening in the industry in commercial production, where mechanical lysis was used. Indeed, the Skilled Team would recognise that Bijl's preference for lysis by homogenisation simply reflected what was already the position in commercial production.

ii) Second, of the remaining problems with Bijl which DSM identified, and which I listed out at [212] above, two in particular would, in my view, strike the Skilled Team. First, the absence of any recognition that an emulsion would form and second, the idea that centrifugation alone could break the emulsion formed from mechanical lysis. As to that second point, Mr Dueppen said it would be wonderful if it did, but his view was that the Skilled Team would not believe it would, or, at the very least, be sceptical of the claim.

iii) Third, because of the lysis teaching and the breadth of the claims set out in Bijl, I consider the Skilled Team would conclude that Bijl was an attempt to stake a claim to a wide area of the field, some of which was standard and known (such as mechanical lysis and winterisation), some of which was known at a general level (enzymatic lysis), some of which was desirable but speculative (solventless extraction, separation by centrifugation alone) and some of which ignored the important problem of breaking the inevitable emulsion which would form, particularly if mechanical methods of lysis were used.

275. Consequently, the Skilled Team would be cautious about Bijl and would have to think about whether any part of it provided sufficient motivation to take it forward.

276. As I mentioned above, both DSM and Mara contended that the Skilled Team would be interested in Bijl's teaching, albeit different parts of it.

277. DSM and their experts suggested that the Skilled Team would be intrigued sufficiently by the suggestion of separation by centrifugation (and without a solvent) to reproduce the two Examples to see if the processes described would actually work. Bearing in mind that in both examples mechanical lysis was used, I conclude that, whilst centrifugation might have resulted in *some* separation of oil from the emulsion, the amount would be small, such that centrifugation alone would not be seen as worth taking forward, at least for mechanically lysed biomass."

55. At [278] the judge identified two important questions:

> "A central question on Bijl is whether the Skilled Team would be motivated to apply the suggestion of enzymatic lysis, either at all, or to *Schizochytrium* microbial cells. Another key question is whether the Skilled Team appreciated that an emulsion from enzymatic lysis would be easier to break than an emulsion generated by mechanical lysis."

56. At [279] the judge noted that, during the trial, Mara sought to develop the proposition that an emulsion formed following enzymatic lysis would be easier to break than an emulsion formed following mechanical lysis methods. The judge could not discern that any expert had said that this was common general knowledge in May 2002. At [280] the judge explained that the proposition was deployed by Mara by arguing that, if the skilled team had any concerns about breaking the emulsion after the separation step, then that would push the skilled team toward choosing enzymatic lysis. Having considered various pieces of evidence on this topic, the judge concluded:

> "283. …. No-one said that the Skilled Team would spontaneously understand that the emulsion formed from enzymatic lysis would be easier to break than an emulsion from mechanical lysis. If the Skilled Team turned their mind to that specific question, they might well hypothesise that it would and of course, if the Skilled Team started experimenting with enzymatic lysis, they would be likely to discover that the emulsion so formed was easier to break.
>
> 284. The problem for Mara is that they could not rely on Dr Kyle's evidence on obviousness of EP155 and the evidence from Mr Dueppen (and Dr Wynn) was firmly based on their experience in commercial production. I did not receive any (reliable) evidence as to what would have been the reaction to Bijl amongst those accustomed to working at lab scale."

57. At [285] the judge said:

> "In my view, the best way to evaluate this case is to apply the well-known *Pozzoli* approach. As for the first two stages, I have identified the Skilled Team and their CGK above. The third stage is to identify the differences between Bijl and claim 1 of EP155. The clearest difference is the use of *Schizochytrium* cells, so I refer to the choice of Schizochytrium as **Step 1**. A more subtle difference is the bringing to the fore of the use of enzymatic lysis with a suitable protease from (a) the general list in Bijl of CGK methods of lysis and (b) the general list of possible enzymes which could be used in enzymatic lysis, plus the later processing to obtain the desired DHA-rich oil. This would involve the following steps:
>
> i) **Step 2**: decide to investigate the use of enzymatic lysis.
>
> ii) **Step 3A**: make a choice as to the enzyme(s) to try.

iii) **Step 3B**: do a literature search as to whether there was any information as to the cell wall composition of Schizochytrium cells to aid in the selection of a suitable enzyme and/or

iv) **Step 3C**: perform some lab scale experiments to find out whether certain well-known enzymes would lyse Schizochytrium cells e.g. alkaline proteases, cellulases.

v) **Step 4**: decide to use an alkaline protease to enzymatically lyse Schizochytrium cells.

vi) **Step 5**: try the separation techniques taught in Bijl at [0028](f)-(h) and in the Examples to see whether the desired DHA could be obtained with a sufficiently good yield or use other separation techniques."

58. The judge said at [286] that he agreed with Mara that, if the earlier steps were obvious, step 5 would not stand in the way of a finding that claim 1 was obvious.

59. The judge outlined Mara's case on step 1 at [287]-[292]. Although the judge did not explicitly find that this step was obvious, he recorded that both Mr Dueppen and Dr Wynn agreed that *Schizochytrium* strain ATCC 20888 was attractive to use in the light of Bijl.

60. The judge considered step 2 at [293]-[297]. He noted Mara's submission that the method of lysis was in Mr Dueppen's realm and evidence from Dr Wynn that Bijl was of more interest to the bioprocessing engineer than to the microbiologist. Although Mara had submitted that Mr Dueppen had agreed in cross-examination that using enzymatic lysis was an obvious thing to do, the judge found the evidence in question was that the skilled team *could* use enzymatic lysis, not that they *would* do so. Finally, he noted that Mara sought to bolster the choice of enzymatic lysis on the grounds that (i) it would avoid the expense, at least for a start-up, of investing in a homogeniser and (ii) it would produce a gentler emulsion that would be easier to break. The judge noted that he had discussed the latter point at [283].

61. The judge considered steps 3A-3C at [298]-[306]. In summary, he found that, not only did Bijl expressly suggest an alkaline protease, but also proteases would be high on the list of enzymes to choose anyway. Step 3B was an obvious step, but it might be bypassed, and it was routine to do tests such as those in step 3C.

62. Although the judge did not explicitly discuss step 4, it is implicit in his reasoning that step 4 would be obvious if step 2 was.

63. The judge concluded as follows:

"309. It should not be a surprise that the above series of steps can be formulated to lead from the prior art Bijl to claim 1 of EP155, but the key question is whether those are a series of *Technograph* steps or whether the combination of all those steps was obvious to the Skilled Team in 2002.

310. I have come to the conclusion that EP155 was not obvious over Bijl. Although it is clear that Mr Dueppen and Dr Wynn took somewhat of a negative view of Bijl in their written evidence, those views were ameliorated in the answers they gave in cross-examination. I also consider that Dr Wynn was overly resistant to suggestions that the Skilled Team would be able to decide on a suitable enzyme. *If* the Skilled Team had decided to investigate enzymatic lysis, they would have found a suitable enzyme or combination of them (e.g. a protease and a carbohydrase). However, overall the evidence extracted from Mr Dueppen and Dr Wynn in cross-examination did not, in my view, establish a case of obviousness for four main reasons.

311. First, when one stands back from the detail, the steps I discussed above show that in fact, Mara's case uses Bijl as nothing more than a hook to pick up the suggestion of enzymatic lysis. Beyond that, Mara's case appeared to me largely to discard the rest of the teaching of Bijl, so this case is not significantly different from a case of obviousness over the CGK concept of enzymatic lysis.

312. The related, second, point is that what was new in Bijl (for the Skilled Team) was not the mention of the CGK methods of lysis but the suggestion of a solventless separation step using centrifugation, with the optional addition of one or more salts. This separation step was demonstrated in two examples, each of which featured mechanical lysis. There was no example drawing attention to enzymatic lysis.

313. Third, enzymatic lysis was CGK and the notion had been around for some years. What was unexplained in Mara's case was why this particular mention of enzymatic lysis in Bijl would trigger the Skilled Team to investigate it, whereas other mentions (e.g. in conferences recorded in the SCO Book) had not. Bijl was published in February 2002, only a few months before the EP155 Priority Date of 3 May 2002. However, in view of the way Mara's case was developed the question: if it was obvious, why was it not done before? has greater significance, to which no answer was supplied.

314. Fourth, despite Mara's best efforts, there was no evidence to support their suggestion that the Skilled Team, on reading Bijl, would understand the emulsion 'problem' was caused by the violence of mechanical lysis, that enzymatic lysis would produce a gentler emulsion and this thought process would point the Skilled Team towards taking up enzymatic lysis.

315. Overall, it is difficult to avoid the conclusion that there was an undue focus on enzymatic lysis, caused by hindsight.

> 316. The issue was reasonably finely balanced such that, with better expert evidence (i.e. which gave a reason why the Skilled Team would focus on enzymatic lysis without hindsight), I might well have been able to find that EP155 was obvious, but, on the basis of the evidence I received, EP155 was valid."

Standard of review on obviousness appeals

64. Since the assessment of obviousness involves a multi-factorial evaluation by the judge, this Court is only entitled to intervene if the judge erred in law or principle: see *Actavis Group PTC EHF v ICOS Corp* [2019] UKSC 15, [2019] Bus LR 1318 at [78]-[81]. See also *Lifestyle Equities CV v Amazon UK Services Ltd* [2024] UKSC 8, [2024] Bus LR 532 at [46]-[50] (Lord Briggs and Lord Kitchin) and *Iconix Luxembourg Holdings SARL v Dream Pairs Europe Inc* [2025] UKSC 25 at [94]-[95] (Lord Briggs and Lord Stephens).

Mara's appeal on EP155

65. Mara maintains that claim 1 of EP155 is obvious over Bijl. Bijl describes extraction of oil from single cell organisms where the cells are lysed. It proposes three ways to lyse, including mechanical (homogenisation) and enzymatic. Enzymatic lysis is mentioned not only in the specification at [0014]-[0015] (paragraph 40 above), but also in the abstract (paragraph 33 above) and in claim 2. Furthermore, the specification also specifically identifies proteases as suitable enzymes in [0015]. While Bijl does not specifically identify *Schizochytrium*, strain ATCC 20888 was common general knowledge and attractive to use, as the judge found.

66. Mara contends that each of the four reasons given by the judge at [311]-[314] for rejecting this case are flawed. Before turning to consider Mara's arguments on these points, I would observe that it is difficult to suppose that an experienced patent judge should have erred in principle in all four respects. This is all the more so given that, as DSM point out, Mara does not challenge the judge's conclusions in [274] (the skilled team would regard Bijl as a strange document) and [278] (the skilled team would nevertheless be sufficiently intrigued by the suggestion of separation by centrifugation (without a solvent) to try reproducing the Examples, but would conclude that centrifugation was not worth taking forward, at least for mechanically lysed biomass).

67. Mara argues that the judge's first reason is wrong because its case was firmly rooted in the disclosure of enzymatic lysis in Bijl, and therefore it was significantly different from a case of obviousness over common general knowledge alone. As DSM points out, this was a matter for the judge's evaluation. He made no error of principle, and his conclusion was one that he was plainly entitled to reach. As he pointed out, what was new about Bijl was the suggestion of separation by centrifugation alone, but Mara's case did not involve the skilled team progressing that suggestion. Furthermore, Mara's case requires the skilled team to pursue development based on Bijl even after they have found that reproducing the Examples, which employ Bijl's preferred method of mechanical lysis, does not yield good results. Still further, Bijl discloses a wide selection of microbes, but Mara's case requires the skilled team to discard them all in favour of *Schizochytrium*, which is not mentioned. In substance, therefore, all that Mara seeks to derive from Bijl is the suggestion of using enzymatic lysis, but that was a common general knowledge technique.

68. Mara says that the judge's second reason is wrong because the absence of a specific example does not negate Bijl's explicit teaching about enzymatic lysis. The answer to this argument is the same: this was a matter for the judge's evaluation, he made no error of principle and his conclusion was at least open to him. As the judge recognised, his first and second reasons are closely related.

69. Mara submits that the judge's third reason is wrong because there is a clear answer to the question "why was it not done before?", namely that Bijl was published only three months before the priority date of EP155. As DSM points out, the judge acknowledged this. Given the judge's conclusion that Mara's case was not significantly different from a case of obviousness over common general knowledge alone, however, Mara's answer to the question does not stand up.

70. Mara contends that the judge's fourth reason is wrong because there *was* evidence to support its suggestion that the skilled team, on reading Bijl, would understand the emulsion problem was caused by the violence of mechanical lysis, that enzymatic lysis would produce a gentler emulsion and this thought process would point the skilled team towards taking enzymatic lysis forward. Mara relies in particular on two extracts from the evidence of Dr Wynn which the judge did not refer to at [281]-[283]. I should explain that it is this contention that persuaded the judge to grant Mara permission to appeal.

71. In addressing this contention, it is important to start by noting that Mara accepts that the judge did not find that it was common general knowledge that enzymatic lysis would produce a gentler emulsion which would be easier to break than the emulsions produced by mechanical methods of lysis. Nor does Mara contend that the judge should have made such a finding on the evidence. Instead, Mara argues that the skilled team, having read Bijl, would appreciate that homogenisation would be likely to lead to an emulsion being formed which would be hard to break, whereas enzymatic lysis would lead to a gentler emulsion being formed which would be easier to break, and would therefore be encouraged to try enzymatic lysis.

72. Mara relies firstly upon paragraph 159 of Dr Wynn's first report. Having referred to the results claimed in Example 1 of Bijl, Dr Wynn commented:

> "The Skilled Microbiologist would find these results very surprising, as it is well known that when lipids and water are mixed, particularly under high-turbulence conditions, such as those present in a homogeniser, it is likely an emulsion would form."

This says nothing about enzymatic lysis producing a gentler emulsion.

73. Secondly, and more importantly, Mara relies upon the following passage in Dr Wynn's oral evidence when asked about what he had said in paragraph 159:

> "Q. Sure. The reason that you give is the fear of an emulsion which you say is a particular problem using the high turbulence condition of a homogenizer?

> A. Which emulsion is the fear that would particularly happen if you did it as described in the examples.
>
> Q. So an enzyme would be better on that score; yes?
>
> A. If you could get an enzyme system to work, it would potentially be better, it would be better than that; yes."

74. In my judgment this evidence does not get Mara home for three reasons. First, as Mara itself submitted to the judge, Dr Wynn was the wrong expert to ask about this. As counsel for DSM accepted, it was legitimate for Mara to cross-examine Dr Wynn on the matter given what he had said in paragraph 159, but little weight can be given to his evidence compared to that of Mr Dueppen. Secondly, it was not put to Dr Wynn that the skilled reader of Bijl would go through the thought process postulated by Mara. All that was put was that enzymatic lysis would *in fact* be better, and even that Dr Wynn only accepted with the qualification "[i]f you could get an enzyme system to work". Thirdly, it difficult to see why the skilled reader of Bijl would go through the thought process postulated by Mara unless it was common general knowledge that enzymatic lysis would lead to a gentler emulsion being formed which would be easier to break. There is nothing in Bijl itself to suggest this train of thought. As the judge said at [315], the argument smacks of hindsight.

75. Accordingly, I do not consider that the judge made any error in his assessment that, on the evidence, claim 1 of EP155 was not obvious over Bijl. I would therefore dismiss Mara's appeal.

Additional common general knowledge as at the priority date of EP801

76. The parties agreed that between 2002 and 2010 there was an increasing interest in moving away from the use of hexane, in particular due to factory safety and consumer marketing. Certain companies, including Martek, started to use isohexane as an alternative. Isohexane is still a volatile and flammable organic compound, but was not classified (at least by the United States regulator) as a hazardous air pollutant. Isohexane was therefore a safer alternative, but there was still a desire to move to even less harmful alternatives. There was also increasing interest in the FRIOLEX process between 2002 and 2010.

77. The judge considered three disputed topics at [649]-[670]. Only the first is material for present purposes. This is whether the reason there was no commercial aqueous extraction method (without any organic solvent) in 2010 was (i) because there was no known effective way of breaking the emulsion, or (ii) for commercial reasons.

78. The judge found at [656] (evidence references omitted):

> "Following the evidence, it is clear that the following were CGK methods for seeking to break an emulsion:
>
> i) **Use of a polar organic solvent** such as isopropanol (as in the FRIOLEX process). This worked by the water-miscible solvent making the aqueous phase even more

> polar, and so less favoured by the non-polar lipids such as TAGs ….
>
> ii) **Addition of salt**. The mechanism of this was to increase the density of the heavy (water-containing) phase and encourage better separation, particularly upon centrifugation ….
>
> iii) **Heating**, which worked by increasing the energy in the system and increasing the rate at which droplets of oil can meet and coalesce ….
>
> iv) **Stirring** (gentle agitation), which works on a similar principle to hearing, by increasing the rate at which droplets may come into contact and coalesce …. Vigorous agitation, however, can promote formation of emulsion ….
>
> v) **Centrifugation**, which when used alone could break weak emulsions, and for stronger emulsions would be used along with other approaches ….
>
> vi) **Combinations** of the above. For instance, heating and stirring would have been used with one of more of the other techniques. Also, centrifugation amplifies the effect of gravity, so works in combination with the increased density differential caused by addition of salt."

79. The judge concluded at [660]:

> "In my judgment, the evidence established the following:
>
> i) The various techniques covered in [656] above were CGK as possible methods for breaking an emulsion. Which ones would actually work effectively in practice would depend on the strength of the emulsion. If in doubt, the Skilled Team would conduct a simple lab test at the bench to see which techniques or combinations would work effectively.
>
> ii) As a matter of fact, no solventless method had been developed at a commercial scale.
>
> iii) But the absence of such a method at a commercial scale was adequately explained by the commercial barriers, namely Martek's patent portfolio."

EP801

80. EP801 is a lengthy document with 352 paragraphs of specification, 18 claims, five figures and a page of references, running to a total of 108 pages. I will summarise the

parts that are relevant for the purposes of this judgment by reference to the headings and sub-headings in the specification.

Background of the invention

81. *Field of the invention*. The specification begins at [0001]:

> "The present invention relates to processes for obtaining a lipid from a cell by lysing the cell, raising a pH of the cell and/or contacting the cell with a salt, and separating the lipid. The scope of protection is defined by the process as set out in the claims."

82. *Background art*. Under this heading, two methods of lipid extraction are described at [0002]-[0003]. In the first, the lipid is separated by solvent extraction, typified by the well-known hexane method. The second involves lysing a cell in a fermentation broth using mechanical force (e.g. homogenisation), enzymatic or chemical treatment, with the separation of the lipid from the resulting composition using an organic solvent e.g. isopropanol.

83. The problems with these processes are discussed in [0004], including that industrial scale production requires a large amount of volatile and flammable organic solvent, creating hazardous operating conditions, the difficulties in recovering the organic solvent and the costs of the processes.

84. The specification states at [0005]:

> "Therefore, there is a need for a process for obtaining lipids from a cell which does not use an organic solvent. Several processes have been proposed for separating a lipid from a cell without the use of an organic solvent. For example, U.S. Patent No. 6,750,048 discloses an aqueous washing process whereby an emulsion is washed with aqueous washing solutions until a substantially non-emulsified lipid is obtained. However, in some embodiments, this process requires multiple washing steps, which require substantial cost and time. U.S. Patent No. 7,431,952 discloses a process whereby lysed cells are centrifuged to remove cell wall debris and then oils are extracted and purified. However, this process provides a crude oil that requires extensive further purification. Thus, what is needed is a process that does not utilize a volatile solvent to extract a lipid from a cell, and which can be performed using readily available equipment and a minimum number of steps to provide a highly pure lipid."

Brief summary of the invention

85. Paragraph [0007] is a consistory clause corresponding to claim 1. The specification then lists at [0008]-[0052] a long series of optional features. Most of these are prefaced "[i]n some embodiments". Many are expressed as very wide ranges, for example "the agitating is for 5 minutes to 96 hours".

86. All of [0008]-[0026] and [0053] are directed to processes. By contrast, [0038]-[0052] are concerned with lipids obtained by the processes of the invention. This is despite the fact that there are no claims to lipids, only claims to processes.

87. The paragraphs concerning lipids include the following:

> "[0044] In some embodiments, the lipid is a crude lipid. In some embodiments, the crude lipid optionally has less than 5% by weight or volume of an organic solvent.
>
> [0052] In some embodiments, the extracted microbial lipid is a crude lipid or a crude oil[.]The crude lipid has less than 5% by weight or volume of an organic solvent."

Detailed description of the invention

88. Paragraph [0056] is another consistory clause corresponding to claim 1. The specification then lists at [0057]-[0085] another series of optional features. Some of these are prefaced "[i]n some embodiments". All of [0057]-[0060], [0062]-[0076] and [0085] are directed to processes, while [0061] and [0077]-[0084] are concerned with lipids.

89. Each of the processes described in [0057]-[0060] includes the feature "wherein the lipid optionally contains less than 5% by weight or volume of an organic solvent". For example, [0057] states:

> "There is further disclosed a process for obtaining a lipid from a cell composition, the process comprising raising the pH of the cell composition to 8 or above to lyse the cell composition and demulsify the cell composition, adding a salt to the cell composition, and separating a lipid from the demulsified cell composition, wherein the lipid optionally contains less than 5% by weight or volume of an organic solvent. …"

90. At [0075] the specification states:

> "In some embodiments, the process does not add an organic solvent to the lysed cell composition. …"

91. *Overview*. The specification states at [0086]:

> "Generally, the processes of the present invention do not utilize an organic solvent in order to extract or otherwise separate a lipid. Thus, in some embodiments, an organic solvent is not added to a cell broth comprising plant material or fermentation broth comprising a microbial cell, is not added to a cell composition, is not added to a lysed cell composition, or is not added to a lipid during a process of the present invention in an amount or concentration sufficient to extract a lipid. In some embodiments, an organic solvent can be added to a cell composition, a lysed cell composition, or a demulsified cell composition. In such embodiments, the organic solvent is added

> in a concentration less than 5%, less than 4%, less than 3%, less than 2%, less than 1%, less than 0.5%, less than 0.1%, or less than 0.05% by volume. … An organic solvent as defined herein can be optionally added to a lysed cell composition, for example, as a component of a base and/or a salt for contacting with the lysed cell composition. However, in such embodiments the organic solvent is present in a concentration such that the lipid is not substantially extracted from the cell composition, lysed cell composition, or demulsified cell composition by the solvent (i.e., in a concentration of less than 5%, less than 4%, less than 3%, less than 2%, less than 1%, less than 0.5%, less than 0.1%, or less than 0.05% by volume or weight)."

92. *Definitions*. Although the specification contains a series of definitions and explanations from [0088]-[0107], none of these are material for present purposes.

93. *Processes*. This section contains another long series of paragraphs from [0108]-[0177] describing processes of the invention. For present purposes it is only necessary to mention the following:

> "[0167] In some embodiments, a broth comprising a microbial cell or a broth comprising plant material is concentrated to provide a lipid concentration of at least 4%, at least 5%, at least 10%, at least 15%, at least 20%, at least 25%, or at least 30% by weight of the broth. In some embodiments, a broth comprising a microbial cell or a broth comprising plant material is concentrated to provide a lipid concentration of 4% to 40%, 4% to 30%, 4% to 20%, 4% to 15%, 5% to 40%, 5% to 30%, 5% to 20%, 10% to 40%, 10% to 30%, 10% to 20%, 15% to 40%, 15% to 30%, 20% to 40%, 20% to 30%, 25% to 40%, or 30% to 40% by weight of the broth.
>
> [0168] In some embodiments, a cell composition or a lysed cell composition is concentrated to provide a lipid concentration of at least 4%, at least 5%, at least 10%, at least 15%, at least 20%, at least 25%, or at least 30% by weight of the lysed cell composition. In some embodiments, a cell composition or a lysed cell composition is concentrated to provide a lipid concentration of 4% to 40%, 4% to 30%, 4% to 20%, 4% to 15%, 5% to 40%, 5% to 30%, 5% to 20%, 10% to 40%, 10% to 30%, 10% to 20%, 15% to 40%, 15% to 30%, 20% to 40%, 20% to 30%, 25% to 40%, or 30% to 40% by weight of the lysed cell composition."

94. *Microbial lipids*. Paragraphs [0178]-[0204] are directed to lipids obtained by the processes of the disclosure. The specification states in [0178]:

> "… In some embodiments, the crude [microbial] lipid has less than 5%, less than 4%, less than 3%, less than 2%, or less than 1% by weight or volume of an organic solvent. …"

95. Similarly, it states in [0189] and [0201]:

> "… In some embodiments, the crude lipid has less than 5% by weight or volume of an organic solvent. …"

Examples

96. The specification describes 39 Examples. Examples 1-21 are examples of the claimed process. Example 22 involves extraction from oil seeds. Examples 23-28 are comparative examples using hexane extraction and the FRIOLEX process. Examples 29-39 provide further analytical data.

The claims

97. The only claim in issue is claim 1. DSM applied to amend claim 1 as granted to introduce a feature from claim 10. The only ground on which Mara opposed the amendment was that it did not save the validity of the claim. Claim 1 as proposed to be amended (referred to as "claim 1A" at trial) is as follows:

> "A process for obtaining a lipid from a microbial cell, said process comprising:
>
> a) lysing a cell to form a lysed cell composition;
>
> b) adding a base to the lysed cell composition, raising the pH of the lysed cell composition to 8 or above to demulsify the cell composition;
>
> c) one or more of cl, c2, c3 and c4;
>
> c1) adding a salt to the lysed cell composition to demulsify the cell composition
>
> c2) heating the lysed cell composition to demulsify the cell composition
>
> c3) agitating the lysed cell composition to demulsify the cell composition
>
> c4) adding a second base to the lysed cell composition to demulsify the cell composition;
>
> and
>
> d) separating a lipid from the demulsified cell composition;
>
> wherein the lipid contains less than 5% by weight of an organic solvent
>
> and wherein the lysing comprises enzymatic treatment."

The issues raised by DSM's appeal on EP801

98. Mara contended that EP801 was obvious over United States Patent Application No. US 2006/00099693 entitled "High quality lipids and methods for producing by enzymatic liberation from biomass" published on 11 May 2006 ("Kobzeff"). The judge accepted this contention. Ground 1 of DSM's appeal is that the judge was wrong to hold that EP801 was obvious over Kobzeff. Ground 1 has two limbs. Ground 1(a) is that the judge wrongly construed the integer of claim 1 of EP801 "wherein the lipid contains less than 5% by weight of an organic solvent". Ground 1(b) is that the judge was wrong to hold that, even on DSM's construction of that integer, EP801 was obvious over Kobzeff. Ground 1(b) only arises if DSM succeed on ground 1(a). DSM do not contend that EP801 was not obvious over Kobzeff if the judge correctly construed the claim.

99. Ground 2 of DSM's appeal is that the judge wrongly construed the integer of claim 1 of EP801 "raising the pH of the lysed composition to 8 or above", and therefore erred in some of his conclusions on infringement. Ground 2 only arises if DSM succeed on both grounds 1(a) and 1(b).

100. Mara contends by a respondent's notice that, if the judge erred in the respects contended for by DSM, he should have held that EP801 was obvious over International Patent Application No. WO 02/10423 published on 7 February 2002 ("Hendrik"). Hendrik is part of the same family of patents as Bijl, and its content is the same. Mara accepts that it can only succeed on its respondent's notice if it succeeds on its EP155 appeal. Since I have concluded that that appeal should be dismissed, the same applies to the respondent's notice.

The law as to interpretation of patent claims

101. Although there was no dispute either before the judge or this Court as to the law concerning the interpretation of patent claims, it is worth setting out the much-cited summary of principles of claim construction by Jacob LJ in *Virgin Atlantic Airways v Premium Aircraft Interiors* [2009] EWCA Civ 1062, [2010] RPC 8 at [5] (omitting two sub-paragraphs concerning the doctrine of equivalents in the light of the subsequent decision of the Supreme Court in *Actavis UK Ltd v Eli Lilly & Co* [2017] UKSC 48, [2017] RPC 21):

> "(i) The first overarching principle is that contained in Art.69 of the European Patent Convention.
>
> (ii) Art.69 says that the extent of protection is determined by the claims. It goes on to say that the description and drawings shall be used to interpret the claims. In short the claims are to be construed in context.
>
> (iii) It follows that the claims are to be construed purposively—the inventor's purpose being ascertained from the description and drawings.
>
> (iv) It further follows that the claims must not be construed as if they stood alone—the drawings and description only being used to

resolve any ambiguity. Purpose is vital to the construction of claims.

(v) When ascertaining the inventor's purpose, it must be remembered that he may have several purposes depending on the level of generality of his invention. Typically, for instance, an inventor may have one, generally more than one, specific embodiment as well as a generalised concept. But there is no presumption that the patentee necessarily intended the widest possible meaning consistent with his purpose be given to the words that he used: purpose and meaning are different.

(vi) Thus purpose is not the be-all and end-all. One is still at the end of the day concerned with the meaning of the language used. Hence the other extreme of the Protocol—a mere guideline—is also ruled out by Art.69 itself. It is the terms of the claims which delineate the patentee's territory.

(vii) It follows that if the patentee has included what is obviously a deliberate limitation in his claims, it must have a meaning. One cannot disregard obviously intentional elements.

(viii) It also follows that where a patentee has used a word or phrase which, acontextually, might have a particular meaning (narrow or wide) it does not necessarily have that meaning in context.

…

(xi) Finally purposive construction leads one to eschew the kind of meticulous verbal analysis which lawyers are too often tempted by their training to indulge."

Ground 1(a) of DSM's appeal on EP801

102. The judge held that "wherein the lipid contains less than 5% by weight of an organic solvent" refers to the lipid *resulting from* the claimed process. DSM contend that it refers to the lipid *during* the process. On DSM's construction, the lipid must contain less than 5% organic solvent throughout the process, including when it is part of the lysed cell composition and of the demulsified cell composition.

103. An oddity of this feature of claim 1 is that it refers to 5% by weight whereas the passages in the specification set out in paragraphs 87-95 above generally refer to 5% by volume or weight. Neither side suggested that this was material to the present issue, however.

104. Although at first blush it also seems odd that it refers to lipid containing organic solvent, rather than organic solvent containing lipid, this is presumably explained by the low concentration of solvent required. Again, neither side suggested that this in itself was significant; but it is related to a point discussed below.

105. DSM rely upon three main arguments in support of their construction. The first is that the claims of EP801 are claims to processes, not claims to the resulting lipids. DSM

argue that it makes little sense to interpret a key feature of claim 1 as being directed to the end result of the process.

106. DSM's second main argument is to emphasise the inventors' purpose. DSM argue that the central teaching of EP801 is that it provides an aqueous extraction process which does not involve organic solvent. This had long been desired in the art, and it is identified as the problem to which the invention is addressed at [0005] (paragraph 84 above). Accordingly, the skilled team would not understand the language of the claim to be referring to a process in which organic solvent is used to extract lipid from microbial cells. Furthermore, it was common general knowledge that any organic solvent-based extraction process would involve substantially all of the solvent being removed before the lipid could be used (see paragraph 27 above). Such processes would therefore be expected to produce lipids containing less than 5% solvent anyway. Again, therefore, it is the process that is inventive, not the product of that process.

107. DSM's third main argument is that the specification supports their interpretation. This argument focusses in particular on [0086] (paragraph 91 above). DSM say that this makes it clear that, while using no organic solvent is preferred, there is an option to include less than 5% "such that the lipid is not substantially extracted … by the solvent". Furthermore, all of the Examples other than the comparative Examples use no organic solvent or less than 5% (save that in Example 8 organic solvent is used to test whether any oil is present in the waste phase, not for extraction).

108. I am not persuaded by these arguments. In my view the judge correctly construed the claim as requiring that the lipid resulting from the claimed process contains less than 5% of organic solvent. The principal reason for this is that the words "the lipid" in the feature in question refer back to "a lipid" in the first clause of the claim and then to "a lipid" in step (d). In the context of the claim, therefore, it is clear that it is the lipid obtained from the process that must have less than 5% of organic solvent. It would have been straightforward to draft a claim that limited the proportion of organic solvent present in each step of the process, but that is not how this claim is drafted.

109. Furthermore, whereas it is relatively easy to see what is meant by the lipid containing less than 5% of organic solvent if this refers to the end result of the process after the lipid has been separated from the demulsified lysed cell composition, it makes little sense to impose a requirement that the lipid contains less than 5% of organic solvent in each step of the process. In step (b), for example, the lipid is part of the lysed cell composition, which is present as an emulsion (hence the demulsification in step (c)). While it would be perfectly intelligible to stipulate that the lysed cell composition should contain less than 5% of organic solvent, it seems very odd to specify that one component of the composition should contain less than 5% of organic solvent. There was some debate during the course of argument as to how the percentage by weight of organic solvent in the lipid could be determined if the lipid was mixed up with other components of the composition. I am content to assume in DSM's favour that this would be technically possible, but the point remains that the claim makes more sense if construed as the judge did.

110. This point is reinforced by the fact that [0167] and [0168] refer to percentages by weight of the broth and of the lysed cell composition respectively (see paragraph 93 above). The concentration referred to is of the lipid rather than of the organic solvent, but nevertheless these passages demonstrate that the drafter of EP801 was aware of the

possibility of using concentration in the broth and in the lysed cell composition as criteria.

111. So far as DSM's first argument is concerned, there is no reason why a process claim should not be defined in part by its result.

112. As for the second argument, purpose is not conclusive. As Mara points out, the specification discloses both processes and lipids obtained by such processes, and clearly differentiates between the two. Furthermore, some passages in the specification are on any view concerned with lipids containing less than 5% of organic solvent: see in particular [0044], [0052], [0178], [0189] and [0201] quoted in paragraphs 87, 94 and 95 above. Other passages are concerned with processes resulting in lipids which optionally contain less than 5% of organic solvent: see [0057]-[0060] discussed in paragraph 89 above. Thus there is clear basis in the specification for claims limited to processes which result in lipids containing less than 5%. The fact that it was conventional to remove organic solvents used in the extraction process does not make this a redundant feature of the claim.

113. Turning to the third argument, I do not consider that [0086] provides clear support for DSM's interpretation. It begins by saying that "generally" processes of the invention do not use organic solvent. This ties in with the statement in [0075] that "[i]n some embodiments, the process does not add an organic solvent …" (paragraph 90 above). [0086] then says that "in some embodiments" organic solvent is not added in an amount or concentration sufficient to extract a lipid. These statements both allow other embodiments to include the addition of organic solvent in such an amount or concentration. Furthermore, although it goes on to say that organic solvent can be added in a concentration of less than 5%, in context this appears to mean 5% of the cell composition, the lysed cell composition or the demulsified cell composition. That makes sense for the reasons discussed above.

Kobzeff

114. Kobzeff is a member of the same family of patents as EP155, and is substantially similar in its disclosure to EP155. I will summarise the disclosure using the headings in the specification.

Field of the invention

115. Kobzeff states at [0002]:

> "The present invention is directed to high-quality lipids, and in particular lipids with low anisidine values. Methods are provided for producing high-quality lipids that include the step of liberating lipids from biomass, such as algal biomass, using enzymatic treatment."

Background of the invention

116. Kobzeff states at [0004]:

> "Problems with prior methods include poor product quality due to chemically aggressive conditions of high temperature and

> high pH, high costs due to the need to dry the biomass or for additional equipment such as homogenizers and pressure vessels."

Summary of the invention

117. This section includes the following statement at [0011];

> "A further method of the present invention is a method for liberating a lipid from a biomass comprising liberating the lipid at a temperature of about 10 C to about 80 C at a pH level of from about pH 5 to about pH 9. This method is conducted in the substantial absence of an extraction solvent."

118. It is common ground that the reference to the substantial absence of "extraction solvent" is a reference to a solvent which solubilises the oil, like hexane, and not to the sort of solvent used in the FRIOLEX process, like isopropanol.

Detailed description

119. This section explains:

> "[0015] The use of protease enzymes, or protease enzymes in combination with surfactants, provides an economical and simple way of releasing the lipid from the biomass under mild conditions conducive to making high-quality lipid. The lipid can then be isolated from the rest of the fermentation broth by centrifugation of the mixture. …
>
> [0016] The use of protease enzymes can help break down emulsion-stabilising proteins present, thereby aiding in the breaking of an emulsion. …"

120. In [0020] microorganisms which are suitable sources for long-chain fatty acids are discussed. Among those disclosed are *Schizochytrium* strain ATCC 20888.

121. At [0024]-[0031] a preferred embodiment is described. I shall follow the judge's example of setting these paragraphs out with the same rather odd levels of indentation as in the specification:

> "[0024] One preferred embodiment of the process of the present invention includes:
>
> [0025] Obtaining lipid-bearing single cell organisms
>
> [0026] Treating with protease or a combination of surfactant and protease
>
> [0027] Separating the lipid from the broth (may be an emulsion)

> [0028] May require additional treatment with a polar organic solvent, salt, precipitating agent, another enzyme (protease or other kind), heating, cooling.
>
> [0029] If the lipid from the above step is in the form of an emulsion, this product can be used 'as is' or dried and used or treated to release the lipid from the emulsion
>
> [0030] Treatment can include treatment with a polar organic solvent, salt, precipitating agent, another enzyme (protease or other kind), heating, cooling, etc.
>
> [0031] The lipid can then be dried, refined, bleached, deodorized and/or reacted as needed."

122. Kobzeff goes on at [0036]:

> "In some cases, after the lipids are liberated from the biomass, the lipids can be separated directly from the undesired materials (e.g., cellular debris), such as by centrifugation, or other appropriate methods. In other cases, an agent such as an alcohol or other polar organic solvent can be added to facilitate the separation of the liberated lipid from the other material. In still other cases, a solvent can be added that will dissolve the lipid and facilitate the separation of the liberated lipid from the other material, e.g., by solvent extraction. …"

123. It is common ground that [0036] discloses three options:

i) separation of the lipids directly with no solvent of any sort involved;

ii) use of a polar organic solvent, in a FRIOLEX-type process; or

iii) a solvent can be used to solubilise the oil, e.g. hexane, in which case no emulsion would arise.

Examples

124. Kobzeff describes three Examples, but it is not necessary to set these out in any detail. It is sufficient to note that the only complete example is Example 3, which uses Alcalase (a protease enzyme) to lyse the cells and isopropanol together with centrifugation to separate the oil from the water and cell debris. This compares advantageously with hexane extraction.

The judge's assessment as to obviousness of EP801

125. As noted above, the judge held that claim 1 of EP801 was obvious over Kobzeff both on his construction of the claim and on DSM's construction. So far as is relevant to the appeal, his reasoning was as follows.

126. First, he held at [850] that all of the elements of claim 1 were disclosed by Kobzeff except the pH of 8 or above in step (b). DSM do not challenge this finding if the judge

was correct as to the construction of "less than 5% organic solvent". It is common ground that, if the judge was wrong about, then there is an additional difference between claim 1 and the disclosure of Kobzeff.

127. Secondly, he set out Mara's contentions at [852]-[868]. It is not necessary to set all of these out since DSM do not challenge the judge's finding that Kobzeff made it obvious to use a pH of 8 or above with a protease enzyme so as to satisfy steps (a) and (b) in claim 1 and the new feature proposed to be added by amendment. The only points that need to be noted are the following submissions of Mara recorded by the judge:

> "[864] In light of the CGK and [0027]-[0030] of Kobzeff, Mr Dueppen agreed that it would be obvious to use salt and/or heat, without any polar organic solvent (Dueppen XX [T2/296/8 - 297/20]). This satisfied step (c) by means of (c1) and/or (c2).
>
> [865] Alternatively, it would also be obvious to adopt Kobzeff's suggestion of using an organic polar solvent such as isopropanol to break the emulsion, in a FRIOLEX approach, in combination with stirring. The solvent would then go in the aqueous phase upon separation of the oil, leaving the oil free of solvent (Dueppen 2 ¶¶122-126; Dueppen XX [T2/298/11-25]). As Mara submitted, this is also within the claims (see the construction of 'less than 5% of organic solvent' above)."

128. Thirdly, he set out DSM's contentions at [869]-[876]. This included DSM's contentions concerning the evidence of Mr Dueppen, and in particular the answer relied on by DSM which I discuss below.

129. Finally, he concluded as follows:

> "877. However, these arguments only work on DSM's construction of the < 5% integer, which I have rejected. Development of a solventless method is not required.
>
> 878. For all these reasons, I find that claims 1A, 6A and 7A of EP801 were obvious over Kobzeff. I accept Mara's submissions as recorded in [855]-[868] above."

130. When the judgment was handed down DSM detected an ambiguity as to whether the second sentence of [878] amounted to an acceptance of both the alternatives recorded in [864] and [865], when only the second depended on the judge's construction of the claims. The judge made it clear at the form of order hearing that the judgment should be read as accepting the submission recorded in [864].

Ground 1(b) of DSM's appeal on EP801

131. DSM's case is that Kobzeff discloses enzymatic lysis, but does not disclose or make obvious an extraction process without organic solvent. DSM contend that the judge made four errors of principle in concluding that claim 1 of EP801 was obvious over Kobzeff on DSM's construction of the "less than 5% organic solvent" requirement. Since I have concluded that the judge interpreted this feature of the claim correctly,

strictly speaking it is not necessary to consider these contentions. I shall nevertheless do so in fairness to the judge.

132. The first two arguments go together. DSM submit that: (i) there was no evidence to support Mara's submission recorded at [864]; and (ii) had the judge properly analysed the meaning and effect of Mr Dueppen's evidence, he would have been bound to conclude that claim 1 was not obvious.

133. Both submissions turn upon the following passage in the cross-examination of Mr Dueppen about Kobzeff:

> "Q. It means the part of the document that addresses techniques to deal with an emulsion, specifically paragraph [0030] that we looked at earlier, is going to be of interest; yes?
>
> A. Yes.
>
> Q. As we discussed earlier, it would be routine for there to be agitation in the form of continual stirring, in any event; yes?
>
> A. Yes.
>
> Q. Paragraph [0030] of Kobzeff identifies several different techniques that can be used as treatment to release the lipid from the emulsion; yes?
>
> A. Yes, those where it had been used to break emulsions, other types of emulsions, yes.
>
> Q. One of which is the use of polar solvents?
>
> A. Yes, which is similar to the way they talked about in one of the examples in paragraph [0036].
>
> Q. But there are others; yes?
>
> A. There are others.
>
> Q. Including, for example, adding salt?
>
> A. Yes.
>
> Q. That, as we have covered, would be understood as a technique for breaking an emulsion; yes?
>
> A. It could break an emulsion, correct
>
> Q. And we saw specifically that paragraph [0036] was expressly contemplating that in some cases, when no extraction solvent was used, there would also be no polar organic solvent added; yes?

A. Yes.

Q. It is the first scenario it mentions, direct separation such as by centrifugation; yes?

A. Yes.

Q. That is without using alcohol or other polar organic solvent; yes?

A. That is what I understand, yes.

Q. Of course, the addition of salt operates so that the centrifugation has an amplified difference in density, as we discussed this morning; yes?

A. Yes.

Q. Surely using salt is one of the obvious things to do?

A. I do not disagree with that.

Q. The skilled person would know that other techniques listed in paragraph [0030] could also be used with salt; yes?

A. They could, yes.

Q. Heating would be another obvious thing to do too; yes?

A. It is possible; yes.

Q. It would be equally obvious to add the salt and then heat it or to heat it up and then add the salt; yes?

A. Again, you have to set up an experimental design to test all these potential scenarios out. It is not obvious which ones work, how they work in combination. These are things that have worked in the past in other emulsions, so yes, any combination could potentially do that but I do not know if it will work or not."

134. DSM do not dispute that Mr Dueppen accepted that it would be obvious to use salt and/or heat to demulsify the lysed cell composition as required by step (c) of claim 1, but they dispute that he accepted that it would be obvious to do so *without any polar organic solvent*. DSM contend that this was not clearly put to the witness, and in any event they emphasise Mr Dueppen's last answer.

135. Mara submits that Mr Dueppen did accept that it would be obvious to use salt and/or heat without any polar organic solvent. Mara argues that this was put to the witness: first, the disclosure in Kobzeff at [0030] of methods for breaking an emulsion, then the disclosure at [0036] of not using polar organic solvent, and finally the obviousness of using the alternatives of salt and/or heat mentioned in [0030]. Mara also argues the answer relied on by DSM does not detract from this, because it goes to the question of which methods will be successful in breaking the emulsion in any particular case, which

is a different issue. As to that, Mara relies upon the facts found by the judge that it was common general knowledge that which methods would actually work in practice depended on the strength of the emulsion and that, if in doubt, the skilled team would conduct a simple lab test to see which worked (see paragraph 79 above).

136. In considering these submissions, this Court has to remember that the judge had the advantage not merely of reading the transcript, but also of hearing Mr Dueppen give evidence. It is clear that the judge accepted Mara's interpretation of this evidence. In my judgment he was entitled to do so. Certainly, it is not clear to me from the transcript that he was wrong to do so. Furthermore, I consider that the point was adequately put to the witness.

137. DSM's third argument is that the judge erred because he made no finding that the skilled team would have a reasonable expectation of success if they tried salt and/or heating to separate the emulsion without a polar solvent. It is fair to say that the judge did not expressly discuss this question, no doubt because his primary and unchallenged conclusion was that claim 1 was obvious on his construction. In my judgment it is implicit in the judge's reasoning that the skilled team would have a sufficient expectation of success to warrant trial of these techniques. Furthermore, there was a sufficient basis for that in the judge's finding as to common general knowledge relied upon by Mara.

138. DSM's fourth argument is that the judge adopted a hindsight-driven, stepwise approach of the kind condemned in *Technograph*. I do not accept this. As can be seen from his reasoning in relation to EP155 at [309]-[315] (see paragraph 63 above), the judge was well of aware of the need to avoid hindsight and *Technograph*. His reasoning in relation to Kobzeff did not require a multiplicity of steps to be taken to arrive at the claimed invention, nor is it infected by hindsight. All of the elements of the claimed invention are present in Kobzeff except that it does not specify use of pH 8 or above, but the judge made an unchallenged finding that that would be obvious with a protease enzyme such as Alcalase.

139. I therefore conclude that the judge made no error in concluding that claim 1 of EP801 was obvious even on DSM's construction.

Ground 2 of DSM's appeal on EP801

140. Ground 2 raises a difficult issue of interpretation concerning the degree of precision with which the numeral "8" is expressed in step (b) of claim 1. Since this issue is contingent on the success of both ground 1(a) and ground 1(b), it is not necessary to consider it, and I will abstain from doing so.

Conclusion

141. For the reasons given above I would dismiss both appeals.

Lord Justice Miles:

142. I agree.

Lord Justice Moylan:

143. I also agree.