The present invention relates to a process for cooling hot torrefied biomass, which process comprises the steps of a) applying water onto the hot torrefied biomass, resulting in steam with entrained dust and organic volatiles, and cooled torrefied biomass comprising water; b) condensing the steam with entrained dust and organic volatiles to form a condensate comprising dust and organic volatiles; and c) recycling the condensate comprising dust and organic volatiles to step a).

The invention also relates to a cooling device for cooling hot torrefied biomass enabling the cooling process according to the invention, and a system for producing torrefied biomass comprising such a cooling device.

Dit octrooi is verleend ongeacht het bijgevoegde resultaat van het onderzoek naar de stand van de techniek en schriftelijke opinie. Het octrooischrift komt overeen met de oorspronkelijk ingediende stukken.
COOLING PROCESS OF TORREFFIED BIOMASS

The present invention relates to a process for cooling hot torrefied biomass, a process for the preparation of torrefied biomass, a device for cooling hot torrefied biomass, and a system for the production of torrefied biomass.

In a torrefaction process, biomass is heated during which biomass properties are changed to obtain a much better fuel quality for combustion and gasification applications. Biomass is present in biodegradable industrial and domestic waste such as e.g. agricultural waste, wood chippings, mowed grass and even municipal solid waste, and is widely viewed of as a good alternative for fossil fuels.

Unfortunately the current energy infrastructure is based on coal fired plants, and biomass currently cannot be fired or even co-fired in such plants, because the properties of biomass differ significantly from those of coal. For example, biomass tends to be difficult to pulverize and its energy density is typically substantially lower than the energy density of coal. The latter also makes logistics and storage of biomass relatively expensive.

In order to co-fire biomass in existing coal-fired plants, the biomass can be treated to alter its properties to be more coal-like. Torrefaction is a thermal pre-treatment method for biomass which can be applied to all kinds of biomass. During the torrefaction process, the biomass is usually heated under atmospheric pressure to temperatures of about 200 - 320 °C in the substantial absence of oxygen. The oxygen depletion prevents combustion of the biomass, while at the same time the high temperature leads to the removal of water and volatile organic compounds from the biomass. After the process, the biomass has decreased in weight by up to 30%, whilst the energy value has only been reduced by e.g. 10%. Thus, a product with a higher calorific value is achieved.

Torrefaction drives moisture, and oxygen- and hydrogen rich functional groups from the crude biomass. As a result, the properties of torrefied biomass are very similar irrespective of the source of the crude biomass. Furthermore, torrefaction eliminates any biological activity, so that biological decomposition like rotting does not occur. Torrefaction also eliminates the risk of spontaneous combustion. The resulting torrefied materials are more brittle, leading to better grindability, and the torrefied biomass is also hydrophobic, which makes storage in open air feasible. Several modes exist for torrefying biomass. For example, the biomass can be heated in a compact moving bed reactor, a belt dryer, a rotating drum, or a fluidized bed reactor.

After torrefaction, the biomass should be cooled to decrease the temperature from reactor conditions (200 to 320 °C) to below 100 °C. This stops the decomposition reactions
that torrefaction represents and conditions the torrefied product for further upgrading such as milling and densification. A potential hazard that can occur when cooled torrefied biomass is exposed to air is spontaneous ignition. Especially when the particles are still hot (> 50 °C) and bone dry.

Direct cooling of the product with water is a very effective manner to reduce the temperature quickly and add a significant amount of moisture. This method yields a high cooling rate of the product particles, which is attractive to freeze the decomposition reactions and reduce volatile emissions from the particles in the cooler or even further downstream. It also eliminates fire hazards.

Such a cooling process comprising a step of applying water onto the hot torrefied biomass is known from WO2012158112-A2, for example. Water is applied to the torrefied material to quench-cool the material, after which both the torrefied material and the gases that are released during cooling are fed to a common cooling device for further cooling the torrefied material together with these gasses. In this way components of these gases condense in the cooling device, e.g. on the torrefied material.

WO2012158111-A1 describes a cooling process for torrefied biomass, in which hot torrefied biomass is transported through a cooled drum by means of a screw. At least a part of the cooled torrefied material is mixed-back with hot torrefied material during cooling.. In this way, gasses given off by the hot material will condense on the cold torrefied material. This decreases clogging of the device, increases the energy yield of the final torrefied product, and increases the hydrophobicity of the final torrefied product. Only the initial application of water provides for fast cooling. The cooling process in the common cooling device is much slower.

WO2013081510-A1 describes cooling of torrefied material by adding water. A cyclonic separator to separate the steam and torrefied material is disclosed. After this separation step, the steam is condensed for recovery of heat.

EP2589648-A1 discloses a process for the torrefaction of biomass, in which processed biomass is cooled by spraying water onto the product. EP2589648-A1 specifically mentions not raising the moisture content of the cooled product above approximately 3 weight percent.

WO2011119470-A1 also discloses cooling of hot torrefied biomass by a water spray. It furthermore discloses conditioning the biomass to a moisture content of 5 to approximately 15% for lubrication purposes during densification.

Now it has been observed that when torrefied biomass is cooled in a mixer vessel using water sprays, that the formed steam besides organic volatiles is never free of dust. This combination of steam, volatiles, and dust makes the treatment of the steam not straightforward and even problematic. Especially the steam condensation involves fouling by the deposition of dust and equipment can readily block when the condensation process is not
facilitated correctly. In turn, this can lead to product loss due to loss of dust, and to a high maintenance and a low uptime characteristic correspondingly.

Generally the invention aims at the reduction and/or elimination of one or more of the above disadvantages related to the cooling of hot torrefied biomass.

According to the invention, the process for cooling hot torrefied biomass comprising a step a) of applying water onto the hot torrefied biomass therefore further comprises the steps of b) condensing the steam with entrained dust and organic volatiles to form a condensate comprising dust and organic volatiles, and c) recycling the condensate comprising dust and organic volatiles to step a). By condensing the steam and recycling the condensate comprising dust and organic volatiles, the water and dust mixture are not separated, but instead the mixture is applied onto the hot biomass. As a result the biomass is cooled. In this way, the dust and organic volatiles are collected and reused as valuable product. This way of integrating furthermore prevents the need for a water/dust separator such as a filter or decanter.

In step b) extra water is preferably added to the process. This extra water compensates for water that is absorbed by the biomass and therefore lost from the recycle loop. Step b) may take place in a condensation device such as a condenser. As previously stated, especially the steam condensation involves fouling. Equipment can readily block when the condensation process is not facilitated correctly. This can lead to severe fouling, product loss due to loss of dust, and to a high maintenance and a low uptime characteristic correspondingly. The addition of water in this particular step of the process has the advantage that the steam with entrained dust and organic volatiles is diluted by the water. This reduces fouling and minimizes the accompanying disadvantages. Furthermore, a cause of the high degree of fouling involved with the steam/dust mixture in condensation is the ratio of water to dust. A low ratio causes the mixture of condensate and dust/organics to be a sticky viscous substance, which attaches to the inner walls of equipment, such as the condenser. A higher ratio of water to dust surprisingly prevents the formation of this sticky viscous substance. Therefore, a high ratio of water to dust is advantageous.

The water is preferably sprayed onto the hot biomass in step a). Spraying results in an even distribution of water on the biomass. Thereby it results in an even cooling.

The biomass can be heated using several methods. Commonly, heating takes place in compact moving bed reactors, belt dryers, rotating drums, and fluidized bed reactors, amongst others. A fluidized bed reactor is particularly advantageous. In such a reactor, the biomass is brought into contact with a hot gas, by which it is fluidized. As a result, the heat transfer between the biomass and the hot gas is particularly good.

Preferably, the fluidized bed reactor is a toroidal bed reactor. A toroidal bed reactor is provided with an annular treatment chamber which defines a substantially vertical axis, which
treatment chamber comprises a supply for biomass particles, a discharge for biomass particles and a bottom, which bottom is provided with supply openings which debouch upwards into the treatment chamber, preferably obliquely with respect to the vertical axis in which a hot gas is supplied to the supply openings for forming a fluidized bed of biomass particles on the bottom which is displaced in the peripheral direction of the annular treatment chamber. Such a toroidal bed reactor is known, for example, from WO99/16541. When using a toroidal bed reactor as a heating device, the heat transfer between the supplied hot gas and the biomass is particularly good.

The hot torrefied biomass preferably is a particulate material. Heat transfer to particulate material is more efficient than heat transfer to material of larger size, as the inside of particulate material heats faster. Preferably, the particles have a size less than 16 mm. In larger particles, the heat transfer is not efficient enough. Also, larger particles cannot be efficiently fluidized. More preferably, the particles have a size less than 8 mm. The heat transfer is even more efficient than for larger particles, and when a fluidized or toroidal bed reactor is used for heating, the gas flow needed for fluidization can be decreased compared to larger particles. Even more preferably, the particles have a size less than 4 mm. This provides for an optimal balance between heat transfer and fluidization.

The invention also provides for a process for the preparation of biomass, which process comprises the steps of i) supplying wet biomass; ii) drying the wet biomass to form dried biomass; iii) heating the dried biomass to form hot torrefied biomass; and iv) cooling the hot torrefied biomass using the process for cooling hot torrefied biomass as previously described. This process removes excess moisture and high-volatiles from the biomass and provides for the production of cooled biomass with a calorific value suitable for co-firing in coal-fired plants.

The process for preparation of biomass further comprises the step of v) pelletizing the cooled torrefied biomass containing water. Pelletization densifies the material, such that storage and transport become more efficient. Handling of pelletized material is also easier than handling particulate material.

The examples, advantageous and preferred embodiments presented above regarding the process for cooling hot torrefied biomass are equally applicable to the process for preparation of biomass and further aspects of the invention described below.

The invention furthermore provides for a device for cooling hot biomass, comprising a housing defining a cooling chamber, and having a biomass inlet for supplying hot torrefied biomass into the cooling chamber, a biomass outlet for discharging cooled torrefied biomass comprising water from the cooling chamber, a water inlet for introducing water into the cooling chamber, a steam outlet for removing steam with entrained dust and organic volatiles from the cooling chamber; a condenser for condensing steam, having a steam inlet for feeding
steam with entrained dust and organic volatiles into the condenser, a condensate outlet for removing condensate comprising dust and organic volatiles from the condenser, wherein the condensate outlet is connected to the water inlet for introducing water into the cooling chamber, and wherein the steam inlet is connected to the outlet for removing steam from the cooling chamber.

In the device for cooling hot biomass, the condenser has a water inlet for feeding fresh water into the condenser.

In the device for cooling hot biomass, the water inlet for introducing water into the cooling chamber is connected to spray nozzles positioned in the cooling chamber.

The invention provides for a system for producing torrefied biomass, comprising a drying zone, comprising an inlet for wet biomass, and an outlet for dried biomass; a torrefaction zone, comprising an inlet for dried biomass, which connects to the outlet for dried biomass of the drying zone, and an outlet for hot torrefied biomass; and a cooling zone comprising a device for cooling hot biomass, further comprising an inlet for hot torrefied biomass, which connects to the outlet for hot torrefied biomass of the torrefaction zone, and an outlet for discharging cooled biomass comprising water.

The system for producing torrefied biomass further comprises a pelletizing zone, comprising an inlet for cooled torrefied biomass comprising water, which connects to the outlet for cooled torrefied biomass comprising water of the cooling zone, and an outlet for pelletized biomass.

In the system for producing torrefied biomass, the torrefaction zone comprises at least a fluidized bed reactor.

Preferably, the fluidized bed reactor in the system for producing torrefied biomass is a toroidal bed reactor.

The torrefaction zone in the system for producing torrefied biomass may further comprise a plug flow reactor. In such a case, the torrefaction zone consists of at least one or multiple fluidized bed reactors, which may be toroidal bed reactors, and one or multiple plug flow reactors. In such a configuration, the advantageous characteristics of both types of reactors are optimally used. The fluidized bed reactor has excellent heat transfer capabilities, but provides for relatively short residence times. The fluidized bed reactor can therefore be used to quickly heat the biomass to a desired temperature during a first time period. The biomass may then be directly or indirectly transferred to the plug flow reactor(s). Plug flow reactors provide for larger volumes and longer residence times, and are therefore well suited to maintain the biomass at a certain torrefaction temperature for a certain second time period, which time period is preferably longer than the first time period, until the biomass is torrefied to a satisfactory level.
The invention is further illustrated by means of the attached drawing, wherein:

Figure 1 is a schematic view of an embodiment of a device for cooling hot torrefied biomass.

Figure 2 is a schematic view of an embodiment of a system for producing torrefied biomass.

Figure 1 provides a schematic view of a device for cooling hot torrefied biomass. It comprises a housing defining a cooling chamber 1. This housing has a biomass inlet 2 for supplying hot torrefied biomass into the cooling chamber, and a biomass outlet 3 for discharging cooled torrefied biomass comprising water from the cooling chamber. The housing further comprises a water inlet 4 for introducing water into the cooling chamber, and a steam outlet 5 for removing steam with entrained dust and organic volatiles from the cooling chamber. In this embodiment, the water inlet 4 is connected to spray nozzles 9 positioned in the cooling chamber. The device for cooling hot biomass further comprises a condenser 6 for condensing steam. This condenser has a steam inlet 7 for feeding steam with entrained dust and organic volatiles into the condenser 6, and a condensate outlet 8 for removing condensate comprising dust and organic volatiles from the condenser 6. In this embodiment, the condenser has a water inlet 22 for feeding fresh water into the condenser. Within the condenser, both direct cooling of the biomass with water as well as indirect cooling may happen simultaneously. Indirect cooling may e.g. take place by contacting the biomass with a cold water-fed piping system in which water is continuously flowed. The water stream in the latter piping system is preferably not connected to the water supply that comes into contact with the biomass. The condensate outlet 8 is connected to the water inlet 4 for introducing water into the cooling chamber 1 via conduit 23. The steam inlet 7 is connected to the outlet 5 via outlets 25 for removing steam from the cooling chamber 1 and conduit 24.

Figure 2 provides a schematic view of a system for producing torrefied biomass. The system comprises a drying zone 10. This drying zone comprises an inlet for wet biomass 11, and an outlet for dried biomass 12. The system further comprises a torrefaction zone 13, which comprises an inlet for dried biomass 14, connecting to the outlet for dried biomass 12 of the drying zone, and an outlet for hot torrefied biomass 15. The system also comprises a cooling zone 16 comprising a cooling device, further comprising an inlet for hot torrefied biomass 17, which connects to the outlet for hot torrefied biomass 15 of the torrefaction zone, and an outlet for discharging cooled biomass comprising water 18. The system may further comprise a pelletizing zone 19. This pelletizing zone comprises an inlet for cooled torrefied biomass comprising water 20. This inlet connects to the outlet for cooled torrefied biomass comprising water 18 of the cooling zone. The pelletizing zone further comprises an outlet for pelletized biomass 21.
In a typical process, biomass is dried in the drying zone 10 to reduce the moisture content to 5-20%, after which it is transported, for example using a conveyor belt, to the torrefaction zone 13. In the torrefaction zone, the dried biomass is torrefied at elevated temperatures.

In this exemplary embodiment, the torrefaction zone consists of multiple treatment devices. The first treatment device is configured as a so-called toroidal bed reactor. In the toroidal bed reactor, the biomass is quickly (within about 2 min.) heated to a temperature of 200-320 °C within a first time period. The biomass is then transported to a second treatment device, which is configured according to the principle of a plug flow reactor. This reactor provides for treatment at comparable temperatures but for a longer period. The second time period is long enough for all biomass particles to be thoroughly heated, thus ensuring that all biomass particles are sufficiently torrefied.

After torrefaction, the torrefied biomass is transported to the cooling zone 16, which comprises a device for cooling hot torrefied biomass. This device comprises a housing defining a cooling chamber 1. The biomass is transported through biomass inlet 2 into cooling chamber 1. Water is sprayed onto the biomass through nozzles 9, resulting in steam with entrained dust and organic volatiles, from now on called dirty steam, and cooled biomass comprising water. The cooled biomass comprising water is transported out of the cooling chamber through outlet 3. The dirty steam leaves the cooling chamber through outlets 5.

Through conduit 24, this steam is transported to the inlet 7 of the condenser. In the condenser, the dirty steam is condensed to form water with entrained dust and organic volatiles. Fresh water is added through inlet 22. Uncondensed dirty steam may leave the condenser through an outlet for dirty steam (not shown in the drawings). The water with entrained dust, organic volatiles, and added fresh water leaves the condenser through outlet 8, and is transported into the spray nozzles 9 in the cooling chamber through inlet 4.

The cooled torrefied biomass may then be transported to a pelletizing zone 21.
C O N C L U S I E S

1. Werkwijze voor het koelen van hete getorrefieerde biomassa, welke werkwijze de stappen omvat van

a) het aanbrengen van water op de hete getorrefieerde biomassa, resulterend in stoom met meegevoerd stof en organische vluchtige stoffen, en gekoelde getorrefieerde biomassa, die water omvat;

b) het condenseren van de stoom met meegevoerd stof en organische vluchtige stoffen om een condensaat, dat stof en organische vluchtige stoffen omvat, te vormen; en

c) het terugvoeren van het condensaat, dat stof en organische vluchtige stoffen omvat, naar stap a).

2. Werkwijze volgens conclusie 1, waarbij in stap b) vers water wordt toegevoegd aan de stoom met meegevoerd stof en organische vluchtige stoffen.

3. Werkwijze volgens conclusie 1 of 2, waarbij in stap a) het water op de hete getorrefieerde biomassa wordt gesproeid.

4. Werkwijze volgens een van de voorgaande conclusies, waarbij de uit stap a)

verkregen gekoelde getorrefieerde biomassa een watergehalte van ten minste 3 vol% bezit.

5. Werkwijze volgens een van de voorgaande conclusies, waarbij de hete getorrefieerde biomassa werd verwarmd in een reactor met geëvaporieerd bed.

6. Werkwijze volgens conclusie 5, waarbij de reactor met geëvaporieerd bed een
toroidale bed reactor is.

7. Werkwijze volgens een van de voorgaande conclusies, waarbij de hete getorrefieerde biomassa een deeltjesvormig materiaal is, bij voorkeur met een
deeltjesafmeting van minder dan 16 mm, meer bij voorkeur van minder dan 8 mm, met de meeste voorkeur van minder dan 4 mm.

8. Werkwijze voor de bereiding van getorrefieerde biomassa, welke werkwijze de stappen omvat van

i) het leveren van vochtige biomassa;

ii) het drogen van de vochtige biomassa om gedroogde biomassa te vormen;

iii) het verwarmen van de gedroogde biomassa om hete getorrefieerde biomassa te vormen; en
iv) het koelen van de hete getorreficeerde biomassa onder gebruikmaking van de werkwijze volgens een van de voorgaande conclusies 1-7.

9. Werkwijze volgens conclusie 8, welke verder de stap omvat van

v) het pelletiseren van de gekoelde getorreficeerde biomassa, die water bevat.

10. Inrichting voor het koelen van hete getorreficeerde biomassa, die omvat een huis dat een koelkamer (1) definiëert, en met een biomassainvoer (2) voor het toevoeren van hete getorreficeerde biomassa in de koelkamer,

een biomassafvoer (3) voor het afvoeren van gekoelde getorreficeerde biomassa, die water omvat, uit de koelkamer,

een waterinvoer (4) voor het inbrengen van water in de koelkamer

een stoominvoer (5) voor het verwijderen van stoom met meegevoerd stof en vluchtige organische stoffen uit de koelkamer;

een condensor (6) voor het condenseren van stoom met een stoominvoer (7) voor het toevoeren van stoom met meegevoerd stof en organische vluchtige stoffen in de condensor (6)

een condensaatafvoer (8) voor het verwijderen van condensaat, dat stof en vluchtige organische stoffen omvat, uit de condensor (6), waarbij de condensaatafvoer (8) is verbonden met de waterinvoer (4) voor het inbrengen van water in de koelkamer (1), en waarbij de stoominvoer (7) is verbonden met de afvoer (5) voor het verwijderen van stoom uit de koelkamer (1).

11. Inrichting volgens conclusie 10, waarbij de condensor (6) een waterinvoer (22) voor het toevoeren van vers water in de condensor bezit.

12. Inrichting volgens conclusies 11, waarbij de waterinvoer (4) voor het inbrengen van water in de koelkamer is verbonden met sproeimondstukken (9), die in de koelkamer zijn geplaatst.

13. Systeem voor het bereiden van getorreficeerde biomassa, omvattend een droogzone (10), die een invoer (11) voor vochtige biomassa omvat, en een afvoer (12) voor gedroogde biomassa,
een torrefactiezone (13), die een invoer (14) voor gedroogde biomassa omvat, en die is verbonden met de afvoer (12) voor gedroogde biomassa van de droogzone, en een afvoer (15) voor hete getorreficeerde biomassa, en
een koelzone (16), die een koelinrichting volgens een van de conclusies 11-13 omvat, verder omvattende een invoer voor hett ge torpedo ficeerde biomassa, die is verbonden met de afvoer voor het ge torpedo ficeerde biomassa van de torrefactiezone, en een afvoer (18) voor het afvoeren van gekoelde biomassa, die water omvat.

14. Systeem volgens conclusie 13, verder omvattende een pelletiseerzone (1), die een invoer (20) voor gekoelde ge torpedo ficeerde biomassa omvat, die water omvat, die verbonden is met de afvoer (18) voor gekoelde ge torpedo ficeerde biomassa die water omvat, van de koelzone, en een afvoer (21) voor gepelletiseerde biomassa.

15. Systeem volgens een van de conclusies 13-14, waarbij de torrefactiezone ten minste een reactor met gefluidiseerd bed omvat.

16. Systeem volgens conclusie 15, waarbij de reactor met gefluidiseerd bed een toroidale bed reactor is.

17. Systeem volgens een van de conclusies 15-16, waarbij de torrefactiezone verder een propstroomreactor omvat.
ABSTRACT

The present invention relates to a process for cooling hot torrefied biomass, which process comprises the steps of a) applying water onto the hot torrefied biomass, resulting in steam with entrained dust and organic volatiles, and cooled torrefied biomass comprising water; b) condensing the steam with entrained dust and organic volatiles to form a condensate comprising dust and organic volatiles; and c) recycling the condensate comprising dust and organic volatiles to step a). The invention also relates to a cooling device for cooling hot torrefied biomass enabling the cooling process according to the invention, and a system for producing torrefied biomass comprising such a cooling device.

Fig. 1
### IDENTIFICATIE VAN DE NATIONALE AANVRAGE

- Nederlands aanvraag nr.: 2014279

### KENMERK VAN DE AANVRAGER OF VAN DE GEMACHTIGDE

- Kennisgeving: P32028NL00/JV
- Indieningsdatum: 12-02-2015
- Ingeroepen voorraadsgroei: 

### AANVRAGER (Naam)

- Topell Energy B.V.

### Datum van het verzoek voor een onderzoek van internationaal type

- 30-05-2015

### Door de Instantie voor Internationaal Onderzoek aan het verzoek voor een onderzoek van internationaal type toegekend nr.

- SN64216

### I. CLASSIFICATIE VAN HET ONDERWERP (bij toepassing van verschillende classificaties, alle classificatiesymbolen opgeven)

Volgens de internationale classificatie (IPC)

- C10L9/08

### II. ONDERZOCHTE GEBIEDEN VAN DE TECHNIEK

#### Onderzochte minimumdocumentatie

#### Classificatiesysteem

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Onderzochte andere documentatie dan de minimum documentatie, voor zover dergelijke documentatie in de onderzochte gebieden zijn opgesteld:

### III. GEEN ONDERZOEK MOGELIJK VOOR BEPAALDE CONCLUSIES

(opmerkingen op aanvullingsblad)

### IV. GEBREK AAN EENHEID VAN UITVINDING

(opmerkingen op aanvullingsblad)

Form PCT/ISA 201 A (11/2000)
ONDERZOEKRAPPORT BETREFFENDE HET
RESULTAAT VAN HET ONDERZOEK NAAR DE STAND
VAN DE TECHNIEK VAN HET INTERNATIONAAL TYPE

A. CLASSIFICATIE VAN HET ONDERWERP.
INV. C10L9/08
ADD.

Volgens de Internationale Classificatie van ontwerpen (IPC) of zowel volgens de nationale classificatie als volgens de IPC.

B. ONDERZOEKDE GEBIEDEN VAN DE TECHNIEK

Onderzochte minimum documentatie (classificatie gevolgd door classificatiesymbolen)
C10L

Onderzochte andere documentatie dan de minimum documentatie, voor dergelijke documenten, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen:

Tijdens het onderzoek geraadpleegde elektronische gegevensbestanden (naam van de gegevensbestanden en, waar uitvoerbaar, gebruikte referentie):
EPO-internal

C. VAN BELANG GЕACHTE DOCUMENTEN

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☒ Leden van dezelfde ontoloog continue zijn vermeld in een bijlage

Datum waarop het onderzoek naar de stand van de techniek van internationaal type werd voltrokken
28 september 2015

Naam en adres van de instantie
European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel: (020-70) 340-2040, Fax: (020-70) 340-3016

De bevorderde ambtenaar

Bertin, Séverine
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☑ Box No. I  Basis of the opinion
☐ Box No. II  Priority
☐ Box No. III  Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐ Box No. IV  Lack of unity of invention
☑ Box No. V  Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐ Box No. VI  Certain documents cited
☐ Box No. VII  Certain defects in the application
☐ Box No. VIII  Certain observations on the application

Examiner
Bertin, Séverine

Form NL237A (Devis) (July 2006)
Box No. I  Basis of this opinion

1. This opinion has been established on the basis of the latest set of claims filed before the start of the search.

2. With regard to any nucleotide and/or amino acid sequence disclosed in the application and necessary to the claimed invention, this opinion has been established on the basis of:

   a. type of material:
      - [ ] a sequence listing
      - [ ] table(s) related to the sequence listing

   b. format of material:
      - [ ] on paper
      - [ ] in electronic form

   c. time of filing/furnishing:
      - [ ] contained in the application as filed
      - [ ] filed together with the application in electronic form
      - [ ] furnished subsequently for the purposes of search

3. [ ] In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

Box No. V  Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

   Novelty
   - Yes: Claims
   - No: Claims

   Inventive step
   - Yes: Claims
   - No: Claims

   Industrial applicability
   - Yes: Claims
   - No: Claims

2. Citations and explanations

   see separate sheet
Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following documents:


1 The present application does not meet the criteria of patentability, because the subject-matter of independent claims 1 and 10 is not new.

2 D1 discloses (zie alinea [0042] - [0044]; figuur 4.5): een werkwijze voor het koelen van hete getorreficeerde biomass, welke werkwijze de stappen omvat van

   a) het aanbrengen van water op de hete getorreficeerde biomass, resulterend in stoom met meegevoerd stof en organische vluchtige stoffen, en gekoelde getorreficeerde biomass, die water omvat;

   b) het condenseren van de stoom met meegevoerd stof en organische vluchtige stoffen om een condensaat, dat stof en organische vluchtige stoffen omvat, te vormen; en

   c) het terugvoeren van het condensaat, dat stof en organische vluchtige stoffen omvat, naar stap a).

3 Furthermore, also D2 (alineaas [0015], [0053], [0060] - [0062]; figuur 1) discloses the subject-matter of claim 1, which is therefore also not new in view of this disclosure.

4 The same reasoning applies, mutatis mutandis, to the subject-matter of the corresponding independent "inrichting" claim 10, which therefore is also considered not new in view of either D1 or D2.

5 At this stage the dependent claims 2-9 and 11-17 do not appear to contain any additional features which, in combination with the features of any claim to which they refer, meet the requirements of novelty or inventive step, as these features are either already known from one or more of the above-cited documents (D1: alineaas [0029], [0042] - [0044], [0055], [0060], [0067]; figuur
4,5; D2: alineas [0015], [0053], [0060] - [0062]; figuur 1) or they come within the scope of the customary practice followed by persons skilled in the art, especially as the advantages thus achieved can be readily contemplated in advance.