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**Datasheet for the decision
of 4 February 2016**

Case Number: T 2194/12 - 3.3.05

Application Number: 01938032.8

Publication Number: 1266385

IPC: H01F1/11, B03C1/01, C12N15/10,
H01F1/00

Language of the proceedings: EN

Title of invention:
POROUS FERRO- OR FERRIMAGNETIC GLASS PARTICLES FOR ISOLATING
MOLECULES

Patent Proprietor:
QIAGEN GmbH

Opponent:
Roche Diagnostics International AG

Headword:

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

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

Decisions cited:
T 0409/91, T 0435/91, T 0608/07, T 1646/12

Catchword:



**Beschwerdekammern
Boards of Appeal
Chambres de recours**

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Case Number: T 2194/12 - 3.3.05

D E C I S I O N
of Technical Board of Appeal 3.3.05
of 4 February 2016

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Decision under appeal: **Decision of the Opposition Division of the
European Patent Office posted on 31 July 2012
rejecting the opposition filed against European
patent No. 1266385 pursuant to Article 101(2)
EPC.**

Composition of the Board:

Chairman H. Engl
Members: G. Glod
P. Guntz

Summary of Facts and Submissions

- I. The appeal lies from the decision of the opposition division to reject the opposition against European patent EP-B-1 266 385.

Claim 1 of the granted patent reads as follows:

"1. A porous, ferro- or ferrimagnetic, glass particle comprising silica glass precipitated or adsorbed on iron oxide particles or pigments, wherein the pores of the silica glass particles comprise pores having a diameter greater than and less than 10 nm, and wherein the cumulative pore area of the pores having a diameter greater than 10 nm is greater than 4 m²/g."

Furthermore the granted patent contains an independent claim 17, relating to a kit for separating, isolating or detecting a molecule of interest from a mixture, comprising a porous, ferro- or ferrimagnetic, glass particle as defined in claim 1, and independent claims 20, 32, 33 and 34, which concern different methods of making porous, ferro- or ferrimagnetic, glass particles. Independent claim 35, which refers back to claim 1, relates to a method of isolating a molecule from a mixture.

- II. The documents cited in the decision included the following:

D1: WO 93/10162
D2: WO 98/31461
D4: WO 98/12717
D5: WO 98/51435
D8: WO 96/41811
D9: US 5 904 848

D10: White, Butler, Creswell and Smith, 1998, Promega Notes 69, p. 12 (Promega Corp)

D12: DE 4 307 262

D13: US 4 233 169

D14: US 4 126 437

D15: US 4 395 271

D17: US 5 610 274

III. In the communication pursuant to Article 15(1) of the Rules of Procedure of the Boards of Appeal (RPBA), the board was of the preliminary opinion that the problem posed was not solved over the whole range claimed. Consequently, the subject-matter of claim 1 was considered an obvious alternative in view of D2.

IV. The arguments of the **appellant** (opponent) may be summarised as follows:

Sufficiency

The subject-matter of claims 1 to 19 and 35 to 39 was not enabled. The expression "diameter of a pore" was unclear. It was not clear how the diameter of a pore should be determined. The definition of the diameter of the pore was not sufficient to distinguish pores having a diameter greater than 10 nm from those having a diameter less than 10 nm. It was not common in the art to define subclasses of pores on the basis of diameter. In view of this lack of clarity, this claim feature had to be interpreted broadly without making a differentiation as to pore size.

Any pore size below 10 nm, i.e. any unevenness, fulfilled the criterion of having a diameter of less than 10 nm. Only one or two inlets or depressions were sufficient to fulfill this criterion.

The description did not teach how to determine the cumulative pore area and the pore size. It was up to the patent proprietor to show that the unusual parameter distinguished the subject-matter from the prior art.

The claimed particles were not enabled, since no reliable method for producing them had been shown in the contested patent. No method for determining whether the particles had the required characteristics was provided. In particular, it was not proven that the particles according to example 4 had all characteristics as defined in claim 1, such as pores with a diameter of less than 10 nm. It was not clear that particles made according to example 4 and called glass particles of the invention referred to particles according to claims 1 to 16.

It was indicated in the patent that the properties of the particles could be varied by changing the reaction parameters (paragraph 18), but there were no details concerning these parameters. The skilled person would not know what needed to be done to ensure that the desired properties such as BET and cumulative pore area were obtained.

Novelty

The subject-matter of claims 1, 2, 9, 14, 17 and 35 to 37 lacked novelty in view of D1. The features of claim 1 were disclosed in amended claims 2 and 4 and on page 3, lines 1 and 2. The combination of pore diameters and pore areas as specified in claim 2 led to a pore volume of at least 5 m²/g. In addition, there was no difference between the adhesion of A to B on the one hand and B to

A on the other hand.

The subject-matter of claims 1 to 5, 9, 12 to 14 and 17 lacked novelty with respect to D2. In view of the BET surface of 40 to 500 m²/g disclosed in D2, it had to be concluded that D2 disclosed particles having pores with a diameter of less than 10 nm. The Curie temperature of less than 100°C was only indicated as preferred; so "magnetite" should not be limited to superparamagnetic material only, but should be interpreted to also refer to ferromagnetic magnetite. It was evident that the definition of superparamagnetic given in D2 included ferro and/or ferrimagnetic as defined in the patent. The size of the magnetite particles given in D2 (page 3, lines 29 to 31) was in agreement with the particle size of the magnetic particles according the patent (claim 12), such that the magnetic properties had to be the same. Ferrimagnetic magnetite was therefore disclosed in D2. The particles had pores having a diameter of less than 60 nm (Table 2). In view of the Gaussian distribution of the pore diameter, pores with a diameter of less than 10 nm had to be present.

Inventive step

D2 could be considered as closest prior art, since it also related to magnetic particles for adsorption of macromolecular constituents having a bimodal pore size distribution that did not agglomerate on removal of the magnetic field (page 6, lines 13 to 15 and 21 to 22).

The problem formulated by the respondent in view of D2 was not derivable from the application as filed. The problem to be solved in view of D2 was to provide an alternative particle.

The solution was obvious, since D2 also taught ferrimagnetic magnetite and pores having a particle size of less than 60 nm, which included pores having a particle size of less than 10 nm. In addition, pores having a particle size of less than 10 nm were known from D8. Ferri- or ferromagnetic particles were also known from the art (D1, D4, D5, D8, D12, D13 and D15).

D8 differed from the subject-matter of claim 1 in that D8 did not disclose that the cumulative pore area of the pores having a diameter greater than 10 nm was greater than 4 m²/g. As shown in D1, D2, D9 and D10, the cumulative pore area of the pores having a diameter greater than 10 nm was typically greater than 4 m²/g. The subject-matter of claim 1 lacked inventive step in view of D8 in combination with D1, D2, D9 or D10.

It was not evident from the contested patent that the three types of particle mentioned in Table 1 of the patent differed in pore size and cumulative pore area, since no details were given for the particles alleged to be according to the invention. Therefore it was not plausible that these features conferred advantageous properties on the claimed subject-matter. There was also no proof that the alleged advantage was present over the complete scope of the claims. Therefore, the alleged advantage of increased effectiveness in plasmid DNA purification could not be taken into account when assessing inventiveness.

The subject-matter of claim 1 also lacked inventive step in view of D9 in combination with D12, D13, D14 or D15.

The subject-matter of claim 20 differed from D4 (page 7, second paragraph) in the washing medium used in step

e) and the drying step f). These steps were known from D17; so the subject-matter of claim 20 lacked inventive step in view of D4 in combination with D17.

The subject-matter of claim 34 did not involve an inventive step in view of D2.

V. The arguments of the **respondent** (patent proprietor) may be summarised as follows:

Sufficiency

The term "pore" was clearly defined and was commonly used in the prior art (e.g. D2 and D8). The definition given in the patent corresponded to the definition present in D8. An unevenness did not extend deeper than its radius.

The expression "pore diameter" was used in the prior art without indicating how it was to be measured (e.g. D8). The term had an established meaning which required no further explanation. The diameter of the pore was to be determined at the surface of the particle.

The patent indicated that the cumulative pore area was measured by standard mercury porosimetry. By adjusting the pressure it was possible to specifically determine the cumulative pore area of pores having a diameter of greater than 10 nm.

Analysing the characteristics of the particles obtained when following the manufacturing methods described in the opposed patent was routine for the skilled person. Therefore he could determine whether the methods described in the patent (e.g. example 4) that were intended for manufacturing the glass particles

according to the invention provided particles according to the claims. Particles as defined in claim 1 were the inevitable result when following the manufacturing instructions given in example 4. The opponent did not provide any evidence that he could not repeat the examples and did not obtain particles according to the claims.

Variation of the reaction parameters allowed the BET and the cumulative pore area to be adjusted.

Novelty

Claim 1 had to be interpreted such that the particles comprise ferri- or ferromagnetic iron oxide, since otherwise the claim would be in contradiction of the description. The feature "comprising pores having a diameter of less than 10 nm" was a relevant technical characteristic; so it was evident that the claimed glass particle had a substantial number of pores having a diameter of less than 10 nm.

D1 disclosed that the iron oxide particles were contained in the outer pores of the porous siliceous material. D1 did not disclose "silica glass precipitated or adsorbed on iron oxide particles or pigments". In addition, D1 taught the skilled person porous glass particles that had a uniform pore diameter. It did not disclose pores having a diameter greater than 10 nm and pores having a diameter less than 10 nm.

D2 did not disclose ferri- or ferromagnetic iron oxide as magnetic cores. As was evident from numerous passages in D2, iron oxide or magnetite was exclusively described as an embodiment of superparamagnetic

material. Iron oxide had a Curie temperature well above 100°C. D2 also did not disclose, explicitly or implicitly, glass particles having small pores of less than 10 nm. There was no evidence that the examples of D2 inevitably led to particles having pores of less than 10 nm. It could also not be concluded from a BET surface area of 40 to 500 m²/g that pores having a diameter of less than 10 nm were present. The BET was primarily due to the greater pores (page 5, lines 12 to 19). D2 did not explicitly disclose magnetite having a crystal size such that it was ferrimagnetic. D2 disclosed the crystal size only in combination with the superparamagnetic property; so the crystal size had to be such that the materials were superparamagnetic (page 3, lines 29 to 31).

Inventive step

D8 was the closest prior art, since it had the same object as the patent and the most structural features in common with particles according to claim 1. In particular it concerned ferromagnetic materials. D8 did not disclose pores having a diameter greater than 10 nm and having a cumulative pore area greater than 4 m²/g.

The objective problem was to provide magnetic glass particles having improved nucleic acid isolation properties.

The problem was solved, as confirmed by the experimental evidence present in the patent. The "example 4 particles" were particles according to claim 1. and the "Boehringer particles" tested in example 6 were particles according to the technology of D8. The latter was confirmed by numerous patent applications of the opponent referring to D8 and analyses performed

prior to filing of the patent. In addition, the results obtained for the "Boehringer particles" in the patent were in line with the results present in Table 1 of D8.

The solution was not obvious, since D8 taught the skilled person to keep the porosity of the surface as low as possible.

The teachings of D1 and D8 could not be combined. D1 also failed to teach to provide two types of differently sized pores.

D9 was not directed to magnetic particles. It would not be technically feasible to transfer an isolated surface characteristic of D9 to the particles of D8.

D10, which was directed only to paramagnetic particles, taught that a pore size of more than 50 nm and a macroporous structure were decisive for an increased surface area and enhanced nucleic acid binding, which was opposite to the teaching of D8.

D10 also taught to use a high concentration of magnetic material to make the particles responsive.

D4 taught non-porous particles and superparamagnetic magnetite.

D9 did not relate to magnetic particles, and any problem-solution approach based on D9 would be artificially designed. None of the combinations of D9 with D12, D13, D14 or D15 led the skilled person to the subject-matter of claim 1.

D2 taught superparamagnetic particles and intended to provide particles that were not vulnerable to leaching

in acidic environments. Even if the problem to be solved with respect to D2 was only to find an alternative, it was still not obvious. Considering the specific disclosure of D2 regarding the processing of low Curie temperature materials, the skilled person had no motivation to switch from a low Curie temperature material to a ferri- or ferromagnetic iron oxide, which was a high Curie temperature material. The prior art, especially D1, D5, D10 and D13, clearly preferred superparamagnetic particles because they showed no tendency to aggregate upon removal of the magnetic field. In addition, there was no motivation to include particles containing pores having a diameter of less than 10 nm. The particles according to the claim responded strongly to a magnetic field and so could be easily collected, even when using a weaker magnet. They did not agglomerate when the magnetic field was removed, in view of their surface characteristics.

D2 could not be combined with D8 in view of their opposite teachings. D1 disclosed particles that fundamentally differed in their structure from the particles of the patent. D9 was unrelated to magnetic glass particles. D10 related to paramagnetic particles not comprising small pores having a diameter of less than 10 nm.

D4 differed from the method according to claim 20 in that it used magnetite-coated silica monospheres instead of ferro- or ferrimagnetic iron oxide particles as magnetic core. In D4, the tetraalkoxysilane was hydrolysed prior to its addition to the reaction solution rather than only after its addition to the reaction solution and the subsequent addition of an alkaline or acidic buffer. In D4 the magnetic silica particles were washed with salt-free water instead of

anhydrous alcohol, and the magnetic silica particles were maintained in an aqueous solution and were not dried.

D17 related to a completely different product.

Starting from D2, the skilled person would not arrive at the process according to claim 34.

VI. Requests

The appellant (opponent) requested that the decision under appeal be set aside and that the European patent be revoked in its entirety.

The respondent (patent proprietor) requested that the appeal be dismissed and that the patent be maintained as granted or, in the alternative, maintained in amended form on the basis of one of auxiliary requests I to VII as submitted with the letter of 27 November 2015.

Reasons for the Decision

Main request - claim 1

1. Interpretation of claim 1

1.1 Claim 1 requires the glass particle to be ferro- or ferrimagnetic and silica glass to be precipitated or adsorbed on iron oxide particles or pigments. This means that the core of the particles is made of iron oxide which is covered by glass.

Although it is not specified that the ferro- or

ferrimagnetic property is due to iron oxide, the skilled person would understand that such needs to be the case.

According to Rule 43(1) EPC, a claim has to define the matter for which protection is sought in terms of technical features of the invention. The ferro- or ferrimagnetic property is such a technical feature. The only component present in claim 1 that can provide said property is the iron oxide; so the skilled person understands that iron oxide has to be ferro- or ferrimagnetic. The board agrees with T 1646/12 (Reasons 2.1) in that the description has to be considered to some extent if there is a lack of clarity. It is indicated in the description that the iron oxide particles or pigments constitute the basic magnetic nuclei of the glass particles of the invention (page 5, lines 32 and 33). This is in line with examples 1 to 5, which relate to the synthesis of glass particles having a ferro- or ferrimagnetic iron oxide as core.

- 1.2 In the board's opinion the diameter of pores is commonly used in the art to characterise porous particles. This is for example confirmed by D2, referring to pores having a diameter of 60 nm (claim 17), and by D8, disclosing pore diameters of less than 10 nm (claim 1). The patent itself indicates that the diameter of a pore refers to the diameter of the pore at the narrowest point of the pore (paragraph 24). The pore is considered to refer to any inlet, depression or recess in the outer surface of the particle in which the depression or recess extends beyond the length of the radius of the inlet, depression or recess measured at the surface of the particle (paragraph 20). This definition is in line with the definition given in D8 (page 3, penultimate paragraph). The skilled person

understands that the diameter of the pore is determined at the surface of the particle. In view of the term "diameter" the skilled person also knows that a line should be drawn through the center of the pore at the surface when trying to determine the diameter. Therefore, the definition cannot be considered unusual for the skilled person.

1.3 According to claim 1, pores having a diameter of less than 10 nm need to be present in the glass particles, but the amount of these pores is not defined. However, since it is an essential feature of the invention, it is understood that the amount cannot be solely due to impurities or artefacts in the production process, but that it should be such that it has an influence on the properties of the particles.

1.4 The cumulative pore area of the pores having a diameter greater than 10 nm can be determined by standard mercury porosimetry as indicated in the patent (page 5, lines 29 to 31). This method has been known for a long time and has been routinely used. The skilled person is able to adapt the method to determine the pore area of different pores by adapting, for example, the applied pressure.

2. Article 100(b) EPC

2.1 The board is of the opinion that the patent in suit fulfills the requirements of Article 83 EPC, for the following reasons.

2.2 Article 83 EPC stipulates that the application is to disclose the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art.

The established jurisprudence of the boards of appeal considers that the requirements of sufficiency of disclosure are met if the invention as defined in the independent claims can be carried out by a person skilled in the art, using his common general knowledge, over the whole scope of the claim without undue burden (e.g. T 409/91, Reasons 3.5; T 435/91, Reasons 2.2 and 2.2.1).

In order to make a case for insufficiency of disclosure, it is necessary to identify gaps in information resulting either from limitations in the teaching or from a lack of guidance in general.

The question then to be answered is whether the skilled person, taking into account common general knowledge, can remedy any such defects, or whether the consequences of the information gaps result in an undue number of experiments to be performed.

- 2.3 In the present case, paragraphs (37) to (45) of the patent contain information on how to produce porous, magnetic, glass particles. In addition, examples 1 to 5 describe the synthesis of such particles. The particles obtained from example 4 are subsequently used to purify DNA (examples 6 and 7).

The skilled person would have no difficulty in reworking the examples. He would recognise that the particles obtained by the method according to example 4 are preferred, since they are subsequently used in the purification of DNA according to examples 6 and 7. None of the examples indicates the particle characteristics (pores and pore area) of the particles obtained and used. However, the particles obtained by the procedure

according to example 4 are indicated as being an example of the porous, magnetic glass particles according to the invention (page 10, line 6). Since claim 1 is supposed to contain the technical features of the invention (Rule 43(1) EPC), the skilled person would understand that particles according to the invention are those that have at least the features of claim 1 of the application as filed, which means that the silica glass particles should comprise pores having a diameter greater than and less than 10 nm.

In any case, the skilled person trying to produce particles according to claim 1 would repeat at least example 4 of the patent. He would then determine the surface properties of the particles obtained, which are commonly described properties (see points 1.2 and 1.4 above), and realise that he had obtained particles according to claim 1.

It is true that the patent provides only fairly general information (paragraph 18) regarding the adjustment of the particle properties. However, the skilled person would expect that the particle used in example 4 relates to a preferred embodiment of the invention and that said particles are likely to have the preferred properties defined in paragraph 39. This interpretation is in line with the data presented in Annex 3 of the opposition division's decision. Although this limited dataset shows a relatively large variation for unknown reasons, all the values of cumulative pore area presented do fall within the scope of claim 1.

There is no evidence that the reworking of example 4 would not yield particles according to the invention. The appellant speculated that the information in the patent was insufficient, but failed to provide any

facts to prove its case. The allegation that the pore size and pore area could not be measured is not credible, as shown before.

Therefore the board concludes that any gaps in information in the patent in suit can readily be filled by reworking the examples.

2.4 It is known that there are several methods and/or models that can be used to determine the particle characteristics, possibly leading to different results. This means that the scope of the claim may be different depending on the methods used to determine the properties. However, the lack of indication of the method in the claim is a problem of clarity (ambiguity) rather than of sufficiency of disclosure, as the exact boundaries of the claim are not precisely defined (see also T 608/07, Reasons 2.5.2).

2.5 No objection under Article 100(b) EPC was raised against the subject-matter of claims 20 to 34.

3. Article 100(a) EPC (novelty)

3.1 D1 discloses porous inorganic magnetic materials produced by adding magnetic metallic particles such as iron oxide to an aqueous slurry of CPG (controlled pore glass) (page 4, ultimate paragraph). The metallic particles are adsorbed or lodged within the pores of the CPG (D1: page 5, lines 5 to 7 and lines 29 to 32).

On the other hand, the particle according to the patent is obtained by precipitating, depositing or adsorbing silica on the surface of the iron oxide particles or pigments (paragraph 47) to form a particle according to claim 1 comprising silica glass precipitated or

adsorbed on iron oxide particles or pigments.

In the board's view, a particle obtained by depositing silica on the iron oxide is manifestly different from a particle obtained by adsorbing iron oxide on the CPG.

Therefore D1 cannot be considered novelty-destroying for the subject-matter of claim 1.

3.2 D2 discloses a particulate adsorbent comprising particles which consist essentially of at least one core consisting essentially of a transition metal-containing component selected from the group consisting of superparamagnetic materials, low Curie Temperature materials, and mixtures thereof, and a siliceous oxide coating on the surface of said core(s) (claim 1). Magnetite is a preferred core (claim 4). The particles contain at least about 0.2 ml/g porosity in pores having a diameter of 60 nm or greater as measured by nitrogen BET method (claim 17). A low Curie temperature material should have a Curie temperature below 100°C (page 3, lines 11 and 12).

However, D2 discloses magnetite only in the context of superparamagnetic materials, as is evident from the wording "for magnetite **and most other superparamagnetic materials**" (emphasis added) (page 3, lines 29 and 30) and "Of the superparamagnetic materials, [...], magnetite iron oxide being most preferred" (page 3, lines 14 to 16). The fact that crystal size ranges of less than 100 nm, more preferably less than 60 nm, are indicated in D2 (page 3, lines 30 and 31) does not imply that the superparamagnetic materials according to D2 are to be considered ferro- or ferrimagnetic materials according to the patent. It is evident that these ranges refer to "the material", which is the

superparamagnetic material (page 3, line 30); so the crystal size needs to be such that superparamagnetism is guaranteed.

It is true that according to D2 superparamagnetic materials include those that exhibit a relatively low remanent magnetism (page 3, lines 6 and 7). However, it cannot be concluded that materials exhibiting ferro- or ferrimagnetic properties are covered by said definition.

Although mixtures of superparamagnetic materials with low Curie temperature materials are disclosed in D2 (claim 1), ferro- or ferrimagnetic glass particles having iron oxide particles as core are not directly and unambiguously derivable therefrom. The Curie temperature of iron oxide is well above 100°C.

D2 discloses in examples 2 to 8 magnetite particles coated with glass having a high surface area and pores having a diameter greater and smaller than 60 nm (see Tables 1 and 2). Although the pore size distribution is Gaussian, it does not follow automatically that particles having a pore size of less than 10 nm are present, since the variance of the pore size is not known. In addition, the BET surface area of 40 to 500 m²/g given in D2 (page 5, line 19) does not imply the presence of pores having a diameter of less than 10 nm, since it is explicitly stated in D2 that of the total pore volume preferably at least about 50% of the pore volume is contained in pores having a diameter of 60 nm or greater (page 5, lines 14 to 16).

The subject-matter of claim 1 is thus neither directly nor unambiguously derivable from D2.

3.3 The conclusion reached for claim 1 also applies to independent claims 17 and 35, since they refer to the particle according to claim 1, and to claims 2 to 16, which are dependent on claim 1.

3.4 The novelty of claims 20 to 34 has not been questioned.

4. Article 100(a) EPC (inventive step)

Claims 1, 17 and 35

4.1 Invention

The invention relates to magnetic glass particles for purifying and separating molecules (paragraph (1)).

4.2 Closest prior art

The closest prior art is the document that relates to the same purpose as the invention and has the most relevant technical features in common.

D2 represents the closest prior art, since it discloses in examples 2 to 8 magnetite particles coated with glass having a high surface area and pores having a diameter greater and smaller than 60 nm (see Tables 1 and 2). D2 relates to superparamagnetic adsorbents that can be easily redispersed on removal of the magnetic field (page 6, lines 21 and 22) and that have high adsorption and high desorption release of organic constituents, especially genetic biological materials (page 7, lines 1 to 3).

D2 relates to the same purpose as the patent, since it discloses both the purification of biological materials and the agglomeration of magnetic particles.

D8 teaches the use of ferromagnetic particles having a substantially pore-free outer glass surface, or an outer glass surface with pores having less than 10 nm diameter, for the purification of biological materials (claims 1, 2 and 6). It does not disclose a bimodal pore size distribution and it does not provide any solution for avoiding agglomeration, since the agglomerated particles are simply filtered out (page 5, penultimate paragraph; example 1, page 16, last sentence).

D1 does not disclose a particle comprising silica glass precipitated or adsorbed on iron oxide particles or pigments and is not as relevant as D2.

D9 relates to porous, synthetic resin membranes having particulate inorganic porous material embedded therein. D9 does not indicate any magnetic properties and is not in the field of magnetic particles for isolating molecules.

4.3 Problem

According to the respondent, the problem to be solved with respect to D2 is to provide particles for the purification of biological material having an improved response to a magnetic field and not agglomerating in the absence of a magnetic field (paragraph 34 of the patent).

4.4 Solution

As a solution to this problem the patent in suit proposes a glass particle according to claim 1, characterised in that it has ferro- or ferrimagnetic

iron oxide particles or pigments as a core and has pores having a diameter of less than 10 nm.

4.5 Success of the solution

It is accepted in the appellant's favour that there is no convincing evidence that the posed problem has been solved over the whole range claimed. Therefore the problem to be solved needs to be redefined in a less ambitious manner.

4.6 Redefinition of the problem

Starting from D2, the problem to be solved is to provide alternative particles for the purification of biological materials.

4.7 Success of the solution

It is accepted that said problem is successfully solved, since Table 1 shows that the particles according to the invention allow an effective purification of DNA. The particles could also be easily redispersed on removal of the magnetic field (page 10, lines 19 to 22). There is no evidence that the particles according to claim 1 are not a usable alternative to those of D2.

4.8 Obviousness

4.8.1 D2 teaches neither towards ferro- or ferrimagnetic iron oxide nor towards pore sizes of less than 10 nm.

D2 emphasises that the core should consist essentially of superparamagnetic material (page 3, lines 5 to 7, and page 4, lines 1 to 3). Low Curie temperature

materials are considered as a possible alternative, but such materials need a change in temperature to allow easy redispersion (page 3, lines 18 to 25, and page 6, lines 22 to 26). Although they are presented as less preferred, they are still considered as a possible alternative. However, iron oxide particles or pigments cannot be considered as low Curie temperature materials.

D2 does not mention pores having a diameter of less than 10 nm. The skilled person does not recognise from the presence of pores having a diameter of less than 60 nm (Tables 1 and 2) that pore diameters of less than 10 nm should also be present. D2 does not provide any pointer to pores having such a low pore diameter.

- 4.8.2 As indicated above (point 3.1), D1 relates to a different type of particle; so the skilled person has no reason to turn to D1 when starting from D2. Even if he were to turn to D1 when trying to find alternative particles, he would only arrive at particles that have the iron oxide adsorbed in the controlled pore glass.
- 4.8.3 D4 also concerns magnetic particles having a core of silicium dioxide with magnetite coated thereon (claim 1; page 7, lines 1 to 3). The same conclusion as for D1 applies.
- 4.8.4 D5 relates to metallic particles comprising a metallic core containing a magnetic material (claims 1 and 4). The teaching is clearly towards the use of superparamagnetic particles in biological applications, since ferromagnetic particles agglomerate (page 3, lines 21 to 15; page 4, lines 19 to 21; page 9, line 11 and lines 24 to 30). In addition, D5 leads away from a

porous coating of the magnetic particles (page 4, lines 8 to 14).

4.8.5 D8 (see point 4.2 above) teaches the use of ferromagnetic particles having a substantially pore-free outer glass surface, or an outer glass surface with pores having less than 10 nm diameter, for the purification of biological materials (claims 1, 2 and 6). D8 leads in a different direction to D2, since it relates to ferromagnetic particles having an essentially pore-free surface (paragraph bridging pages 5 and 6). It is thus doubtful that a skilled person would consider D8 when starting from D2.

But even if the skilled person were to take D8 into account, he would consider at best the particles of D8 as possible alternative to those of D2, which means that he would arrive at particles which do not have pores having a diameter greater than 10 nm. There is no reason why the skilled person should combine the porosity of D2 with the porosity of D8, since the skilled person knows that a change in surface properties would also change the drag characteristics. D2 teaches that the drag characteristics have an influence on the response of the particles to the applied magnetic field (page 5, lines 28 to 33). Therefore, when looking for alternative particles to those of D2, the skilled person would not start combining surface properties from different types of particle.

4.8.6 As mentioned above (point 4.2), D9 is silent about magnetic properties.

- 4.8.7 D10 relates to paramagnetic particles having a pore size of greater than 50 nm (first page, last paragraph).
- 4.8.8 D12 generally teaches magnetic particles and does not provide any details on porosity.
- 4.8.9 D13 discloses porous magnetic glass particles having a uniform pore size of preferably less than 200 nm (column 4, lines 20 to 22). The particles should exhibit superparamagnetic behaviour (column 4, lines 25 to 28, and column 5, lines 22 to 25). Although pore sizes of less than 10 nm are contemplated by D13 (see examples 9 and 12 in Table II), the teaching of D13 is clearly towards superparamagnetism and to a uniform pore size distribution.
- 4.8.10 D14 belongs to the field of electrophotography (column 1, lines 5 to 8), which is remote from the field of D2. In addition, the particles are superparamagnetic (column 3, lines 55 to 57).
- 4.8.11 D15 provides the same teaching as D13 (column 4, lines 25 to 33, and column 5, lines 26 to 30).
- 4.8.12 In summary, the prior art does not lead in an obvious manner to the solution of the problem.
- 4.8.13 The conclusion reached for claim 1 also applies to independent claims 17 and 35, since they refer to the particle according to claim 1, and to claims 2 to 16, which are dependent on claim 1.

Claim 20

The board finds that the subject-matter of claim 20 involves an inventive step for the following reasons.

4.9 Invention

The invention relates to a method for making porous, ferro- or ferrimagnetic glass particles.

4.10 Closest prior art

The appellant considered D4 to be the closest prior art. It discloses a process for adding an outer layer of silica on magnetic particles composed of a core of silica coated with magnetite (page 7, lines 1 to 5). A suspension of the magnetic particles is brought to pH 7 to 9 and an acetic acid solution of tetraethylortho-silane is added. Thereafter the pH value is brought to 8 to 10. The particles are separated from the suspension and washed with distilled water before they are redispersed in distilled water (page 7, lines 9 to 21).

4.11 Problem to be solved

The problem to be solved is to provide an effective method for the production of ferro- or ferrimagnetic glass particles.

4.12 Solution

As a solution to this problem the patent in suit proposes a method according to claim 20, characterised in that a suspension of ferro- or ferrimagnetic iron oxide particles is provided, the separated porous, ferro- or ferrimagnetic glass particles are washed with

anhydrous alcohol and the particles are dried at a temperature below the Curie temperature.

4.13 Success of the solution

It is accepted that the problem is solved, since example 4 illustrates such a method that leads to ferro- or ferrimagnetic glass particles. There is no evidence that the method was not suitable for the effective production of such particles.

4.14 Obviousness

The starting material used in D4, namely silica coated with magnetite, is different from the starting material (ferro- or ferrimagnetic iron oxide particles) used in process step a) of claim 20. As a consequence, the product obtained after execution of the hydrolysis step is also different. Therefore, it cannot be argued that the final processing of the glass particles according to steps e) and f) of claim 20 was an obvious, generally known alternative. The skilled person would not know the effect of drying on the final properties of a different type of particle. In general, it cannot be stated that process conditions that are suitable for one type of particle are also suitable for a substantially different type of particle. In addition, D4 is completely silent about a drying step, so it appears that such a step is not desired in the process of D4.

D17 relates to a different product, namely controlled pore glass containing magnetic iron oxide particles absorbed within the pores and having amino acid residues attached on the surface (claim 1), than D4, so it cannot be concluded that process steps present in

D17 could be easily transferred to the process of D4. Furthermore, the starting material in D17 is also different from the starting material in claim 20.

Claim 34

4.15 The board finds that the subject-matter of claim 34 involves an inventive step for the following reasons.

4.16 Invention

The invention relates to a method for making porous, ferro- or ferrimagnetic glass particles.

4.17 Closest prior art

The appellant considered D2 to be the closest prior art. It discloses a process for making the particles according to D2 (page 9, line 5, to page 10, line 14).

4.18 Problem to be solved

The problem to be solved is to provide an effective method for the production of ferro- or ferrimagnetic glass particles.

4.19 Solution

As a solution to this problem the patent in suit proposes a method according to claim 34, characterised in that a suspension of ferro- or ferrimagnetic iron oxide particles in paraffin oil is provided and the particles are dried at a temperature of about 200°C.

4.20 Success of the solution

It is accepted that the problem is solved, since example 3 illustrates such a method that leads to ferro- or ferrimagnetic glass particles. There is no evidence that the method was not suitable for the effective production of such particles.

4.21 Obviousness

Although the use of a suspension in paraffin oil instead of water could be considered trivial *per se*, there is no teaching in the prior art suggesting the use of such a suspension in the context of the invention. It allows the process to be run effectively, so that the desired properties of the glass particles are obtained.

Drying at 200°C is not obvious in view of D2, suggesting low-temperature drying and even preferring the wetted state (page 10, lines 12 to 14).

In conclusion, for the board the prior art does not render the claimed solution obvious.

Claims 32 and 33

4.22 The appellant did not provide substantiated reasoning as to why the subject-matter of these claims did not involve an inventive step. The board sees no reason to question the inventiveness of these claims, either, since the claimed methods relate to alternative processes to those of claims 20 and 34 for making porous, ferro- or ferrimagnetic glass particles. No prior-art document describes or suggests such processes.

The subject-matter of claims 32 and 33 thus involves an inventive step.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



C. Vodz

H. Engl

Decision electronically authenticated