

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

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PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing
(day/month/year)

09 JAN 2019

Applicant's or agent's file reference
N00564WO-PCT

FOR FURTHER ACTION

See paragraph 2 below

International application No.
PCT/US18/53162

International filing date (day/month/year)
27 September 2018 (27.09.2018)

Priority date (day/month/year)
28 September 2017 (28.09.2017)

International Patent Classification (IPC) or both national classification and IPC

IPC - C09K 8/02, 8/08, 8/20 (2018.01)

CPC - C08B 37/0024; C09K 8/02, 8/08

Applicant **CARGILL, INCORPORATED**

1. This opinion contains indications relating to the following items:

- ☒ 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 under Rule 43bis.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/US
Mail Stop PCT, Attn: ISA/US
Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450
Facsimile No. 571-273-8300

Date of completion of this opinion
13 November 2018 (13.11.2018)

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Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:

- ☒ the international application in the language in which it was filed.
☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a)).

3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:

a. ☐ forming part of the international application as filed:

- ☐ in the form of an Annex C/ST.25 text file.
☐ on paper or in the form of an image file.

b. ☐ furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.

c. ☐ furnished subsequent to the international filing date for the purposes of international search only:

- ☐ in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a)).
☐ on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

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Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-29, 34-36, 43-44, 47, 49, 51-60, 66	YES
	Claims	30-33, 37-42, 45-46, 48, 50, 61-65	NO
Inventive step (IS)	Claims	4	YES
	Claims	1-3, 5-66	NO
Industrial applicability (IA)	Claims	1-66	YES
	Claims	NONE	NO

2. Citations and explanations:

Claims 30-33, 37-42, 45-46, 48, 50 and 61-65 lack novelty under PCT Article 33(2) as being anticipated by US 2016/0122623 A1 to Chevron U.S.A. Inc. (hereinafter 'Chevron').

Regarding claim 30, Chevron discloses a method of maintaining a Filterability Ratio of an aqueous beta-glucan composition (a scleroglucan (beta-glucan) polymer powder is mixed with an aqueous brine solution wherein the composition has a filter ratio of less than 1.5; paragraphs [0024], [0038], [0073]), the method comprising: controlling temperature of the aqueous beta-glucan composition, salinity of the aqueous beta-glucan composition (a scleroglucan (beta-glucan) polymer powder is mixed with an aqueous brine solution softened to adjust salinity (controlling salinity) to have a TDS such as 32,290 ppm; paragraphs [0038], [0073]), or a combination thereof, such that the Filterability Ratio of the aqueous beta-glucan composition is less than 2 (the aqueous scleroglucan composition prepared with the brine has a filter ratio of less than 1.5; paragraphs [0024], [0038]).

Regarding claim 31, Chevron discloses the method of claim 30, and Chevron further discloses wherein the controlling of the temperature or salinity of the aqueous beta-glucan composition is performed above-surface (the scleroglucan (beta-glucan) polymer powder is mixed with an aqueous brine solution softened to adjust salinity (controlling salinity) to have a TDS such as 32,290 ppm wherein the aqueous polymer composition has a filter ratio of less than 1.5 for use as an oil injection solution (performed above-surface); paragraphs [0024], [0038], [0073]), in a subterranean formation, or a combination thereof.

Regarding claim 32, Chevron discloses the method of claim 30, and Chevron further discloses comprising controlling temperature of the aqueous beta-glucan composition, salinity of the aqueous beta-glucan composition (the scleroglucan (beta-glucan) polymer powder is mixed with an aqueous brine solution softened to adjust salinity (controlling salinity) to have a TDS such as 32,290 ppm; paragraphs [0038], [0073]), or a combination thereof, such that the Filterability Ratio of the aqueous beta-glucan composition is less than 2 and greater than or equal to 1.2 (the aqueous scleroglucan composition prepared with the brine has a filter ratio of less than 1.5; paragraphs [0024], [0038]).

Regarding claim 33, Chevron discloses the method of claim 30, and Chevron further discloses comprising controlling temperature of the aqueous beta-glucan composition, salinity of the aqueous beta-glucan composition (the scleroglucan (beta-glucan) polymer powder is mixed with an aqueous brine solution softened to adjust salinity (controlling salinity) to have a TDS such as 32,290 ppm; paragraphs [0038], [0073]), or a combination thereof, such that the Filterability Ratio of the aqueous beta-glucan composition is less than 1.2 (the aqueous scleroglucan composition prepared with the brine has a filter ratio of less than 1.5; paragraphs [0024], [0038]).

Regarding claim 37, Chevron discloses the method of claim 30, and Chevron further discloses wherein controlling salinity of the aqueous beta-glucan composition comprises changing or maintaining the salinity of the aqueous beta-glucan composition such that the salinity of the aqueous beta-glucan composition reaches or is maintained at a predetermined salinity (the scleroglucan (beta-glucan) polymer powder is mixed with an aqueous brine solution that can be softened (changing) to adjust salinity (controlling salinity) wherein a brine has a TDS of 32,290 ppm (reaches a predetermined salinity); paragraphs [0038], [0073]).

Regarding claim 38, Chevron discloses the method of claim 30, and Chevron further discloses wherein controlling salinity of the aqueous beta-glucan composition comprises diluting the aqueous beta-glucan composition such that the salinity of the aqueous beta-glucan composition reaches or is maintained at a predetermined salinity (the scleroglucan (beta-glucan) polymer powder is mixed with an aqueous brine solution that can be softened to adjust salinity (controlling salinity) wherein a brine has a TDS of 32,290 ppm (reaches a predetermined salinity) and the aqueous fluid can be a mixture of fluids such as a seawater and well or fresh water (diluting); paragraphs [0038], [0073]).

Regarding claim 39, Chevron discloses the method of claim 37, and Chevron further discloses wherein the predetermined salinity is sufficient such that the aqueous beta-glucan composition has a Filterability Ratio of less than 2, or less than 1.2 (the aqueous scleroglucan (beta-glucan) composition prepared with the brine with a TDS such as 32,290 ppm (predetermined salinity) has a filter ratio of less than 1.5; paragraphs [0024], [0038], [0073]).

Regarding claim 40, Chevron discloses the method of claim 30, and Chevron further discloses wherein the refined beta-glucan has a concentration in the aqueous beta-glucan composition of about 30 ppm to about 3,000 ppm (the scleroglucan (beta-glucan) hydrated polymer has a concentration from 100-50,000 ppm, scleroglucan is a biopolymer prepared from a fungus (refined); paragraphs [0038], [0065]).

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Regarding claim 41, Chevron discloses the method of claim 30, and Chevron further discloses wherein the refined beta-glucan has a concentration in the aqueous beta-glucan composition of about 400 ppm to about 3,000 ppm (the scleroglucan (beta-glucan) hydrated polymer has a concentration from 100-50,000 ppm, scleroglucan is a biopolymer prepared from a fungus (refined); paragraphs [0038], [0065]).

Regarding claim 42, Chevron discloses the method of claim 30, and Chevron further discloses wherein the method is a method of treating a subterranean formation comprising placing the aqueous beta-glucan composition in a subterranean formation (the scleroglucan (beta-glucan) hydrated polymer solution is injected into a wellbore of a subterranean reservoir; paragraphs [0038], [0065], [0071]).

Regarding claim 45, Chevron discloses the method of claim 42, and Chevron further discloses wherein the method of treating a subterranean formation comprises enhanced oil recovery polymer flooding, hydraulic fracturing, or a combination thereof (a method of enhancing oil recovery in a subterranean reservoir comprises injecting the scleroglucan hydrated polymer flooding fluid into a wellbore and can be utilized as a hydraulic fracturing fluid; paragraphs [0038], [0019], [0071]-[0072]).

Regarding claim 46, Chevron discloses the method of claim 42, and Chevron further discloses wherein controlling the temperature or salinity of the aqueous beta-glucan composition is performed prior to, during, or after the placing of the aqueous beta-glucan composition in the subterranean formation (the scleroglucan (beta-glucan) polymer powder is mixed with an aqueous brine solution that can be softened to adjust salinity (controlling salinity) for use (prior to) as an injection solution into a wellbore of a subterranean reservoir; paragraphs [0038], [0071], [0073]).

Regarding claim 48, Chevron discloses the method of claim 42, and Chevron further discloses wherein controlling the temperature or salinity of the aqueous beta-glucan composition so that the aqueous beta-glucan composition has a Filterability Ratio of less than 2, or less than 1.2, is performed prior to, during, or after the placing of the aqueous beta-glucan composition in the subterranean formation (the scleroglucan (beta-glucan) polymer powder is mixed with an aqueous brine solution that can be softened to adjust salinity (controlling salinity) wherein a brine has a TDS of 32,290 ppm and the aqueous scleroglucan composition prepared with the brine has a filter ratio of less than 1.5 for use (prior to) as an injection solution into a wellbore of a subterranean reservoir; paragraphs [0038], [0071], [0073]).

Regarding claim 50, Chevron discloses the method of claim 42, and Chevron further discloses comprising diluting the aqueous beta-glucan composition to reduce the salinity thereof so that the aqueous beta-glucan composition has a Filterability Ratio of less than 2, or less than 1.2, prior to placing the aqueous beta-glucan composition in the subterranean formation (the scleroglucan (beta-glucan) polymer powder is mixed with an aqueous brine solution that can be softened (reduce salinity) to adjust salinity wherein a brine has a TDS of 32,290 ppm and the aqueous fluid can be a mixture of fluids such as a seawater and well or fresh water (diluting); paragraphs [0038], [0073]).

Regarding claim 61, Chevron discloses the method of claim 42, and Chevron further discloses comprising performing an enhanced oil recovery procedure in the subterranean formation using the aqueous beta-glucan composition (a method of enhancing oil recovery in a subterranean reservoir comprises injecting the aqueous scleroglucan polymer fluid into a wellbore; paragraphs [0019], [0038], [0071]).

Regarding claim 62, Chevron discloses the method of claim 61, and Chevron further discloses wherein the enhanced oil recovery procedure comprises polymer flooding (a method of enhancing oil recovery in a subterranean reservoir comprises injecting the aqueous scleroglucan polymer flooding fluid into a wellbore; paragraphs [0019], [0038], [0071]).

Regarding claim 63, Chevron discloses the method of claim 61, and Chevron further discloses wherein the aqueous beta-glucan composition in the subterranean formation sweeps petroleum in the subterranean formation toward a well (injecting the aqueous scleroglucan polymer flooding fluid into a wellbore increases flow (sweeps) of hydrocarbons to (petroleum toward) the production wellbore; paragraphs [0019], [0038], [0071]).

Regarding claim 64, Chevron discloses the method of claim 63, and Chevron further discloses further comprising removing the petroleum from the well (injecting the aqueous scleroglucan polymer flooding fluid into a wellbore increases flow of hydrocarbons (petroleum) to the production wellbore and remove the hydrocarbons from the reservoir; paragraphs [0003], [0019], [0038], [0072]).

Regarding claim 65, Chevron discloses a method of treating a subterranean formation, the method comprising: placing the aqueous beta-glucan composition in a subterranean formation, such that the Filterability Ratio of the aqueous beta-glucan composition in the subterranean formation is less than 2 (the scleroglucan (beta-glucan) polymer powder is mixed with an aqueous brine solution wherein the aqueous polymer composition has a filter ratio of less than 1.5 for use as an oil injection solution to enhance oil recovery in a subterranean reservoir (placing in), as per instant application paragraph [0052] the filterability ratio can be maintained for any duration of time such as for a fraction of a second including 0.001 second or less (such that Filterability Ratio in the subterranean formation is less than 2); paragraphs [0024], [0038], [0071], [0073]).

Claims 1-3, 5-14, 16-25, 27-29, 34-36 and 49 lack an inventive step under PCT Article 33(3) as being obvious over Chevron in view of US 2015/0038698 A1 to Cargill, Incorporated (hereinafter 'Cargill').

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Regarding claim 1, Chevron discloses a refined beta-glucan that forms an aqueous beta-glucan composition (a scleroglucan (beta-glucan) polymer powder is mixed with an aqueous brine solution; paragraphs [0024], [0038], [0073]) comprising 1 g/L of the refined beta-glucan (the scleroglucan (beta-glucan) hydrated polymer has a concentration from 100-50,000 ppm, equates to 0.01-5 g/L and scleroglucan is a biopolymer prepared from a fungus (refined); paragraphs [0038], [0065]), the aqueous beta-glucan composition having a salinity of 100,000 ppm TDS or less (the scleroglucan (beta-glucan) polymer powder is mixed with an aqueous brine solution has TDS such as 32,290 ppm; paragraphs [0038], [0073]) and having a Filterability Ratio of less than 2 (the aqueous scleroglucan composition prepared with the brine has a filter ratio of less than 1.5; paragraphs [0024], [0038]). Chevron does not disclose having a Filterability at a temperature of at least 50C. Cargill discloses a Filterability at a temperature of at least 50C (aqueous beta-glucan filtration temperature is in the range of 50-90C; paragraph [0026]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the composition, as previously disclosed by Chevron, in order to have provided a Filterability at a temperature of at least 50C, as previously disclosed by Cargill, for the benefit of providing typical filtration temperature is in the range of 50-90C and heating to an elevated temperature results in more complete dissolution of a beta-glucan (Cargill; paragraphs [0023], [0026]).

Regarding claim 2, Chevron and Cargill, in combination, disclose the refined beta-glucan of claim 1, and Chevron further discloses wherein the refined beta-glucan is in the form of a powder, a liquid concentrate, an aqueous beta-glucan composition having a concentration of the refined beta-glucan of other than 1 g/L, the beta-glucan composition comprising 1 g/L of the refined beta-glucan, or a combination thereof (the scleroglucan (beta-glucan) hydrated (aqueous) polymer has a concentration from 100-50,000 ppm, equates to 0.01-5 g/L and scleroglucan is a biopolymer prepared from a fungus (refined); paragraphs [0038], [0065]).

Regarding claim 3, Chevron and Cargill, in combination, disclose the refined beta-glucan of claim 1, and Chevron further discloses wherein the refined beta-glucan is in the form of the aqueous beta-glucan composition comprising 1 g/L of the refined beta-glucan (the scleroglucan (beta-glucan) hydrated (aqueous) polymer has a concentration from 100-50,000 ppm, equates to 0.01-5 g/L and scleroglucan is a biopolymer prepared from a fungus (refined); paragraphs [0038], [0065]), having a salinity of 100,000 ppm TDS or less (the scleroglucan (beta-glucan) polymer powder mixed with an aqueous brine solution has TDS such as 32,290 ppm; paragraphs [0038], [0073]) and having a Filterability Ratio of less than 2 (the aqueous scleroglucan composition prepared with the brine has a filter ratio of less than 1.5; paragraphs [0024], [0038]). Chevron does not disclose Filterability at a temperature of at least 50C. Cargill discloses a Filterability at a temperature of at least 50C (aqueous beta-glucan filtration temperature is in the range of 50-90C; paragraph [0026]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the composition, as previously disclosed by Chevron, in order to have provided a Filterability at a temperature of at least 50C, as previously disclosed by Cargill, for the benefit of providing typical filtration temperature is in the range of 50-90C and heating to an elevated temperature results in more complete dissolution of a beta-glucan (Cargill; paragraphs [0023], [0026]).

Regarding claim 5, Chevron and Cargill, in combination, disclose the refined beta-glucan of claim 1, and Chevron further discloses wherein the aqueous beta-glucan composition having a salinity of 100,000 ppm TDS or less (the scleroglucan (beta-glucan) polymer powder mixed with an aqueous brine solution has TDS such as 32,290 ppm; paragraphs [0038], [0073]) has a Filterability Ratio of less than 2 and greater than or equal to 1.2 (the aqueous scleroglucan composition prepared with the brine has a filter ratio of less than 1.5; paragraphs [0024], [0038]). Chevron does not disclose Filterability at a temperature of at least 50C. Cargill discloses a Filterability at a temperature of at least 50C (aqueous beta-glucan filtration temperature is in the range of 50-90C; paragraph [0026]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the composition, as previously disclosed by Chevron, in order to have provided a Filterability at a temperature of at least 50C, as previously disclosed by Cargill, for the benefit of providing typical filtration temperature is in the range of 50-90C and heating to an elevated temperature results in more complete dissolution of a beta-glucan (Cargill; paragraphs [0023], [0026]).

Regarding claim 6, Chevron and Cargill, in combination, disclose the refined beta-glucan of claim 1, and Chevron further discloses wherein the aqueous beta-glucan composition having a salinity of 100,000 ppm TDS or less (the scleroglucan (beta-glucan) polymer powder mixed with an aqueous brine solution has TDS such as 32,290 ppm; paragraphs [0038], [0073]) has a Filterability Ratio of less than 1.2 (the aqueous scleroglucan composition prepared with the brine has a filter ratio of less than 1.5; paragraphs [0024], [0038]). Chevron does not disclose Filterability at a temperature of at least 50C. Cargill discloses a Filterability at a temperature of at least 50C (aqueous beta-glucan filtration temperature is in the range of 50-90C; paragraph [0026]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the composition, as previously disclosed by Chevron, in order to have provided a Filterability at a temperature of at least 50C, as previously disclosed by Cargill, for the benefit of providing typical filtration temperature is in the range of 50-90C and heating to an elevated temperature results in more complete dissolution of a beta-glucan (Cargill; paragraphs [0023], [0026]).

Regarding claim 7, Chevron and Cargill, in combination, disclose the refined beta-glucan of claim 1, and Chevron further discloses wherein the refined beta-glucan forms an aqueous beta-glucan composition comprising 1 g/L of the refined beta-glucan (the scleroglucan (beta-glucan) hydrated polymer has a concentration from 100-50,000 ppm, equates to 0.01-5 g/L and scleroglucan is a biopolymer prepared from a fungus (refined); paragraphs [0038], [0065]), the aqueous beta-glucan composition having a salinity of 100,000 ppm TDS or less (the scleroglucan (beta-glucan) polymer powder mixed with an aqueous brine solution has TDS such as 32,290 ppm; paragraphs [0038], [0073]) and having a Filterability Ratio of less than 2, or less than 1.2 (the aqueous scleroglucan composition prepared with the brine has a filter ratio of less than 1.5; paragraphs [0024], [0038]). Chevron does not disclose Filterability at a temperature of at least 40C. Cargill discloses Filterability at a temperature of at least 40C (aqueous beta-glucan filtration temperature is in the range of 50-90C (at least 40C); paragraph [0026]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the composition, as previously disclosed by Chevron, in order to have provided Filterability at a temperature of at least 40C, as previously disclosed by Cargill, for the benefit of providing typical filtration temperature is in the range of 50-90C and heating to an elevated temperature results in more complete dissolution of a beta-glucan (Cargill; paragraphs [0023], [0026]).

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Regarding claim 8, Chevron and Cargill, in combination, disclose the refined beta-glucan of claim 1, and Chevron further discloses wherein the refined beta-glucan forms an aqueous beta-glucan composition comprising 1 g/L of the refined beta-glucan (the scleroglucan (beta-glucan) hydrated polymer has a concentration from 100-50,000 ppm, equates to 0.01-5 g/L and scleroglucan is a biopolymer prepared from a fungus (refined); paragraphs [0038], [0065]), the aqueous beta-glucan composition having a salinity of 180,000 ppm TDS or less (the scleroglucan (beta-glucan) polymer powder mixed with an aqueous brine solution has TDS such as 32,290 ppm; paragraphs [0038], [0073]) and having a Filterability Ratio of less than 2, or less than 1.2 (the aqueous scleroglucan composition prepared with the brine has a filter ratio of less than 1.5; paragraphs [0024], [0038]). Chevron does not disclose Filterability at a temperature of at least 60C. Cargill discloses Filterability at a temperature of at least 60C (aqueous beta-glucan filtration temperature is in the range of 50-90C (at least 60C); paragraph [0026]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the composition, as previously disclosed by Chevron, in order to have provided Filterability at a temperature of at least 60C, as previously disclosed by Cargill, for the benefit of providing typical filtration temperature is in the range of 50-90C and heating to an elevated temperature results in more complete dissolution of a beta-glucan (Cargill; paragraphs [0023], [0026]).

Regarding claim 9, Chevron and Cargill, in combination, disclose the refined beta-glucan of claim 1, and Chevron further discloses wherein the refined beta-glucan forms an aqueous beta-glucan composition comprising 1 g/L of the refined beta-glucan (the scleroglucan (beta-glucan) hydrated polymer has a concentration from 100-50,000 ppm, equates to 0.01-5 g/L and scleroglucan is a biopolymer prepared from a fungus (refined); paragraphs [0038], [0065]), the aqueous beta-glucan composition having a salinity of 180,000 ppm TDS or less (the scleroglucan (beta-glucan) polymer powder mixed with an aqueous brine solution has TDS such as 32,290 ppm; paragraphs [0038], [0073]) and having a Filterability Ratio of less than 2, or less than 1.2 (the aqueous scleroglucan composition prepared with the brine has a filter ratio of less than 1.5; paragraphs [0024], [0038]). Chevron does not disclose Filterability at a temperature of at least 50C. Cargill discloses Filterability at a temperature of at least 50C (aqueous beta-glucan filtration temperature is in the range of 50-90C (at least 50C); paragraph [0026]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the composition, as previously disclosed by Chevron, in order to have provided Filterability at a temperature of at least 50C, as previously disclosed by Cargill, for the benefit of providing typical filtration temperature is in the range of 50-90C and heating to an elevated temperature results in more complete dissolution of a beta-glucan (Cargill; paragraphs [0023], [0026]).

Regarding claim 10, Chevron and Cargill, in combination, disclose the refined beta-glucan of claim 1, and Chevron further discloses wherein the refined beta-glucan forms an aqueous beta-glucan composition comprising 1 g/L of the refined beta-glucan (the scleroglucan (beta-glucan) hydrated polymer has a concentration from 100-50,000 ppm, equates to 0.01-5 g/L and scleroglucan is a biopolymer prepared from a fungus (refined); paragraphs [0038], [0065]), the aqueous beta-glucan composition having a salinity of 200,000 ppm TDS or less (the scleroglucan (beta-glucan) polymer powder mixed with an aqueous brine solution has TDS such as 32,290 ppm; paragraphs [0038], [0073]) and having a Filterability Ratio of less than 2, or less than 1.2 (the aqueous scleroglucan composition prepared with the brine has a filter ratio of less than 1.5; paragraphs [0024], [0038]). Chevron does not disclose Filterability at a temperature of at least 67C. Cargill discloses Filterability at a temperature of at least 67C (aqueous beta-glucan filtration temperature is in the range of 50-90C (at least 67C); paragraph [0026]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the composition, as previously disclosed by Chevron, in order to have provided Filterability at a temperature of at least 67C, as previously disclosed by Cargill, for the benefit of providing typical filtration temperature is in the range of 50-90C and heating to an elevated temperature results in more complete dissolution of a beta-glucan (Cargill; paragraphs [0023], [0026]).

Regarding claim 11, Chevron and Cargill, in combination, disclose the refined beta-glucan of claim 1, and Chevron further discloses wherein the refined beta-glucan forms an aqueous beta-glucan composition comprising 1 g/L of the refined beta-glucan (the scleroglucan (beta-glucan) hydrated polymer has a concentration from 100-50,000 ppm, equates to 0.01-5 g/L and scleroglucan is a biopolymer prepared from a fungus (refined); paragraphs [0038], [0065]), the aqueous beta-glucan composition having a salinity of 200,000 ppm TDS or less (the scleroglucan (beta-glucan) polymer powder mixed with an aqueous brine solution has TDS such as 32,290 ppm; paragraphs [0038], [0073]) and having a Filterability Ratio of less than 2, or less than 1.2 (the aqueous scleroglucan composition prepared with the brine has a filter ratio of less than 1.5; paragraphs [0024], [0038]). Chevron does not disclose Filterability at a temperature of at least 55C. Cargill discloses Filterability at a temperature of at least 55C (aqueous beta-glucan filtration temperature is in the range of 50-90C (at least 55C); paragraph [0026]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the composition, as previously disclosed by Chevron, in order to have provided Filterability at a temperature of at least 55C, as previously disclosed by Cargill, for the benefit of providing typical filtration temperature is in the range of 50-90C and heating to an elevated temperature results in more complete dissolution of a beta-glucan (Cargill; paragraphs [0023], [0026]).

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Regarding claim 12, Chevron and Cargill, in combination, disclose the refined beta-glucan of claim 1, and Chevron further discloses wherein the refined beta-glucan forms an aqueous beta-glucan composition comprising 1 g/L of the refined beta-glucan (the scleroglucan (beta-glucan) hydrated polymer has a concentration from 100-50,000 ppm, equates to 0.01-5 g/L and scleroglucan is a biopolymer prepared from a fungus (refined); paragraphs [0038], [0065]), the aqueous beta-glucan composition having a salinity of 213,000 ppm or less (the scleroglucan (beta-glucan) polymer powder mixed with an aqueous brine solution has TDS such as 32,290 ppm; paragraphs [0038], [0073]) and having a Filterability Ratio of less than 2, or less than 1.2 (the aqueous scleroglucan composition prepared with the brine has a filter ratio of less than 1.5; paragraphs [0024], [0038]). Chevron does not disclose Filterability at a temperature of at least 60C. Cargill discloses Filterability at a temperature of at least 60C (aqueous beta-glucan filtration temperature is in the range of 50-90C (at least 60C); paragraph [0026]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the composition, as previously disclosed by Chevron, in order to have provided Filterability at a temperature of at least 60C, as previously disclosed by Cargill, for the benefit of providing typical filtration temperature is in the range of 50-90C and heating to an elevated temperature results in more complete dissolution of a beta-glucan (Cargill; paragraphs [0023], [0026]).

Regarding claim 13, Chevron and Cargill, in combination, disclose the refined beta-glucan of claim 1, wherein the refined beta-glucan forms an aqueous beta-glucan composition comprising 1 g/L of the refined beta-glucan (the scleroglucan (beta-glucan) hydrated polymer has a concentration from 100-50,000 ppm, equates to 0.01-5 g/L and scleroglucan is a biopolymer prepared from a fungus (refined); paragraphs [0038], [0065]), the aqueous beta-glucan composition having a salinity of 213,000 ppm or less (the scleroglucan (beta-glucan) polymer powder mixed with an aqueous brine solution has TDS such as 32,290 ppm; paragraphs [0038], [0073]) and having a Filterability Ratio of less than 2, or less than 1.2 (the aqueous scleroglucan composition prepared with the brine has a filter ratio of less than 1.5; paragraphs [0024], [0038]). Chevron does not disclose Filterability at a temperature of at least 56C. Cargill discloses Filterability at a temperature of at least 56C (aqueous beta-glucan filtration temperature is in the range of 50-90C (at least 56C); paragraph [0026]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the composition, as previously disclosed by Chevron, in order to have provided Filterability at a temperature of at least 56C, as previously disclosed by Cargill, for the benefit of providing typical filtration temperature is in the range of 50-90C and heating to an elevated temperature results in more complete dissolution of a beta-glucan (Cargill; paragraphs [0023], [0026]).

Regarding claim 14, Chevron and Cargill, in combination, disclose the refined beta-glucan of claim 1, and Chevron further discloses wherein the refined beta-glucan forms an aqueous beta-glucan composition comprising 1 g/L of the refined beta-glucan (the scleroglucan (beta-glucan) hydrated polymer has a concentration from 100-50,000 ppm, equates to 0.01-5 g/L and scleroglucan is a biopolymer prepared from a fungus (refined); paragraphs [0038], [0065]), the aqueous beta-glucan composition having a salinity of 35,000 ppm TDS (the scleroglucan (beta-glucan) polymer powder mixed with an aqueous brine solution has TDS such as 32,290 ppm; paragraphs [0038], [0073]) and having a Filterability Ratio of less than 2, or less than 1.2 (the aqueous scleroglucan composition prepared with the brine has a filter ratio of less than 1.5; paragraphs [0024], [0038]). Chevron does not disclose Filterability at a temperature of at least 40C. Cargill discloses Filterability at a temperature of at least 40C (aqueous beta-glucan filtration temperature is in the range of 50-90C (at least 40C); paragraph [0026]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the composition, as previously disclosed by Chevron, in order to have provided Filterability at a temperature of at least 40C, as previously disclosed by Cargill, for the benefit of providing typical filtration temperature is in the range of 50-90C and heating to an elevated temperature results in more complete dissolution of a beta-glucan (Cargill; paragraphs [0023], [0026]).

Regarding claim 16, Chevron and Cargill, in combination, disclose the refined beta-glucan of claim 1, and Chevron further discloses wherein the refined beta-glucan forms an aqueous beta-glucan composition comprising 1 g/L of the refined beta-glucan (the scleroglucan (beta-glucan) hydrated polymer has a concentration from 100-50,000 ppm, equates to 0.01-5 g/L and scleroglucan is a biopolymer prepared from a fungus (refined); paragraphs [0038], [0065]), the aqueous betaglucan composition having a salinity of 60,000 ppm TDS or less (the scleroglucan (beta-glucan) polymer powder mixed with an aqueous brine solution has TDS such as 32,290 ppm; paragraphs [0038], [0073]) and having a Filterability Ratio of less than 2, or less than 1.2 (the aqueous scleroglucan composition prepared with the brine has a filter ratio of less than 1.5; paragraphs [0024], [0038]). Chevron does not disclose Filterability at a temperature of at least 40C. Cargill discloses Filterability at a temperature of at least 40C (aqueous beta-glucan filtration temperature is in the range of 50-90C (at least 40C); paragraph [0026]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the composition, as previously disclosed by Chevron, in order to have provided a Filterability at a temperature of at least 40C, as previously disclosed by Cargill, for the benefit of providing typical filtration temperature is in the range of 50-90C and heating to an elevated temperature results in more complete dissolution of a beta-glucan (Cargill; paragraphs [0023], [0026]).

Regarding claim 17, Chevron and Cargill, in combination, disclose the refined beta-glucan of claim 1, and Chevron further discloses wherein the refined beta-glucan forms an aqueous beta-glucan composition comprising 1 g/L of the refined beta-glucan (the scleroglucan (beta-glucan) hydrated polymer has a concentration from 100-50,000 ppm, equates to 0.01-5 g/L and scleroglucan is a biopolymer prepared from a fungus (refined); paragraphs [0038], [0065]), the aqueous beta-glucan composition having a salinity of 60,000 ppm TDS or less (the scleroglucan (beta-glucan) polymer powder mixed with an aqueous brine solution has TDS such as 32,290 ppm; paragraphs [0038], [0073]) and having a Filterability Ratio of less than 2, or less than 1.2 (the aqueous scleroglucan composition prepared with the brine has a filter ratio of less than 1.5; paragraphs [0024], [0038]). Chevron does not disclose Filterability at a temperature of at least 30C. Cargill discloses a Filterability at a temperature of at least 30C (aqueous beta-glucan filtration temperature is in the range of 50-90C (at least 30C); paragraph [0026]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the composition, as previously disclosed by Chevron, in order to have provided a Filterability at a temperature of at least 30C, as previously disclosed by Cargill, for the benefit of providing typical filtration temperature is in the range of 50-90C and heating to an elevated temperature results in more complete dissolution of a beta-glucan (Cargill; paragraphs [0023], [0026]).

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Regarding claim 18, Chevron and Cargill, in combination, disclose the refined beta-glucan of claim 1, and Chevron further discloses the aqueous beta-glucan composition comprising 1 g/L of the refined beta-glucan (the scleroglucan (beta-glucan) hydrated polymer has a concentration from 100-50,000 ppm, equates to 0.01-5 g/L and scleroglucan is a biopolymer prepared from a fungus (refined); paragraphs [0038], [0065]). Chevron does not disclose a pH of about 2 to about 11. Cargill discloses a pH of about 2 to about 11 (an initial beta-glucan solution has a pH of above 11.0 and is acidified to obtain an acidic beta-glucan wherein the pH is lowered to below 5.0; paragraphs [0011], [0013], [0035]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the composition, as previously disclosed by Chevron, in order to have provided a pH of about 2 to about 11, as previously disclosed by Cargill, for the benefit of providing lowering pH into the acidic range increases viscosity of a beta-glucan filtrate purified solution wherein viscosity is decreased at high pH values and adjusting the pH allows for the viscosity to be adjusted for a desired property of the composition (Cargill; paragraph [0035]).

Regarding claim 19, Chevron and Cargill, in combination, disclose the refined beta-glucan of claim 1, and Chevron further discloses the aqueous beta-glucan composition comprising 1 g/L of the refined beta-glucan (the scleroglucan (beta-glucan) hydrated polymer has a concentration from 100-50,000 ppm, equates to 0.01-5 g/L and scleroglucan is a biopolymer prepared from a fungus (refined); paragraphs [0038], [0065]). Chevron does not disclose a pH of about 5 to about 10. Cargill discloses a pH of about 5 (an initial beta-glucan solution has a pH of above 11.0 and is acidified to obtain an acidic beta-glucan wherein the pH is lowered to below 5.0 (pH of about 5); paragraphs [0011], [0013], [0035]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the composition, as previously disclosed by Chevron, in order to have provided a pH of about 5, as previously disclosed by Cargill, for the benefit of providing lowering pH into the acidic range increases viscosity of a beta-glucan filtrate purified solution wherein viscosity is decreased at high pH values and adjusting the pH allows for the viscosity to be adjusted for a desired property of the composition (Cargill; paragraph [0035]).

Regarding claim 20, Chevron and Cargill, in combination, disclose the refined beta-glucan of claim 1, and Chevron further discloses an aqueous beta-glucan composition comprising the refined beta-glucan (the scleroglucan (beta-glucan) polymer powder is mixed with an aqueous brine solution; paragraphs [0038], [0073]).

Regarding claim 21, Chevron and Cargill, in combination, disclose the aqueous beta-glucan composition of claim 20, and Chevron further discloses wherein the aqueous beta-glucan composition has a concentration of the refined beta-glucan of about 30 ppm to about 3,000 ppm (the scleroglucan (beta-glucan) hydrated polymer has a concentration from 100-50,000 ppm, scleroglucan is a biopolymer prepared from a fungus (refined); paragraphs [0038], [0065]).

Regarding claim 22, Chevron and Cargill, in combination, disclose the aqueous beta-glucan composition of claim 20, and Chevron further discloses wherein the aqueous beta-glucan composition has a concentration of the refined beta-glucan of about 400 ppm to about 1,500 ppm (the scleroglucan (beta-glucan) hydrated polymer has a concentration from 100-50,000 ppm, scleroglucan is a biopolymer prepared from a fungus (refined); paragraphs [0038], [0065]).

Regarding claim 23, Chevron and Cargill, in combination, disclose the aqueous beta-glucan composition of claim 20, and Chevron further discloses wherein the aqueous beta-glucan composition has a temperature of about 0C to about 140C (the aqueous scleroglucan composition prepared with the brine has the filter ratio at 25C; paragraphs [0024], [0026], [0038]).

Regarding claim 24, Chevron and Cargill, in combination, disclose the aqueous beta-glucan composition of claim 20, and Chevron further discloses wherein the aqueous beta-glucan composition has a temperature of 25C (the aqueous scleroglucan composition prepared with the brine has the filter ratio determined at 25C; paragraphs [0024], [0026], [0038]). Chevron does not disclose has a temperature of about 60C to 110C. Cargill discloses a temperature of about 60C to 110C (heating a beta-glucan solution to 50C - 80C; paragraphs [0023]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the composition, as previously disclosed by Chevron, in order to have provided has a temperature of about 60C to 110C, as previously disclosed by Cargill, for the benefit of providing heating to an elevated temperature results in more complete dissolution of a beta-glucan (Cargill; paragraph [0023]).

Regarding claim 25, Chevron and Cargill, in combination, disclose the aqueous beta-glucan composition of claim 20, and Chevron further discloses wherein the aqueous beta-glucan composition has a salinity of about 0 ppm TDS to 400,000 ppm TDS (the scleroglucan (beta-glucan) polymer powder mixed with an aqueous brine solution has TDS such as 32,290 ppm; paragraphs [0038], [0073]).

Regarding claim 27, Chevron and Cargill, in combination, disclose the aqueous beta-glucan composition of claim 1, and Chevron further discloses the aqueous beta-glucan composition (the scleroglucan (beta-glucan) polymer powder mixed with an aqueous brine solution; paragraphs [0024], [0038]).

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Regarding claim 28, Chevron discloses a refined beta-glucan that forms an aqueous beta-glucan composition (a scleroglucan (beta-glucan) polymer powder is mixed with an aqueous brine solution; paragraphs [0024], [0038], [0073]) comprising 1 g/L of the refined beta-glucan (the scleroglucan (beta-glucan) hydrated polymer has a concentration from 100-50,000 ppm, equates to 0.01-5 g/L and scleroglucan is a biopolymer prepared from a fungus (refined); paragraphs [0038], [0065]), the aqueous beta-glucan composition having a salinity of 100,000 ppm TDS or less (the scleroglucan (beta-glucan) polymer powder is mixed with an aqueous brine solution has TDS such as 32,290 ppm; paragraphs [0038], [0073]) and having a Filterability Ratio of less than 1.2 (the aqueous scleroglucan composition prepared with the brine has a filter ratio of less than 1.5; paragraphs [0024], [0038]). Chevron does not disclose at a temperature of at least 40C. Cargill discloses Filterability at a temperature of at least 40C (aqueous beta-glucan filtration temperature is in the range of 50-90C (at least 40C); paragraph [0026]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the composition, as previously disclosed by Chevron, in order to have provided Filterability at a temperature of at least 40C, as previously disclosed by Cargill, for the benefit of providing typical filtration temperature is in the range of 50-90C and heating to an elevated temperature results in more complete dissolution of a beta-glucan (Cargill; paragraphs [0023], [0026]).

Regarding claim 29, Chevron and Cargill, in combination, disclose the aqueous beta-glucan composition of claim 20, and Chevron further discloses a method of maintaining the Filterability Ratio of the aqueous beta-glucan composition, the method comprising: controlling temperature of the aqueous beta-glucan composition, salinity of the aqueous beta-glucan composition (the scleroglucan (beta-glucan) polymer powder mixed with an aqueous brine solution has TDS such as 32,290 ppm wherein aqueous solutions can be softened to adjust their salinity (controlling salinity); paragraphs [0038], [0073]), or a combination thereof, such that the Filterability Ratio of the aqueous beta-glucan composition is less than 2 (the aqueous scleroglucan composition prepared with the brine has a filter ratio of less than 1.5; paragraphs [0024], [0038]).

Regarding claim 34, Chevron discloses the method of claim 30, and Chevron further discloses the aqueous beta-glucan composition at a predetermined temperature (the scleroglucan (beta-glucan) polymer powder is mixed with an aqueous brine solution and the filter ratio is measured at 25C (predetermined temperature); paragraphs [0024], [0026], [0038], [0073]). Chevron does not disclose controlling temperature comprises maintaining or changing the temperature such that it reaches or is maintained at a predetermined temperature. Cargill discloses controlling temperature comprises changing the temperature such that it reaches a predetermined temperature (heating a beta-glucan solution to an elevated temperature of 50C - 80C (changing temperature such that it reaches a predetermined temperature); paragraphs [0023]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the method, as previously disclosed by Chevron, in order to have provided controlling temperature comprises changing the temperature such that it reaches a predetermined temperature, as previously disclosed by Cargill, for the benefit of providing heating to an elevated temperature results in more complete dissolution of a beta-glucan (Cargill; paragraph [0023]).

Regarding claim 35, Chevron discloses the method of claim 30, and Chevron further discloses the aqueous beta-glucan composition at a predetermined temperature (the scleroglucan (beta-glucan) polymer powder is mixed with an aqueous brine solution and the filter ratio is measured at 25C; paragraphs [0024], [0026], [0038], [0073]). Chevron does not disclose controlling temperature comprises heating so that the temperature reaches or is maintained at a predetermined temperature. Cargill discloses controlling temperature comprises heating so that the temperature reaches a predetermined temperature (heating a beta-glucan solution to an elevated temperature of 50C - 80C (reaches a predetermined temperature); paragraphs [0023]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the method, as previously disclosed by Chevron, in order to have provided controlling temperature comprises heating so that the temperature reaches a predetermined temperature, as previously disclosed by Cargill, for the benefit of providing heating to an elevated temperature results in more complete dissolution of a beta-glucan (Cargill; paragraph [0023]).

Regarding claim 36, Chevron and Cargill, in combination, disclose the method of claim 34, and Chevron further discloses wherein the predetermined temperature is sufficient such that the aqueous beta-glucan composition has a Filterability Ratio of less than 2, or less than 1.2 (the aqueous scleroglucan composition prepared with the brine has a filter ratio of less than 1.5 at 25C (predetermined temperature); paragraphs [0024], [0038]).

Regarding claim 49, Chevron discloses the method of claim 42, and Chevron further discloses comprising the aqueous beta-glucan composition has a Filterability Ratio of less than 2, or less than 1.2, prior to placing the aqueous beta-glucan composition in the subterranean formation (the aqueous scleroglucan composition prepared with the brine has a filter ratio of less than 1.5 for use (prior to placing) as an injection flooding fluid in a subterranean formation; paragraphs [0019], [0024], [0038]). Chevron does not disclose heating prior to placing in the subterranean formation. Cargill discloses heating (heating a beta-glucan solution to 50C - 80C; paragraphs [0023]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the method, as previously disclosed by Chevron, in order to have provided heating, as previously disclosed by Cargill, for the benefit of providing heating to an elevated temperature results in more complete dissolution of a beta-glucan (Cargill; paragraph [0023]), thus heating the beta-glucan composition prior to placing in the subterranean formation to further result in a filterability ratio of less than 2.

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Claims 43, 51, 54 and 59-60 lack an inventive step under PCT Article 33(3) as being obvious over Chevron in view of US 2012/0205099 A1 to Briechle, et al. (hereinafter 'Briechle').

Regarding claim 43, Chevron discloses the method of claim 42, and Chevron further discloses the controlling of the temperature or salinity of the aqueous beta-glucan composition (the scleroglucan (beta-glucan) polymer powder is mixed with an aqueous brine solution that can be softened to adjust salinity (controlling salinity); paragraphs [0038], [0073]) and placing the aqueous beta-glucan composition in the subterranean formation (the scleroglucan (beta-glucan) hydrated polymer solution is injected into a wellbore into a subterranean reservoir; paragraphs [0038], [0065], [0071]). Chevron does not disclose allowing the temperature or salinity of the subterranean formation to change or maintain the temperature or salinity of the aqueous beta-glucan composition. Briechle discloses allowing the temperature of a subterranean formation to change the temperature of an aqueous beta-glucan composition (an aqueous beta-glucan formulation for injection into a borehole (subterranean formation) at a deposit temperature of 70-150C (allowing temperature of the formation to change the temperature of a composition); paragraphs [0033]-[0034], [0036]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the method, as previously disclosed by Chevron, in order to have provided allowing the temperature of the subterranean formation to change the temperature of the aqueous beta-glucan composition, as previously disclosed by Briechle, for the benefit of providing an aqueous beta-glucan formulation for polymer flooding at a deposit temperature of more than 70C into a borehole (Briechle; abstract; paragraph [0038]).

Regarding claim 51, Chevron discloses the method of claim 42, and Chevron further discloses comprising injecting the aqueous beta-glucan composition in the subterranean formation so that the aqueous beta-glucan composition has a Filterability Ratio of less than 2, or less than 1.2 (the aqueous scleroglucan (beta-glucan) polymer solution has a filter ratio of less than 1.5 for use as an injection solution into a wellbore of a subterranean reservoir; paragraphs [0038], [0071], [0073]). Chevron does not disclose allowing the subterranean formation to heat after injecting so that the aqueous beta-glucan composition has a Filterability Ratio of less than 2. Briechle discloses allowing the subterranean formation to heat after injecting (an aqueous beta-glucan formulation for injection into a borehole (subterranean formation) at a deposit temperature of 70-150C (allowing to heat after injecting); paragraphs [0033]-[0034], [0036]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the method, as previously disclosed by Chevron, in order to have provided allowing the subterranean formation to heat after injecting, as previously disclosed by Briechle, for the benefit of providing an aqueous beta-glucan formulation for polymer flooding at a deposit temperature of more than 70C into a borehole (Briechle; abstract; paragraph [0038]), a deposit temperature at an elevated temperature would enhance the dilution of the beta-glucan in solution and further decrease the Filterability Ratio of less than 2.

Regarding claim 54, Chevron discloses the method of claim 42, and Chevron further discloses comprising a tubular in the subterranean formation and injecting the aqueous beta-glucan composition through the tubular to place the aqueous beta-glucan composition in the subterranean formation (the aqueous scleroglucan (beta-glucan) polymer solution for use as an injection solution pumped through a tubing (tubular) into a wellbore of a subterranean reservoir; paragraphs [0038], [0071]). Chevron does not disclose heating a tubular in the subterranean formation prior to or during injecting through the tubular. Briechle discloses heating a tubular in the subterranean formation prior to or during injecting through the tubular (an aqueous formulation of beta-glucan is injected into a borehole (subterranean formation) lined with steel tubes (tubular) at a deposit temperature of 70-150C (heating a tubular prior to injecting); paragraphs [0034], [0036], [0038], [0082]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the method, as previously disclosed by Chevron, in order to have provided heating a tubular in the subterranean formation prior to or during injecting through the tubular, as previously disclosed by Briechle, for the benefit of providing an aqueous beta-glucan formulation for polymer flooding at an elevated deposit temperature into a borehole (Briechle; abstract; paragraph [0038]).

Regarding claim 59, Chevron discloses the method of claim 42, and Chevron further discloses the subterranean formation (the aqueous scleroglucan polymer solution for use as an injection solution is pumped into a subterranean reservoir; paragraphs [0038], [0071]). Chevron does not disclose the subterranean formation has a temperature of about 0C to about 140C. Briechle discloses a subterranean formation has a temperature of about 0C to about 140C (injecting a beta-glucan composition through a borehole at a deposit temperature of 70-150C; paragraphs [0033]-[0034], [0036]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the method, as previously disclosed by Chevron, in order to have provided the subterranean formation has a temperature of about 0C to about 140C, as previously disclosed by Briechle, for the benefit of providing an aqueous beta-glucan formulation for polymer flooding at an elevated deposit temperature into a borehole (Briechle; abstract; paragraph [0038]).

Regarding claim 60, Chevron discloses the method of claim 42, and Chevron further discloses wherein the subterranean formation (the aqueous scleroglucan polymer solution for use as an injection solution is pumped into a subterranean reservoir; paragraphs [0038], [0071]). Chevron does not disclose the subterranean formation has a temperature of about 60C to about 110C. Briechle discloses a subterranean formation has a temperature of about 60C to about 110C (injecting the beta-glucan composition through a borehole at a deposit temperature of 70-150C; paragraphs [0033]-[0034], [0036]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the method, as previously disclosed by Chevron, in order to have provided the subterranean formation has a temperature of about 60C to about 110C, as previously disclosed by Briechle, for the benefit of providing an aqueous beta-glucan formulation for polymer flooding at an elevated deposit temperature into a borehole (Briechle; abstract; paragraph [0038]).

Claims 44, 47 and 53 lack an inventive step under PCT Article 33(3) as being obvious over Chevron in view of US 2015/0114646 A1 to M-I L.L.C. (hereinafter 'M-I').

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Regarding claim 44, Chevron discloses the method of claim 42, and Chevron further discloses wherein the controlling of temperature or salinity of the aqueous beta-glucan composition comprises modifying temperature or salinity of the aqueous beta-glucan composition prior to or during the placing of the aqueous beta-glucan composition in the subterranean formation (the scleroglucan (beta-glucan) polymer powder is mixed with an aqueous brine solution that can be softened (changing) to adjust salinity (controlling salinity) wherein a brine has a TDS of 32,290 ppm (reaches a predetermined salinity) for use (prior to) as an injection solution into a wellbore of a subterranean reservoir; paragraphs [0038], [0071], [0073]). Chevron does not disclose modifying temperature or salinity of the subterranean formation prior to or during the placing of the aqueous beta-glucan composition in the subterranean formation such that the temperature or salinity of the subterranean formation changes or maintains the temperature or salinity of the aqueous beta-glucan composition, or a combination thereof. M-I discloses modifying temperature of the subterranean formation during a placing such that the temperature of the subterranean formation changes the temperature of a composition (introducing (injecting) carbon nanomaterials into a wellbore fluid to heat fluids in a wellbore downhole environment; paragraph [0014]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the method, as previously disclosed by Chevron, in order to have provided modifying temperature of the subterranean formation during the placing such that the temperature of the subterranean formation changes the temperature of the composition, as previously disclosed by M-I, for the benefit of providing introducing a heated fluid into a wellbore to aid in breaking of filter cakes (M-I; paragraph [0014]).

Regarding claim 47, Chevron discloses the method of claim 42, and Chevron further discloses the subterranean formation (the scleroglucan aqueous solution for use as an injection solution into a wellbore of a subterranean reservoir; paragraphs [0038], [0071]) such that after placing the aqueous beta-glucan composition in the subterranean formation the aqueous beta-glucan composition has a Filterability Ratio of less than 2, or less than 1.2 (the scleroglucan (beta-glucan) polymer powder is mixed with an aqueous brine solution wherein the aqueous polymer composition has a filter ratio of less than 1.5 for use as an oil injection solution to enhance oil recovery in a subterranean reservoir, as per instant application paragraph [0052] the filterability ratio can be maintained for any duration of time such as for a fraction of a second including 0.001 second or less (Filterability Ratio after placing in the subterranean formation is less than 2); paragraphs [0024], [0038], [0071], [0073]). Chevron does not disclose the subterranean formation has a temperature. M-I discloses a subterranean formation has a temperature (introducing carbon nanomaterials into a wellbore fluid to heat fluids in a wellbore downhole environment; paragraph [0014]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the method, as previously disclosed by Chevron, in order to have provided the subterranean formation has a temperature, as previously disclosed by M-I, for the benefit of providing heating a wellbore to aid in breaking of filter cakes (M-I; paragraph [0014]).

Regarding claim 53, Chevron discloses the method of claim 42, and Chevron further discloses comprising the aqueous beta-glucan composition in the subterranean formation (the aqueous scleroglucan (beta-glucan) polymer solution is injected into a wellbore of a subterranean reservoir; paragraphs [0038], [0065], [0071]). Chevron does not disclose heating the subterranean formation using a heated injection fluid during or prior to placement. M-I discloses heating a subterranean formation using a heated injection fluid during placement (introducing (injecting) carbon nanomaterials into a wellbore fluid to heat fluids in a wellbore downhole environment; paragraph [0014]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the method, as previously disclosed by Chevron, in order to have provided heating the subterranean formation using a heated injection fluid during placement, as previously disclosed by M-I, for the benefit of providing introducing a heated fluid into a wellbore to aid in breaking of filter cakes (M-I; paragraph [0014]).

Claims 52 and 56 lack an inventive step under PCT Article 33(3) as being obvious over Chevron in view of US 2016/0024890 A1 to CESI Chemical, Inc. (hereinafter 'Chemical').

Regarding claim 52, Chevron discloses the method of claim 42, and Chevron further discloses comprising injecting the aqueous beta-glucan composition in the subterranean formation so that the aqueous beta-glucan composition has a Filterability Ratio of less than 2, or less than 1.2 (the aqueous scleroglucan (beta-glucan) polymer solution has a filter ratio of less than 1.5 and is injected into a wellbore of a subterranean reservoir; paragraphs [0024], [0038], [0065], [0071]). Chevron does not disclose diluting after injecting. Chemical discloses diluting after injecting (a stimulation fluid for enhanced oil recovery is injected into a wellbore before injection of a dilution fluid (diluting after injecting); paragraphs [0051], [0131]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the method, as previously disclosed by Chevron, in order to have provided diluting after injecting, as previously disclosed by Chemical, for the benefit of inhibiting blocking of fine pores of the mineral oil formation (Chevron; paragraph [0049]).

Regarding claim 56, Chevron discloses the method of claim 42, and Chevron further discloses comprising salinity prior to placing the aqueous beta-glucan composition in the subterranean formation (the aqueous scleroglucan (beta-glucan) brine solution has a salinity and is injected into a wellbore of a subterranean reservoir; paragraphs [0038], [0071], [0073]). Chevron does not disclose injecting fluid into a subterranean formation to lower salinity prior to or during placing. Chemical discloses injecting fluid into a subterranean formation during placing (injecting a dilution fluid into a wellbore during injection of a stimulation fluid; paragraphs [0051], [0131]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the method, as previously disclosed by Chevron, in order to have provided injecting fluid into a subterranean formation during placing, as previously disclosed by Chemical, for the benefit of inhibiting blocking of fine pores of the mineral oil formation (Chevron; paragraph [0049]), and further injecting a dilution fluid during an injection of the aqueous beta-glucan composition would result in a lower salinity.

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Claims 57-58 lack an inventive step under PCT Article 33(3) as being obvious over Chevron in view of US 2004/0005987 A1 to Ristol, et al. (hereinafter 'Ristol').

Regarding claim 57, Chevron discloses the method of claim 42, and Chevron further discloses the subterranean formation (the scleroglucan (beta-glucan) hydrated polymer solution is injected into a wellbore of a subterranean reservoir; paragraphs [0038], [0065], [0071]). Chevron does not disclose a subterranean formation has a pH of about 5 to about 10. Ristol discloses a subterranean formation has a pH of about 5 to about 10 (an aqueous drilling fluid used in drilling wells through subterranean formations having a pH between 7-12; paragraph [0008]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the method, as previously disclosed by Chevron, in order to have provided a subterranean formation has a pH of about 5 to about 10, as previously disclosed by Ristol, for the benefit of providing a desired pH environment in the subterranean formation from an aqueous drilling fluid (Ristol; paragraph [0008]).

Regarding claim 58, Chevron discloses the method of claim 42, and Chevron further discloses the subterranean formation (the scleroglucan (beta-glucan) hydrated polymer solution is injected into a wellbore of a subterranean reservoir; paragraphs [0038], [0065], [0071]). Chevron does not disclose a subterranean formation has a pH of about 6.5 to about 8.5. Ristol discloses a subterranean formation has a pH of about 6.5 to about 8.5 (an aqueous drilling fluid used in drilling wells through subterranean formations having a pH between 7-12; paragraph [0008]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the method, as previously disclosed by Chevron, in order to have provided a subterranean formation has a pH of about 6.5 to about 8.5, as previously disclosed by Ristol, for the benefit of providing a desired pH environment in the subterranean formation from an aqueous drilling fluid (Ristol; paragraphs [0008]).

Claim 66 lacks an inventive step under PCT Article 33(3) as being obvious over Chevron in view of US 2015/0233222 A1 to Teklu, et al. (hereinafter 'Teklu').

Regarding claim 66, Chevron discloses a method of treating a subterranean formation, the method comprising: placing the aqueous beta-glucan composition in a subterranean formation; and before the placing, during the placing, after the placing, or a combination thereof, heating the aqueous beta-glucan composition, adjusting the aqueous beta-glucan composition to reduce the salinity thereof, or a combination thereof, such that the Filterability Ratio of the aqueous beta-glucan composition in the subterranean formation is less than 2 (the scleroglucan (beta-glucan) polymer powder is mixed with an aqueous brine solution softened to adjust salinity by reducing the concentration of ions in the aqueous fluid (before the placing reduce salinity) to have a TDS such as 32,290 ppm wherein the aqueous polymer composition has a filter ratio of less than 1.5 for use as an oil injection solution to enhance oil recovery in a subterranean reservoir (placing in), as per instant application paragraph [0052] the filterability ratio can be maintained for any duration of time such as for a fraction of a second including 0.001 second or less (in the subterranean formation); paragraphs [0024], [0038], [0071], [0073]). Chevron does not disclose diluting to reduce the salinity. Teklu discloses diluting to reduce the salinity (low-salinity water is prepared by a dilution; paragraph [0024]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the method, as previously disclosed by Chevron, in order to have provided diluting to reduce the salinity, as previously disclosed by Teklu, for the benefit of providing a low salinity water by dilution for use to recover oil from a reservoir (Teklu; paragraphs [0023]-[0024]).

Claims 15 and 26 lack an inventive step under PCT Article 33(3) as being obvious over Chevron, in view of Cargill and further in view of Briechele.

Regarding claim 15, Chevron and Cargill, in combination, disclose the refined beta-glucan of claim 1, and Chevron further discloses wherein the refined beta-glucan forms an aqueous beta-glucan composition comprising 1 g/L of the refined beta-glucan (the scleroglucan (beta-glucan) hydrated polymer has a concentration from 100-50,000 ppm, equates to 0.01-5 g/L and scleroglucan is a biopolymer prepared from a fungus (refined); paragraphs [0038], [0065]), the aqueous beta-glucan composition having a salinity of 32,000 ppm TDS (the scleroglucan (beta-glucan) polymer powder mixed with an aqueous brine solution has TDS such as 32,290 ppm; paragraphs [0038], [0073]) and having a Filterability Ratio of less than 2, or less than 1.2, at a temperature of at least 22C (the aqueous scleroglucan composition prepared with the brine has a filter ratio of less than 1.5 at 25C (at least 22C); paragraphs [0024], [0026], [0038]). Chevron does not disclose a salinity of 35,000 ppm TDS. Briechele discloses a salinity of 35,000 ppm TDS (an aqueous formulation of beta-glucan has a salinity of 20,000 ppm to 250,000 ppm of salts in water wherein the aqueous formulation is guided by the type of water to make up and dilute the original concentrate; paragraphs [0034], [0065]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the composition, as previously disclosed by Chevron, in order to have provided a salinity of 35,000 ppm TDS, as previously disclosed by Briechele, for the benefit of providing a desired salinity range of a beta-glucan aqueous formulation for use in oil production (Briechele; abstract).

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Regarding claim 26, Chevron and Cargill, in combination, disclose the aqueous beta-glucan composition of claim 20, and Chevron further discloses wherein the aqueous beta-glucan composition has a salinity of about 32,000 ppm TDS (the scleroglucan (beta-glucan) polymer powder mixed with an aqueous brine solution has TDS such as 32,290 ppm; paragraphs [0038], [0073]). Chevron does not disclose a salinity of about 35,000 ppm TDS to about 220,000 ppm TDS. Briechele discloses a salinity of about 35,000 ppm TDS to about 220,000 ppm TDS (an aqueous formulation of beta-glucan has a salinity of 20,000 ppm to 250,000 ppm of salts in water wherein the aqueous formulation is guided by the type of water to make up and dilute the original concentrate; paragraphs [0034], [0065]). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the composition, as previously disclosed by Chevron, in order to have provided a salinity of about 35,000 ppm TDS to about 220,000 ppm TDS, as previously disclosed by Briechele, for the benefit of providing a desired salinity range of a beta-glucan aqueous formulation for use in oil production (Briechele; abstract).

Claim 55 lacks an inventive step under PCT Article 33(3) as being obvious over Chevron in view of Briechele, and further in view of CA 3009290 A1 to BASF SE (hereinafter 'BASF').

Regarding claim 55, Chevron and Briechele, in combination, disclose the method of claim 54, and Chevron further discloses fluid in the tubular and the aqueous beta-glucan composition through the tubular to place the aqueous beta-glucan composition in the subterranean formation (the aqueous scleroglucan (beta-glucan) polymer solution for use as an injection solution pumped through a tubing (tubular) into a wellbore of a subterranean reservoir; paragraphs [0038], [0071]). Chevron does not disclose reducing a flow rate of fluid in the tubular to increase a temperature of the tubular prior to or during injecting through the tubular. BASF discloses reducing a flow rate of fluid in the tubular to increase a temperature of the tubular (a gradual polymer flooding flow (reducing flow rate during) in a tube allows the polymer composition to remain for a long period in the formation in the course of which it's exposed to an elevated temperature of the formation (increase temperature of the tubular); page 15, lines 37-42; page 18, lines 25-31). It would have been obvious to a person of ordinary skill in the art, at the time of the invention, to have modified the method, as previously disclosed by Chevron, in order to have provided reducing a flow rate of fluid in the tubular to increase a temperature of the tubular, as previously disclosed by BASF, for the benefit of providing method of modifying the temperature of the injection solution by reducing a flow rate of the composition through the tubing.

Claim 4 meets the criteria set out in PCT Article 33(2)-(3).

Claim 4 meets the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest the refined beta-glucan of claim 1, wherein the Filterability Ratio is determined by passing a 1 g/L aqueous solution of the refined beta-glucan through a 1.2 micron filter at a consistent pressure sufficient to initially give a flux through the filter at time zero of about 1-3 grams of solution per second, wherein the Filterability Ratio is (time required for 180 g solution to pass through the filter - time required for 160 g solution to pass through the filter) / (time required for 80 g solution to pass through the filter - time required for 60 g of solution to pass through the filter).

Chevron and Cargill, in combination, disclose the refined beta-glucan of claim 1, and Chevron further discloses the Filterability Ratio of the 1 g/L refined aqueous beta-glucan solution (the aqueous scleroglucan composition has a concentration from 100-50,000 ppm and filter ratio of less than 1.5, equates to 0.01-5 g/L; paragraphs [0024], [0038], [0065]). Chevron does not disclose the Filterability Ratio is determined by passing a 1 g/L aqueous solution of the beta-glucan through a 1.2 micron filter at a consistent pressure sufficient to initially give a flux through the filter at time zero of about 1-3 grams of solution per second, wherein the Filterability Ratio is (time required for 180 g solution to pass through the filter - time required for 160 g solution to pass through the filter) / (time required for 80 g solution to pass through the filter - time required for 60 g of solution to pass through the filter). Briechele discloses a Filterability Ratio is determined of an aqueous solution of the refined beta-glucan (a filtration ratio of an aqueous beta-glucan filtrate is 1.01 to 2.0; paragraphs [0034], [0048]-[0049]). Briechele does not disclose a Filterability Ratio is determined by passing a 1 g/L aqueous solution of the refined beta-glucan through a 1.2 micron filter at a consistent pressure sufficient to initially give a flux through the filter at time zero of about 1-3 grams of solution per second, wherein the Filterability Ratio is (time required for 180 g solution to pass through the filter - time required for 160 g solution to pass through the filter) / (time required for 80 g solution to pass through the filter - time required for 60 g of solution to pass through the filter). WO 2017/055532 A1, (hereinafter 'Wintershall'532') discloses a Filterability Ratio is determined by an amount of an aqueous solution of the refined beta-glucan through a 1.2 micron filter at a pressure, wherein a Filterability Ratio is (time required for 90 g solution to pass through the filter - time required for 70 g solution to pass through the filter) / (time required for 70 g solution to pass through the filter - time required for 50 g of solution to pass through the filter) (0.35 g/l of a glucan solution is passed through a 1.2 micron filter membrane with pressure that produces a filtration ratio of 1.53-2.18 wherein the filtration ratio is (time required for 190 g solution to pass through the filter - time required for 170 g solution to pass through the filter) / (time required for 170 g solution to pass through the filter - time required for 50 g of solution to pass through the filter); page 16, lines 25-45; page 17, lines 1-39; page 18, lines 20-24). Wintershall'532 does not disclose the Filterability Ratio is determined by passing a 1 g/L solution through a 1.2 micron filter at a consistent pressure sufficient to initially give a flux through the filter at time zero of about 1-3 grams of solution per second, wherein the Filterability Ratio is (time required for 180 g solution to pass through the filter - time required for 160 g solution to pass through the filter) / (time required for 80 g solution to pass through the filter - time required for 60 g of solution to pass through the filter).

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EP 0271907 B1 to Wintershall AG (hereinafter 'Wintershall'907') discloses a Filterability Ratio is determined an aqueous solution of glucan through a filter (a homopolysaccharide comprising only glucose (glucan) filtered through a 3-5 micron filter has a filtration ratio value below 1.6; paragraphs [0007], [0011], [0044], [0046]). Wintershall'907 does not disclose the Filterability Ratio is determined by passing a 1 g/L aqueous solution of the refined beta-glucan through a 1.2 micron filter at a consistent pressure sufficient to initially give a flux through the filter at time zero of about 1-3 grams of solution per second, wherein the Filterability Ratio is (time required for 180 g solution to pass through the filter - time required for 160 g solution to pass through the filter) / (time required for 80 g solution to pass through the filter - time required for 60 g of solution to pass through the filter).

Chevron, Briechele, Wintershall'532, and Wintershall'907 fail to disclose individually, or in combination, the method of claim 4, wherein the Filterability Ratio is determined by passing a 1 g/L solution through a 1.2 micron filter at a consistent pressure sufficient to initially give a flux through the filter at time zero of about 1-3 grams of solution per second, wherein the Filterability Ratio is (time required for 180 g solution to pass through the filter - time required for 160 g solution to pass through the filter) / (time required for 80 g solution to pass through the filter - time required for 60 g of solution to pass through the filter). It would not have been obvious to one of ordinary skill in the art at the time the invention was made to have provided this limitation, because it would have required impermissible hindsight or suitable testing in order to show a method of determining a filtration ratio of a 1g/L beta-glucan solution is at the specified glucan amounts and flux through the filter.

Claims 1-66 have industrial applicability as defined by PCT Article 33(4) because the subject matter can be made or used in industry.