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(54) Title: EXTRUDED SNACK PRODUCT AND METHODS OF MAKING

(57) Abstract: A low fat extruded snack product is provided. The snack product includes (a) water in an amount of from about 40% to about 80% by weight of the snack product; (b) a non-animal derived protein in an amount of from about 5% to about 30% by weight of the snack product; and (c) an edible lipid component in the amount of less than about 10% by weight of the snack product.



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EXTRUDED SNACK PRODUCT AND METHODS OF MAKING

TECHNICAL FIELD

5 The present disclosure relates to an improved snack and to the process for preparing the same. More particularly, the present disclosure relates to an extruded snack comprising a low fat content and a high non-animal derived protein content without the use of a thickening or binding agent.

BACKGROUND

10 A wide variety of starch and protein-based snacks are presently available to consumers. Many of these snacks are in the form of chips, strips, or fries. Many of these conventional snacks are full of empty calories from fat and carbohydrates.

15 Consumers consider a number of factors when evaluating the desirability of a snack, especially potato derived snacks, for example, French fries, wedges, twistlers or chips. In addition to taste and visual appeal, texture is an important consideration. Many consumers find French fries that quickly become soggy to be unappealing. Accordingly, it would be desirable to provide consumers with an extruded snack that resembles French fries or chips that can be produced to stay crunchier and less soggy (hot or cold), to have a delicious taste and that are a
20 healthier option than traditional French fries or chips, i.e. less fat and a good source of plant-based protein. This enhances consumers enjoyment of the snack.

SUMMARY

25 In one embodiment, a low fat extruded snack product includes (a) water in an amount of from about 40% to about 80% by weight of the snack product; (b) a non-animal derived protein in an amount of from about 5% to about 30% by weight of the snack product; and (c) an edible lipid component in the amount of less than about 10% by weight of the snack product.

30 In another embodiment, a process for making a low fat snack product includes the steps of (a) preparing a mixture including from about 40% to about 80% water by weight of the product, from about 5% to about 30% of a non-animal derived protein, and from less than about 10% of an edible lipid component; (b) extruding the mixture at a pressure between 30 and 1500 psig and a temperature between 65 and 180 °C; (c) cutting the resulting extruded mixture at an

angle to the direction of fibers of from about 10 degrees to about 90 degrees to form snack pieces; and (d) freezing the snack pieces.

In yet another embodiment, a process for making a low fat snack product includes the steps of (a) preparing a mixture including from about 40% to about 80% water by weight of the product, from about 5% to about 30% of a non-animal derived protein, and from less than about 10% of an edible lipid component; (b) extruding the mixture at a pressure between 30 and 1500 psig and a temperature between 65 and 180 °C; (c) freezing the snack pieces; and (d) cutting the resulting extruded mixture at an angle to the direction of fibers of from about 10 degrees to about 90 degrees to form snack pieces.

These and other features, aspects and advantages of specific embodiments will become evident to those skilled in the art from a reading of the present disclosure.

DETAILED DESCRIPTION

The following text sets forth a broad description of numerous different embodiments of the present disclosure. The description is to be construed as exemplary only and does not describe every possible embodiment since describing every possible embodiment would be impractical, if not impossible. It will be understood that any feature, characteristic, component, composition, ingredient, product, step or methodology described herein can be deleted, combined with or substituted for, in whole or part, any other feature, characteristic, component, composition, ingredient, product, step or methodology described herein. Numerous alternative embodiments could be implemented, using either current technology or technology developed after the filing date of this patent, which would still fall within the scope of the claims. All publications and patents cited herein are incorporated herein by reference.

The present disclosure relates to a delicious, extruded substitute to traditional French fries or chips that can produced to stay crunchier and less soggy (hot or cold), to have a delicious taste and that is a healthier option than traditional French fries or chips, i.e. less fat and a good source of plant-based protein.

“Non-animal derived protein” refers to protein preparations made from raw materials including, but not limited to, grain (rice, millet, maize, barley, wheat, oat, sorghum, rye, teff, triticale, amaranth, buckwheat, quinoa); legume or pulses, beans (such as soybean, mung beans, faba beans, lima beans, runner beans, kidney beans, navy beans, pinto beans, azuki beans, and the like), peas (such as green peas, yellow peas, chickpeas, pigeon peas, cowpea, and black-eyed peas and the like), sesame, garbanzo, potatoes, lentils, and lupins; seed and oilseed (black mustard, India mustard, rapeseed, canola, safflower, sunflower seed, flax seed, hemp seed, poppy

seed, pumpkin, chia, sesame); nuts (almond, walnut, Brazil, Macadamia, cashews, chestnuts, hazelnuts, pine, pecans, peanuts, pistachio and ginkgo); algal (kelp, wakame, spirulina, chlorella); mycoprotein and/or fungal protein.

According to the present disclosure, a low fat extruded snack product may include, water, a non-animal derived protein, a fat component and a flavour. The snack product may also include other optional ingredients.

Extruded Snack Composition and Extrusion Process

The present disclosure further relates to extruded snack products and methods for making snack products. The extruded snack products are produced with high moisture content and provide a product that simulates a traditional French fry or chip and has a desirable texture, mouthfeel, flavor and color.

Texturization of protein is the development of a texture or a structure via a process involving heat, and/or shear and the addition of water. The texture or structure will be formed by protein fibers that will provide a unique texture and perception when consumed. The mechanism of texturization of proteins starts with the hydration and unfolding of a given protein by breaking intramolecular binding forces by heat and/or shear. The unfolded proteins molecules are aligned and bound by shear.

To make non-animal proteins palatable, texturization into snack products, for example, through extrusion processing has been an accepted approach. Due to its versatility, high productivity, energy efficiency and low cost, extrusion processing is widely used in the modern food industry. Extrusion processing is a multi-step and multifunctional operation, which leads to mixing, hydration, shear, homogenization, compression, deaeration, pasteurization or sterilization, stream alignment, shaping, expansion and/or fiber formation. Ultimately, the non-animal protein, typically introduced to the extruder in the form of a dry blend, is processed to form a fibrous material.

More recent developments in extrusion technology have focused on using twin screw extruders under high moisture (40-80%) conditions for texturizing non-animal proteins into fibrous products. In the high moisture twin screw process, also known as “wet extrusion”, the raw materials, predominantly non-animal proteins such as soy and/or pea protein, are mixed and fed into a twin-screw extruder, where a proper amount of water is dosed in and all ingredients are further blended and then melted by the thermo-mechanical action of the screws. The realignment of large protein molecules, the laminar flow, and the strong tendency of stratification within the extruder's long slit cooling die contribute to the formation of a fibrous structure. The resulting

wet-extruded products tend to exhibit improved visual appearance and improved palatability. Therefore, this extrusion technology shows promise for texturizing non-animal proteins to meet increasing consumer demands for healthy and tasty foods.

Texturization processes may also include spinning, simple shear flow, and simple shear flow and heat in a Couette Cell ("Couette Cell" technology). The spinning process consists of unfolding protein molecules in a high alkaline pH solution, and coagulating the unfolded protein molecules by spraying the protein alkaline solution into an acid bath. The spraying is made by a plate with numerous fine orifices. The protein coagulates forming fibers as soon as it gets in contact with the acid medium. The fibers are then washed to remove remaining acid and/or salts formed in the process. A Couette Cell is a cylinder based device where the inner cylinder rotates and the outer cylinder is stationary, being easy to scale up. The Couette Cell operates under the same principle of forming protein fibers by subjecting the protein to heat and shear in the space between the stationary cylinder and the rotational cylinder.

With respect to simple shear flow and heat in a Couette Cell, this process can induce fibrous structural patterns to a granular mixture of non-animal proteins at mild process conditions. This process is described in "On the use of the Couette Cell technology for large scale production of textured soy-based meat replacers", Journal of Food Engineering 169 (2016) 205-213, which is incorporated herein by reference.

Extruded snack products having qualities (for example, texture, moisture, mouthfeel, flavor, and color) similar to that of traditional French fries may be produced using non-animal proteins formed using extrusion under conditions of relatively high moisture. In one embodiment, snack products may include non-animal protein and an edible lipid material as described herein. In another embodiment, snack products may include non-animal protein, one or more of an edible fiber, an edible lipid material and a flavour composition as described herein. For purposes of this disclosure, the extruded snack product or snack product is the extruded mixture (dry ingredients plus water) before further processing (like frying, deep frying, baking etc).

In one embodiment, the amount of non-animal protein included in the mixture to be extruded includes no more than about 90% by weight of the dry ingredients. For example, the amount of non-animal protein present in the ingredients utilized to make snack products according to the present disclosure may range from about 15% to about 90% by weight of the dry ingredients. In another embodiment, the amount of non-animal protein present in the ingredients utilized to make snack products according to the present disclosure may range from about 15% to about 75% by weight of the dry ingredients. In another further embodiment, the amount of non-

animal protein present in the dry ingredients utilized to make snack products according to the present disclosure may be about 75%.

The term “dry ingredients” includes all the ingredients in the mixture to be extruded except for added water and ingredients added with the added water (i.e., the “wet ingredients”).

5 Thus, the dry ingredients may include the non-animal protein component, the edible lipid component (despite the fact that the edible lipid component may be a liquid oil) and a flavour composition. In another embodiment, the dry ingredients may include a carbohydrate component.

In one embodiment, the non-animal protein ingredients are isolated from soybeans.
10 Suitable soybean derived protein-containing ingredients include soy protein isolate, soy protein concentrate, soy flour, and mixtures thereof. The soy protein materials may be derived from whole soybeans in accordance with methods generally known in the art. In another exemplary embodiment, the non-animal protein ingredients are isolated from grain, legume or pulses, seed and oilseed, nut, algal, mycoprotein or fungal protein, insects, leaf protein and combinations
15 thereof as described herein. In one embodiment, the extruded snack product includes from about 25% to about 40% soy protein concentrate (containing about 70% protein), which means approximately 17.5% to about 28% protein.

In addition to the foregoing, the ingredients utilized to make the snack product may include an edible lipid component that comprises one or more edible lipids.

20 In accordance with the present disclosure, nearly any edible lipid material may be employed, including natural and synthetic oils, for example, sunflower, safflower, rapeseed, canola, soybean, cottonseed, peanut, palm and corn oils and in either non-hydrogenated or partially hydrogenated form. In one embodiment, the edible lipid material is an edible vegetable oil, such as sunflower oil or safflower oil.

25 In one embodiment, the total edible lipid content is less than about 10% of the weight of the dry ingredients utilized to make the snack product. As such, in one embodiment, the total edible lipid content is an amount less than about 5% by weight of the dry ingredients. In yet another embodiment, the total edible lipid content is an amount less than about 2% by weight of the dry ingredients

30 In addition to the foregoing, the ingredients utilized to make the snack product may include a flavour composition. By “flavour composition” it is meant a composition created by a flavorist using methods known to the skilled person that is a mixture of tastants, aroma compounds and sensates. Examples of suitable flavours include natural flavours, artificial flavours, spices, seasonings, and the like. Exemplary flavour compositions include synthetic

flavor oils and flavoring aromatics and/or oils, oleoresins, essences, and distillates, and a combination comprising at least one of the foregoing.

Generally any flavour such as those described in "Chemicals Used in Food Processing", Publication No 1274, pages 63-258, by the National Academy of Sciences, can be used. This publication is incorporated herein by reference.

The extruded snack product may include from about .01% to about 6.0%, in another embodiment from about 0.1% to about 1.0%, in yet another embodiment from about 0.5% to about 1%, or any individual number within the range, by weight of a flavour. Additionally, the flavour may be added pre or post extrusion to the snack product.

In addition to the foregoing, the snack product includes water at a relatively high amount. In one embodiment, the total moisture level of the mixture extruded to make the snack product is controlled such that the snack product has a moisture content that is from about 40% to about 80% by weight. To achieve such a high moisture content, water is typically added to the ingredients. Although, a relatively high moisture content is desirable, it may not be desirable for the snack product to have a moisture content much greater than about 80%. In another embodiment, it may not be desirable for the snack product to have a moisture content much greater than about 70%. As such, in one embodiment the amount of water added to the ingredients and the extrusion process parameters are controlled such that the snack product (following extrusion) has a moisture content that is from about 40% to about 80% by weight.

In one embodiment, along with the water are added additional "wet ingredients" including, for example, color.

In another embodiment, vitamins and minerals may be added to fortify extruded snack products. As an example, in some embodiments, the product may be fortified with calcium using calcium sources such as carbonate (CaCO_3) and/or potassium and phosphates and/or iron.

In another embodiment, salts of various types may also be used to improve taste, and to act as buffering agents to enhance protein stability. Such salts include sodium citrate, sodium chloride, potassium citrate, potassium phosphate, and dipotassium phosphate.

In another embodiment, antioxidants may prevent and/or reduce oxidation and may preserve the flavorant and appearance of the product during refrigerated and/or unrefrigerated storage. Antioxidants may reduce oxidation by trapping free radicals in the product.

In addition to the above components, the snack product may optionally comprise a carbohydrate component. A variety of ingredients may be used as all or part of the carbohydrate component. That said, such ingredients are typically classified as a starch, a flour, or an edible fiber and the carbohydrate component may comprise one or more types of starch, flour, edible

fiber, and combinations thereof. Examples of starch include wheat starch, corn starch, rice starch, oat starch, potato starch, and combinations thereof. Examples of flour include wheat flour, rice flour, white corn flour, oat flour, sorghum flour, rye flour, amaranth flour, quinoa flour, and combinations thereof.

5 Edible fiber is a particularly advantageous carbohydrate to include in the extrusion mixture because fiber tends to bind water when the mixture is extruded. Any appropriate type of edible fiber may be used in the present invention in appropriate amounts. Exemplary sources of edible fiber include soluble and insoluble dietary fiber, wood pulp cellulose, modified cellulose, seed husks, oat hulls, citrus fiber, carrot fiber, pea fiber, corn bran, soy polysaccharide, oat bran, 10 wheat bran, barley bran, and rice bran. The fiber may be present in the dry pre-mix from about 0.1% to about 10% by weight. In one embodiment, the fiber is about 2% to about 8% by weight of the dry ingredients. In another embodiment the fiber is about 5% by weight of the dry ingredients. Particularly desirable types of fiber are those that effectively bind water when the mixture of non-animal protein and fiber is extruded. In one embodiment, the snack product may 15 include an edible carrot fiber.

Among the suitable extrusion apparatuses useful in the practice of the described process is a commercially available double barrel, twin-screw extruder apparatus such as a Cleextral BC21 model manufactured by Cleextral (France).

The screws of a twin-screw extruder can rotate within the barrel in the same or opposite 20 directions. Rotation of the screws in the same direction is referred to as single flow or co-rotating whereas rotation of the screws in opposite directions is referred to as double flow or counter-rotating. The speed of the screw or screws of the extruder may vary depending on the particular apparatus; however, it is typically from about 100 to about 750 revolutions per minute (rpm). Generally, as the screw speed increases, the density of the extrudate will decrease. The extrusion 25 apparatus contains screws assembled from shafts and worm segments, as well as mixing lobe and ring-type shearing elements as recommended by the extrusion apparatus manufacturer for extruding non-animal protein material.

The extrusion apparatus generally comprises a plurality of heating zones through which the protein mixture is conveyed under mechanical pressure prior to exiting the extrusion 30 apparatus through an extrusion die. The temperature in each successive heating zone generally exceeds the temperature of the previous heating zone by between about 10° C to about 70° C. In one embodiment, the dry premix is transferred through multiple heating zones within the extrusion apparatus, with the protein mixture heated to a temperature of from about 25° C. to about 160° C such that the molten extrusion mass enters the extrusion die at a temperature of

from about 160° C. In one embodiment, the protein mixture is heated in the respective heating zones to temperatures of about 65° C, about 95° C, about 150° C, and about 160° C.

The pressure within the extruder barrel is typically between about 30 psig and about 1500 psig, or more specifically between about 50 psig and about 300 psig. Generally, the pressure within the last two heating zones is between about 30 psig and about 1500 psig, even more specifically between about 50 psig to about 300 psig. The barrel pressure is dependent on numerous factors including, for example, the extruder screw speed, feed rate of the mixture to the barrel, feed rate of water to the barrel, and the viscosity of the molten mass within the barrel.

Water along with additional “wet ingredients” is injected into the extruder barrel to hydrate the non-animal protein mixture and promote texturization of the proteins. As an aid in forming the molten extrusion mass, the water may act as a plasticizing agent. Water may be introduced to the extruder barrel via one or more injection jets. The rate of introduction of water to the barrel is generally controlled to promote production of an extrudate having the aforementioned desired characteristics, such as an extrudate with a moisture content as described above.

EXAMPLES

The following examples are given solely for the purpose of illustration and are not to be construed as limitations of the present invention, as many variations of the invention are possible without departing from the spirit and scope of the present disclosure.

Soy protein concentrate (Arcon SM supplied by ADM containing 71% protein) and edible lipid component (safflower oil) were used as ingredients and were blended for 1 to 5 minutes to form a uniform mass.

Extrusion was performed using a pilot-scale, co-rotating, intermeshing, twin-screw food extruder (Cletral BC21 model manufactured by Cletral (France). A continuous dry feeding equipment was used to feed the raw materials into the extruder. While operating, water was injected, via an inlet port, into the extruder by a positive displacement pump. The pump was pre-calibrated and adjusted so that the extrudate moisture content was between 60.5% and 62.5%. The screw speed was set at 250 rpm. At the end of the extruder, a long cooling die was attached, with a dimension of 50 mm × 10 mm × 600 mm (W×H×L).

As seen in Table 1 below, a low-fat extruded snack product was prepared via extrusion.

Table 1
Extruded Snack Composition

	Example 1	Example 2
Dry Feed (35 wt%)		
Soy Protein Concentrate	35	35
Liquid Feed (65 wt%)		
Water (Moisture Content)	62.5	60.5
Safflower Oil	1.5	1.5
Salt	1	1
Colour	-	1
Flavour	-	1
Total	100	100

The above ingredients were used in a method for the preparation of extruded snacks in the amounts indicated. The method comprised:

- a. Blending together the soy protein concentrate and the safflower oil in a blender until a uniform mass is obtained. This mass is then fed into an extruder via a continuous feeding device;
- b. The remaining dry ingredients are dissolved or suspended in the water and are fed with a pump through an injection port in the extruder.
- c. extruding the mixture at a pressure between 30 and 450 psig and a temperature between 65 and 180°C;
- d. freezing the snack pieces;
- e. cutting the resulting extruded mixture at an angle to the longitudinal axis of the fibers of about 45 degrees to form snack pieces; and
- f. frying the snack pieces at 150 °C for about 3-5 minutes.

It has been observed that cutting of the extruded mixture at an angle to the to the longitudinal axis of the mixture coming out of the extruder of between about 10 and about 90 degrees reduces or manages chewiness.

The non-animal derived protein together with a hot extrusion process creates a protein melt which is then cooled down in a cooling die to create a fibrous structure. Gluing happens by the melting of the protein and not by the interaction with a starch. The gluing along with the angle of cutting of the extruded mixture provides a unique texture and allows one to fry, deep fry, air fry or bake the snack product, maintaining crispness over time with a high level of moisture.

The dimensions and values disclosed herein are not to be understood as being strictly limited to the exact numerical values recited. Instead, unless otherwise specified, each such dimension is intended to mean both the recited value and a functionally equivalent range surrounding that value. For example, a dimension disclosed as “40 mm” is intended to mean “about 40 mm”.

While particular embodiments of the present invention have been illustrated and described, it would be obvious to those skilled in the art that various other changes and modifications can be made without departing from the spirit and scope of the invention. It is therefore intended to cover in the appended claims all such changes and modifications that are within the scope of this invention.

What is claimed is:

1. A low fat extruded snack product comprising:
 - a. water in an amount of from 40% to 80% by weight of the snack product;
 - 5 b. a non-animal derived protein in an amount of from 5% to 30% by weight of the snack product; and
 - c. an edible lipid component in the amount of less than 10% by weight of the snack product.
- 10 2. The snack product according to claim 1, further comprising a flavour composition, wherein the flavour composition is added to the snack product pre or post extrusion.
3. The snack product according to claim 1, wherein the amount of water is not greater than about 70%.
- 15 4. The snack product according to claim 1, wherein the amount of non-animal derived protein is 25%.
5. The snack product according to claim 1, wherein the non-animal derived protein is
20 derived from a soy protein concentrate.
6. The snack product according to claim 1, wherein the edible lipid component is safflower oil.
- 25 7. The snack product according to claim 1 having the shape of French fries or chips.
8. A process for making a low fat snack product, comprising:
 - a. preparing a mixture including from 40% to 80% water by weight of the product,
30 from 5% to 30% of a non-animal derived protein, and from less than 10% of an edible lipid component;
 - b. extruding the mixture at a pressure between 30 and 1500 psig and a temperature between 65 and 180 °C;
 - c. freezing the snack pieces; and
 - d. cutting the resulting extruded mixture at an angle to the to the longitudinal axis of
35 the mixture of from 10 degrees to 90 degrees to form snack pieces.

9. The process according to claim 13, wherein the snack pieces are processed for consumption by frying, deep frying, air frying or baking.

10. The process according to claim 14, wherein the snack pieces are processed by frying at
5 150 °C for 3-5 minutes.

11. The process according to claim 13, wherein the amount of water is not greater than 70%.

12. The process according to claim 13 wherein snack pieces have the shape of French fries or
10 chips.

INTERNATIONAL SEARCH REPORT

International application No

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A. CLASSIFICATION OF SUBJECT MATTER

INV. A23P30/20 A23J3/26

ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A23P A23J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2017/174518 A1 (NESTEC SA [CH]) 12 October 2017 (2017-10-12) page 6, line 27 - page 7, line 2; claims 1-3; figure 1; examples 2,3 page 8, line 28 - page 9, line 11 page 11, line 30 - page 13, line 13 -----	1-8, 11, 12
X	WO 2012/158023 A1 (OJAH B V [NL]; GIEZEN FRANCISCUS EGENIUS [NL] ET AL.) 22 November 2012 (2012-11-22) page 16, line 6 - line 11; claims 1-3, 7, 9, 10 page 9, line 26 - page 11, line 3 page 13, line 3 - line 7 ----- -/--	1-5, 7-12



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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INTERNATIONAL SEARCH REPORT

International application No

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2019/143859 A1 (HERSHEY CO [US]) 25 July 2019 (2019-07-25) paragraph [0024] - paragraph [0029]; claims 1,11 -----	1-5, 7, 8, 11, 12
X	WO 2020/030628 A1 (NOVAMEAT TECH S L [ES]) 13 February 2020 (2020-02-13) page 45, line 10 - page 50, line 9; claims 1,2 -----	1-4
X	WO 2016/150834 A1 (NESTEC SA [CH]) 29 September 2016 (2016-09-29) page 9, line 6 - page 10, line 7; claims 1,11,15; figure 1 page 12, line 15 - line 26; figure 1 -----	1-8, 11, 12
X	WO 2017/046659 A1 (SUNFED LTD [NZ]) 23 March 2017 (2017-03-23) paragraph [0124] - paragraph [0126]; claims 1-7, 14,20; examples 1-7; tables 2-4 paragraph [0026] paragraph [0119] -----	1-12

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2017174518 A1	12-10-2017	CA 3017040 A1	12-10-2017
		CN 108882726 A	23-11-2018
		EP 3439486 A1	13-02-2019
		US 2019150476 A1	23-05-2019
		WO 2017174518 A1	12-10-2017
WO 2012158023 A1	22-11-2012	CA 2835155 A1	22-11-2012
		DK 2706867 T3	14-06-2018
		EP 2706867 A1	19-03-2014
		EP 3395181 A1	31-10-2018
		ES 2672262 T3	13-06-2018
		HR P20180878 T1	24-08-2018
		HU E039003 T2	28-12-2018
		PL 2706867 T3	31-10-2018
		PT 2706867 T	12-06-2018
		TR 201807663 T4	21-06-2018
		US 2014127363 A1	08-05-2014
		US 2020329736 A1	22-10-2020
		WO 2012158023 A1	22-11-2012
WO 2019143859 A1	25-07-2019	CA 3084067 A1	25-07-2019
		US 2021106026 A1	15-04-2021
		WO 2019143859 A1	25-07-2019
WO 2020030628 A1	13-02-2020	AR 115915 A1	10-03-2021
		AU 2019316690 A1	04-02-2021
		BR 112021002252 A2	04-05-2021
		CA 3107569 A1	13-02-2020
		CL 2021000275 A1	19-07-2021
		CN 112839522 A	25-05-2021
		CO 2021002711 A2	20-05-2021
		EP 3833194 A1	16-06-2021
		IL 280604 A	25-03-2021
		JP 2021533749 A	09-12-2021
		KR 20210052438 A	10-05-2021
		US 2021345643 A1	11-11-2021
		WO 2020030628 A1	13-02-2020
WO 2016150834 A1	29-09-2016	AU 2016236364 A1	27-07-2017
		EP 3270716 A1	24-01-2018
		PL 3270716 T3	21-09-2020
		PT 3270716 T	21-07-2020
		US 2018064137 A1	08-03-2018
		WO 2016150834 A1	29-09-2016
WO 2017046659 A1	23-03-2017	AU 2016322709 A1	10-05-2018
		CN 108471780 A	31-08-2018
		EP 3349591 A1	25-07-2018
		HK 1259179 A1	29-11-2019
		US 2019045809 A1	14-02-2019
		US 2021289813 A1	23-09-2021
		WO 2017046659 A1	23-03-2017