

### **Purpose and extent of the examiners' report**

[001] The Examiners' report sets out the expected solution, explains why this solution was expected, and shows how the marks were distributed. In addition, it highlights the most common mistakes and explains which deductions were made for these mistakes.

[002] The purpose of the Examiners' report is to enable candidates to prepare for future examinations (cf. Article 6(6) of the Regulation on the European qualifying examination for professional representatives).

### **General considerations**

[003] It is noted that any references in this text to the Guidelines for Examination at the European Patent Office (GL) refer to the version valid at the date of the examination.

### **The paper**

[004] This paper is concerned with disposable respiratory face masks.

[005] The paper starts by explaining that the Corona virus is mainly transmitted via microscopic droplets and how these droplets can be stopped by a face mask. Commercial face masks are often single-use only and use polymers that will end up in the environment after disposal.

[006] The paper describes a face mask that is made from biodegradable fibres of natural origin. The fibres of natural origin are cellulose fibres. It is preferred that the cellulose fibres are nanofibres that are made from native cellulose. The paper then explains the different types of masks and the importance of having small pore sizes. A pore size of less than about 100 nm is preferred, because 100 nm is the size of the coronavirus. An additional challenge mentioned is that a low breathing resistance is wanted to give more user comfort.

[007] The paper likewise discloses a process for manufacturing the cellulose nanofibres. A process is described using waste residues of paper making. These waste residues contain gelatin and the native cellulose nanofibres can be obtained from this waste residue by mechanical milling. No chemicals are needed in this process. The native cellulose nanofibres are then cast into a nanofilter layer.

[008] The gelatin in the paper waste residue will give rise to a coating of gelatin on the cellulose nanofibres. The gelatin will give rise to a nanofilter bearing electric charges which will improve the retention of the coronavirus.

[009] The paper has four prior art documents.

[010] Document D1 discloses ecological face masks for protection against COVID-19. The document describes cellulose fibres from cultivated plants such as cotton, flax, hemp etc. The mask can be in the form of a cotton double-layer cloth or can be made of hemp. The filter has a 98% filtration efficiency for particles of 3 µm. The cotton can be impregnated with a chemical substance to be able to bear electrical charges. The masks have good breathability.

[011] Document D2 discloses a trilayer nanofilter system, the middle layer of which comprises cellulose acetate. The cellulose acetate nanofibres form a network with an average pore size of between 80 and 100 nm.

[012] Document D3 is an extract from an encyclopaedia about cellulose acetate. It shows that the cellulose acetate has some biodegradability but not much.

[013] Document D4 is provided by the client and describes a method for testing FFP2 masks.

[014] The examining division raises several objections. Claims 1 and 2 lack novelty over D1. D2 is considered to take away the novelty of claims 1, 3, 5 to 7 and 10. Claim 8 is considered obvious starting from D2. Claims 4 and 11 are considered to lack clarity because the expression *paper waste residues* is considered not clear.

[015] The letter of the client expresses a misunderstanding of the objections of the examining division. Concerning D1 they argue that these masks are heavy, uncomfortable and do not have the three-layer structure of the invention. Concerning D2 it is argued that the fibres in D2 are synthetic nanofibres and that these masks would be less biodegradable, for which reference is also made to D3. The client provides experimental test data as evidence for advantages of the invention over the facemask described in D2. These tests show a substantially lower breathing resistance for the facemask according to the invention. Document D4 describes the method that is used in the experiments.

[016] The client provides new claims. Claim 1 is amended to specify that the filter layer is made of cellulose nanofibres from hemp. Claims 2 to 4, as well as claim 11 were deleted. Concerning claims 4 and 11 the client says he deleted them to expedite the proceedings but is clearly open to a better solution. They also mention that they wish protection from competitors manufacturing masks from plants other than hemp.

[017] The candidate is expected to formulate a product claim that is not restricted to masks with a filter made from hemp. It is in any case not very clear what the restriction "from hemp" means for the product claims. It will still be cellulose.

A better claim, as presented in the Appendix, could be "Biodegradable disposable respiratory face mask comprising at least one nanofilter layer comprising native cellulose nanofibres".

[018] Novelty

D1 does not disclose at least the features "at least one nanofilter layer comprising native cellulose nanofibres" and "wherein the native cellulose nanofibres form a network with an average pore size of less than 100 nm".

[019] There is no clear and unambiguous disclosure of nanofibres in D1 at all; indeed, D1 instead discloses the use of a "super soft 100% organic cotton in a tightly knitted fabric" (see para. [009] of D1) and "compacted cellulose fibres from hemp" (see paras. [012]-[013] of D1). From the application one can surmise that the cellulose comprises nanofibres in a bound form. However, there is no unambiguous disclosure of nanofibres as such in D1.

[020] As discussed in paragraphs [040]-[041] of the application, "The production of nanofibres from cellulose is not a trivial task "as it is difficult to separate cellulose into single nanofibres". Consequently, the direct use of cotton or hemp without any process to extract nanofibres would not result in native cellulose nanofibres that form a network with an average pore size of less than 100nm.

[021] Furthermore, the image of the hemp mask supplied in the photo of D1 suggests that the hemp fibres are used directly, without any separation into nanofibres.

[022] For at least these reasons, a product claim as presented in the Appendix is novel over D1.

[023] Document D2 discloses nanofilters but it does not describe native cellulose fibres. The nanofilters of D2 are based on synthetic cellulose fibres. The feature "native cellulose nanofibres" is disclosed in paragraphs [023], [024], [042], [048], [050], [051] and it is essential and necessary to establish novelty over D2.

[024] The original process claim is novel over D1 and D2 because these documents do not disclose that nanofibres are produced from papermaking waste residues by milling and casting.

[025] Clarity.

The examiner objects to the clarity of original claims 4 and 11. The term “wastepaper residues” is not defined in the claim and the subject-matter for which protection is sought is not clear.

[026] Inventive step

Inventive step can be reasoned based on the different effects that are mentioned in the application. Candidates should demonstrate a proper use of the problem-solution approach, showing all the steps.

[027] Document D2 is probably the best starting point for inventive step. However, it can also be argued that D1 is closest prior art.

[028] For the subject-matter of claim 1, as presented in the Appendix, the distinguishing feature over D2 lies in the native cellulose fibres. The inventive concept is the **nanofilter** comprising **native** cellulose nanofibres (native cellulose-I crystal structure retained), which is linked to high filtering efficiency coupled to high air permeability/low breathing resistance. The applicant has provided further experiments that show that the masks of the present application have a better breathability than those of D2. The technical effect over D2 is, therefore, improved breathability. The problem of breathing resistance is already identified in the application (see e.g. [037]) and the objective problem can, therefore, be defined as how to improve the breathability.

[029] Candidates who restricted their claim in a different way could also arrive at an inventive claim. Such a claim could, for example, be additionally restricted to the fibres being coated with gelatin. The closest prior art, D2, does not have any gelatin coating of the fibres. It is clear from the application (see paragraph [051]) that such fibres bear electrostatic charges that provide a stronger interaction with the coronavirus and thus better separation.

[030] Starting from D1 it is important to realise that this document teaches two different embodiments. One of them is a mask with a double layer cotton cloth impregnated with polyethyleneimine (paragraphs [005] to [009]). This structure can trap virus particles electrostatically. The second embodiment is a mask with compacted cellulose without chemical treatment (paragraphs [010] to [016]). The part of D1 that is the most suitable closest prior art is the disclosure of paragraphs [005] to [009] as this part of the document also mentioned the ability to trap viruses.

[031] A less good part of D1 to start from is the disclosure in paragraphs [010] to [016]. It is not disclosed in these paragraphs whether the virus is trapped.

[032] For the independent process claim, the distinguishing feature with respect to D2 is that the nanofibres are produced from papermaking waste residues by milling and casting. These differences give a nanofilter in accordance with claim 1. The argumentation for inventive step is, therefore, very similar to the argumentation presented for claim 1.

[033] Also for this claim D1 can be considered a suitable closest prior art. The difference lies in the fact that the specific process steps are not disclosed.

### **Marking**

[034] As usual, when multiple solutions were offered for claims or argumentation, the worst solution was marked. Moreover, unless otherwise stated, the individual marks referred to in the various sections of this document apply to the example set of claims. Marks were only deducted once for the same error and thus no double penalisation was applied. It is however to be noted that deductions for both unconvincing arguments and related erroneous claims amendments were not considered to be a double penalisation. These are independent aspects of the examination. For instance, it is possible for candidates to provide poor arguments for a correct amendment. In such a case, the claim would receive full marks, but the argumentation would not. Similarly, a perfect argumentation explaining the basis for an amendment could also attract full marks in cases where the candidates forgot to perform the amendment in their set of claims.

### Claims (30 marks)

[035] This year 30 marks are available for the claims. Out of these 30 marks, 26 marks are available for the independent claims.

Claim 1, directed to the face mask, should have the following wording:

*Biodegradable disposable respiratory face mask comprising at least one nanofilter layer wherein the at least one nanofilter layer comprises native cellulose nanofibres.*

For claim 1, 16 marks are available.

It is not necessary to specify that the filter is a nanofilter, as the use of the nanofibers makes it inherently a nanofilter. However, such a claim is considered to be an elegant formulation

of the claim. Specifying the pore size of the filter to have a “pore size of less than about 100 nm” is also considered a good claim ([025], [035], [036], [050]).

[036] As usual, an independent claim that is not novel does not attract any marks.

[037] Claims that were only novel by virtue of a feature such as (completely) biodegradable in 30 days, or FFP2 mask, lost 7 marks.

[038] A product claim that was formulated only as a product-by-process (Filter obtainable by the process of claim 10) was considered to be inappropriate as there was the possibility of defining the product by its structural features. Consequently, for such a product-by-process claim 13 marks were deducted.

Claims that were severely limited lost 8 marks. For example, by defining that the fibres are made from hemp, as the applicant suggested in the letter that they wanted a broader scope.

[039] Claims that comprised unnecessary limitations were deducted up to 5 marks for each such limitation, e.g., a limitation to “comprising gelatin” (which could be due to the introduction of a process feature), “three layers”, “five layers”.

[040] General issues of lack of clarity in the independent product claim led to a deduction of 2 marks for each unclear feature. Further issues of Article 123(2) EPC led to a loss of 7 marks for the product claim. As explained above, it was made sure that candidates were not punished twice for the same mistake.

[041] It was acceptable to define the nanofibres as having a Type I crystal structure rather than stating that they are native. Some candidates, however, defined instead of the “native cellulose nanofibres” “cellulose nanofibres of natural origin,” which is considered not to establish novelty over D2. According to EPO communication (point 3.2), “cellulose fibres” encompass any fibres derived from cellulose, including processed or synthetic cellulose fibres; according to patent [039], cellulose has natural origin (plants) and is a source of natural fibres; according to D3, cellulose acetate is derived from cellulose (chemical treatment of cellulose); hence it can be argued that cellulose acetate being derived from cellulose has a natural “origin”. For this reason, no marks can be awarded for a claim relying on fibres of natural origin as a differentiating feature.

In addition, the combination of this feature with other features is not directly and unambiguously disclosed by the application and, depending on the wording of the claim, could attract a deduction of -7 marks. Paragraph [017] of the application only discloses fibres of natural origin, not nanofibres.

[042] Some candidates restricted the product claim to FFP2 masks with three layers, most probably because the tests provided in the client's letter are based on such FFP2 masks. As the effect is clearly from the middle layer of the mask, it could be argued that the effect is shown for the broader claim 1 as presented above. Limiting to three-layer masks was, therefore, considered to be an unnecessary limitation. 5 marks are deducted for this restriction.

[043] Claim 10, directed to a process for manufacturing a face mask filter layer should have the following wording:

*Process for manufacturing a biodegradable filter layer for a multilayer FFP2 type face mask, the process comprising: providing papermaking waste residues comprising gelatin and at least 1% (in weight) of cellulose fibres, milling using grinding balls, and casting into a thin nonwoven layer by melt-blowing or spunbonding.*

10 marks are available for such an independent process claim.

[044] Maintaining claim 10 in its original form and thus not resolving the clarity objection of the examiner did not attract any marks for the process claim.

[045] Further unnecessary limitations or issues of Article 123(2) EPC led to a loss of 3 marks for the process claim. General issues of lack of clarity in the independent process claim led to a deduction of 2 marks for each unclear feature.

[046] Some candidates referred to PCT/EQE/2022A (see paragraph [044]) in their process claim. Candidates who defined the paper waste only by this reference lost all 10 marks as this would not solve the clarity objection (Guidelines, part F, chapter III, 8). When this reference was combined with other features 6 marks were lost.

#### Dependent claims

[047] For the dependent claims 4 marks are available.

[048] Claim 4 needed to define the term of waste residues more precisely by specifying its composition ("comprising at least 1% (in weight) of cellulose fibres and gelatin"). This attracted 2 marks.

[049] Maintaining and adapting the other dependent claims and adapting their dependency could also earn 2 marks.

As usual, drafting of additional claims did not attract any marks. In any case, drafting such claims was time not well spent.

### **Argumentation (70 marks)**

#### Amendments (14 marks)

[050] Providing basis for independent claims and explaining why the different features could be combined attracted up to 14 marks.

[051] For the product claim (7 marks)

For the claim directed to the face mask, the candidates were supposed to provide a basis for the amended features of nanofilter layer comprising native cellulose nanofibres.

Basis for the product claim is found in the application as follows. The fact that the cellulose fibres are native nanofibres is based on paragraph [021] to [023], [050], [051] and claim 3.

Basis for the filter layer being a nanofilter layer can be found in [026], [035]-[038], [042], [050]-[055].

The combination of “nanofilter layer” and “native cellulose nanofibres” has basis in paragraphs [021]-[023] and [035]. The at least one filter layer (par. [021]) is preferably a nanofilter layer (par. [035]) which comprises native cellulose nanofibres (par. [023] and the whole disclosure). These generic features are not inextricably linked to any specific material or method of manufacturing.

3 marks are available for identifying the correct paragraphs in the application, 4 marks for providing reasoning.

For “fibres of natural origin” in claim 1, there is no basis in the application as originally filed. Paragraph [017] uses this expression, but this paragraph is only concerned with biodegradable fibres in general and not with the nanofibres of the invention. Such an amendment does, therefore, not fulfil the requirements of Article 123(2) EPC.

[052] For the process claim (5 marks)

The basis for the clarification “comprising at least 1% (in weight) of cellulose fibres and gelatin” is paragraphs [045] and [046]. From these paragraphs it is clear that the



papermaking waste always comprises cellulose fibres and gelatin). These features should, therefore, both be introduced into the process claim.

The step “simple mechanical milling technique” (par. [048]) does not require indication of any further process details.

2 marks are available for identifying the correct paragraphs in the application, 3 marks for providing reasoning.

[053] Dependent claims (2 marks)

It should be argued that the claims are maintained and 2 and 4 have been amended in line with claims 1 and 10. 2 marks are available for this.

Clarity (4 marks)

[054] Concerning clarity it could be argued that the claims are now clear because the papermaking waste is now clearly defined. Up to 4 marks are available for this argument.

Novelty (16 marks)

[055] Claim 1:

Novelty in view of D1 should identify the distinguishing feature of a **nanofilter** layer (a filter layer comprising nanofibers).

D1 discloses a filtering layer made of compacted cellulose fibres. However, D1 does not disclose a nanofilter layer. Even if **cellulose nanofibres** may be regarded as inherently present in cellulose (cf. [0041]), they are strongly bound together and thus in a form which prevents their separation and formation of a nanosized network comprising small pore sizes in the nanometer scale (nanofilter layer, cf. [0035]). Thus, D1 does not directly and unambiguously disclose a nanofilter layer.

A maximum of 6 marks is available for this argumentation with respect to D1.

[056] Novelty in view of D2 should identify the distinguishing feature of **native** cellulose nanofibres. D2 discloses a nanofilter layer with a middle layer of cellulose acetate (which is a synthetic fibre) with a nanofiber structure. Said cellulose acetate nanofibres are however not **native** cellulose nanofibres, as D2 discloses it to be synthetic and being in solution with TFE during manufacturing which induces structural changes from the native state of the nanofibres (cf. [0042]).

A maximum of 6 marks is available for this argumentation with respect to D2.

[057] Good arguments for different novelty establishing features can also attract full marks.

[058] No novelty objections were raised with respect to D3 or D4. Arguments with respect to novelty versus said documents were not expected and did not attract any marks.

[059] Claim 10:

No novelty objection was raised against the subject-matter of claim 10, but an amendment of this claim was expected. Therefore, the novelty of the amended claim had to be addressed. The candidates could argue that their amended claim was restricted with respect to the original wording. As the original claim was considered novel according to the communication of the examining division, such an argument is sufficient. 4 marks were available for this argument.

Other arguments regarding the novelty of the claim could also give these 4 marks.

For example, D1 discloses a process for manufacturing a biodegradable filter layer made of compacted cellulose fibres comprising providing agricultural waste rich in cellulose fibres as the starting material (cf. D1 [012], [016]) but does not disclose the distinguishing features of a **nanofilter** layer, filter layer (suitable) for FFP2 type face mask, papermaking waste residues, waste residues comprising at least 1% (in weight) of cellulose fibres and gelatine, milling, one of melt-blowing or spunbonding.

Identification of any of these features as distinguishing feature(s) that provide(s) novelty of the independent process claim over D1 attracts 2 marks.

D2 discloses a process for manufacturing a (biodegradable) nanofilter layer (D2 [005]) for a multilayer FFP2 type face mask (D2 [006]), the process comprising the step of manufacturing a nonwoven nanofiber layer by electrospinning. Furthermore, D2 discloses the use of nonwoven, cotton spunbond fabric for the outer layers of the trilayer nanofilter system. However, D2 does not disclose the distinguishing features of the process comprising the method steps of providing papermaking waste residues comprising at least 1% (in weight) of cellulose fibres and gelatin, milling using grinding balls, casting into a thin nonwoven layer by melt-blowing or spunbonding.

Identification of any of these features as distinguishing feature(s) that provide(s) novelty of the independent process claim over D2 attracts 2 marks.

### Inventive step (36 marks)

[060] Claim 1 (30 marks):

D2 is considered to represent the closest prior art as it also discloses a mask with very similar performance for removal of the Coronavirus. 6 marks are available for selecting this closest prior art and presenting convincing arguments why.

It can also be argued that D1 is closest prior art. Depending on how the arguments from D1 were presented, it was also possible to obtain full marks. D1 discloses two embodiments. In paragraphs [005] to [009] a mask is disclosed that can trap the virus. This embodiment is considered closest to the claimed subject-matter. Arguing this can give up to 6 marks. The embodiment in paragraphs [010] to [015] is considered to be further away as it is not disclosed that it can trap the virus. Starting from this part of D1 can give up to 4 marks.

Arguing why the other document is a less good starting point can give 2 marks.

Identifying the differences is already done for novelty, but 2 marks are available to identify these as the second step of the problem solution approach.

The product claim of the model solution has as technical effect the improved breathability. This effect is derivable from paragraph [037] of the application. In view of G2/21 it is, therefore, possible to use the tests performed by the applicant. The candidates were expected to refer to G2/21 in their arguments and to cite the new data. Based on this analysis the objective technical problem could be defined as the provision of a facemask with improved breathability. There is no indication in the prior art to use native cellulose nanofibres in a facemask.

For the arguments concerning the technical effect 12 marks are available: 3 for identifying the effect, 6 for analysing and citing the new data and finally 3 marks for referring to G2/21.\*

Finally, 3 marks are available for formulating the problem and 5 marks for arguing why the solution is not obvious. In view of D1 as closest prior art, the problem should be defined as the provision of an alternative mask with good retention. 3 marks are available for this. If an improved retention is argued, 1 mark is available for the definition of the problem. As there is no proof of such a technical effect, this is speculation.

[061] Different solutions

Candidates who restricted the facemask to fibres coated with gelatin could also argue that the coated fibres have improved performance due to the electric charges of the filter, which then has a stronger interaction with the Coronavirus, which is also charged. This is based on paragraphs [051] and [052] of the application.

Again, D2 is the closest prior art. The difference lies in the fact that in claim 1 a nanofilter with native cellulose fibres coated with gelatin is used, whereas in D2 cellulose acetate fibres are used.

\* Erroneous allocation of marks published in original report corrected

The gelatin has as technical effect that electrostatic charges are present on the fibres, which will have a strong interaction with the Coronavirus. Better separation can thus be achieved. Even though there is no technical data to support this effect it is credible that this effect is achieved. The objective technical problem is thus the provision of a more efficient facemask. There is no indication in D2 to add gelatin to the fibres. D1 does disclose the addition of gelatin in order to increase cohesion between the fibres. Nothing is said about electrostatic charges. So even though D1 suggests the use of gelatin, there is no indication to use gelatin in the nanofibres of D2 in order to increase the separation efficiency.

These arguments are worth 15 marks in total. Closest prior art 4 marks and identifying the differences 2 marks. 3 marks for identifying technical effect, 2 marks for the problem and 4 marks for arguing why the subject-matter is not obvious.

15 marks are also available for candidates who started this line of argumentation from the closest part of D1 as closest prior art.

[062] Some candidates presented arguments on the biodegradability of the facemask. This argument is not convincing at all. It is not supported by any technical evidence. Moreover, D1 already discloses that natural cellulose fibres are biodegradable. No marks were given for candidates who presented this as their argument for inventive step.

[063] Claim 10 (6 marks):

As was mentioned under novelty, candidates could argue that their amended claim was restricted with respect to the original wording. As the original claim was considered to involve an inventive step according to the communication of the examining division, such an argument is sufficient. 6 marks were available for this argument.

A full argumentation of the inventive step of the claim could also give these 6 marks. D2 is considered to represent the closest prior art with respect to the claimed subject-matter of claim 10 as it likewise discloses a process for manufacturing a (somehow) biodegradable nanofilter layer for a multilayer FFP2 type face mask as the claimed invention (see above).

Identifying D1 as the closest prior art could also attract the 6 marks, as long as arguments were presented from the closest part of D1.

The claimed subject-matter distinguishes from the manufacturing process disclosed by D2 in that it comprises the steps of

- providing papermaking waste residues comprising at least 1% (in weight) of cellulose fibres and gelatin,
- milling using grinding balls,

- casting into a thin nonwoven layer by melt-blowing or spunbonding

There is a plurality of technical effects which results from some or all these distinguishing features. In principle, any of these can be used for reasoning an inventive step, which however will appear more or less convincing and must be evaluated on a case-by-case basis based on the solidity of the presented arguments.

The most solid argument seems to be based on the technical effect that these method steps in combination provide a nanofilter layer comprising native cellulose nanofibres and thus the technical effect of providing a nanofilter layer with improved breathability and wear comfort as reasoned for the product claim.

A further technical effect of the claimed process is that the nanofilter manufactured by the claimed process comprises nanofibres which became coated with gelatin during the process. The application discloses that an increase of filtering capacity due to electrostatic interactions might be expected. However, there is no clear evidence provided for such an improvement over the filtering capacity of D2. Thus, less marks would be awarded when inventive step argumentation based on said technical effect.

A further technical effect might be based on the fact, that both the produced filter layer as well as the manufacturing process are more eco-friendly in respect to degradability of the product or avoidance of toxic solvents. However, said line of argumentation is considered less convincing and accordingly was awarded less marks.

The objective technical problem thus could be considered as manufacturing a nanofilter layer which provides improved breathability and wear comfort.

Finally, the arguments why the subject-matter of claim 10 is not obvious: D2 discloses the problem of the process using toxic solvents and the electrospinning step being complex but does not provide any hints on how to exchange the provided synthetic cellulose acetate or what to use as a different manufacturing step for providing the nanofilter layer.

Even when considering the disclosure of D1 that provides the technical teaching that agricultural waste rich in cellulose fibres could be used as starting material for providing a filtering layer made of compacted cellulose fibres, said teaching would not provide a nanofilter layer. Furthermore, and regardless of whether or not such a starting material would be an appropriate material for the electrospinning technique of D2, neither D2 nor D1 provide the technical teaching that said starting material comprises the claimed at least 1% (in weight) of cellulose fibres and gelatine. Likewise, D2 and D1 do not disclose any milling using grinding balls. Thus, the person skilled in the art neither could nor would arrive at the claimed method steps when starting from the process of D2.

## APPENDIX

Marked up amended sets of claims in all three languages (compared to original set of claims).

EN

### Amended claims (marked up)

1. Biodegradable disposable respiratory face mask comprising at least one nanofilter layer comprising native cellulose nanofibres.
2. The biodegradable disposable respiratory face mask according to claim 1 wherein the native cellulose nanofibres are derived from cotton or hemp.
- ~~3. The biodegradable disposable respiratory face mask according to any one of claims 1 or 2 wherein the at least one filter layer is made of cellulose nanofibres.~~
- ~~4.3.~~ The biodegradable disposable respiratory face mask according to claims 1 or ~~2~~3 wherein the cellulose nanofibres are derived from papermaking waste residues comprising gelatin and at least 1% (in weight) of cellulose fibres.
- ~~5. 4.~~ The biodegradable disposable respiratory face mask according to any one of claims 1 to ~~4~~3 which is a surgical face mask or a dust face mask.
- ~~6. 5.~~ The biodegradable disposable respiratory face mask according to claim ~~5~~4 which is an FFP2 type face mask.
- ~~7. 6.~~ The biodegradable disposable respiratory face mask according to claim ~~6~~5 wherein the FFP2 face mask comprises a multilayer structure with at least three layers comprising at least one outer layer (A) with a thickness of about 40  $\mu\text{m}$  acting as a water barrier; at least one inner (middle) layer (B) with a thickness of about 8  $\mu\text{m}$  acting as filter layer; and at least another outer layer (A') with a thickness of about 40  $\mu\text{m}$  for contact with the skin.
- ~~8. 7.~~ The biodegradable disposable respiratory face mask according to claim ~~7~~6 wherein the FFP2 face mask comprises five layers comprising the outer layers (A and A') and further comprising two inner (middle) layers (B and B'), acting as filter layers, separated by a hydrophilic separation layer (C).
- ~~9. 8.~~ The biodegradable disposable respiratory face mask according to any one of claims ~~7~~or 8 ~~6~~or 7 wherein at least one layer is manufactured by conventional techniques for making nonwoven fabrics such as melt-blowing or spunbonding.

~~10.~~ 9. The biodegradable disposable respiratory face mask according to any one of claims ~~7~~  
~~to 9~~ 6 to 8 wherein the outer layers (A and A') are made of nonwoven cotton or hemp fabric.

~~11.~~ 10. Process for manufacturing a biodegradable filter layer for a multilayer FFP2 type face mask, the process comprising: providing papermaking waste residues comprising gelatin and at least 1% (in weight) of cellulose fibres, milling using grinding balls, and casting into a thin nonwoven layer by melt-blowing or spunbonding.