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(54) **Title**: METHODS AND MATERIALS RELATED TO NUTRITIONAL SUPPLEMENT COMPOSITIONS CONTAINING A POTATO POLYSACCHARIDE PREPARATION

(57) **Abstract**: The document provides nutritional supplement compositions. For example, nutritional supplement compositions containing a potato polysaccharide preparation, methods for obtaining potato polysaccharide preparations, methods for making nutritional supplement compositions containing a potato polysaccharide preparation, and methods for increasing or decreasing expression of polypeptides involved with mitochondria activity or function are provided.

METHODS AND MATERIALS RELATED TO NUTRITIONAL SUPPLEMENT COMPOSITIONS CONTAINING A POTATO POLYSACCHARIDE PREPARATION

BACKGROUND

1. Technical Field

The document relates to nutritional supplement compositions. For example, this document relates to nutritional supplement compositions containing a potato polysaccharide preparation, methods for obtaining potato polysaccharide preparations, methods for making nutritional supplement compositions containing a potato polysaccharide preparation, and methods for increasing or decreasing expression of polypeptides involved with mitochondria activity or function.

2. Background Information

Potatoes are starchy, edible tubers obtained from potato plants and form an integral part of much of the world's food supply. In fact, potatoes are the fourth largest food crop in the world. The main potato species worldwide is *Solanum tuberosum.*

SUMMARY

The document provides nutritional supplement compositions. For example, this document provides nutritional supplement compositions containing a potato polysaccharide preparation, methods for obtaining potato polysaccharide preparations, methods for making nutritional supplement compositions containing a potato polysaccharide preparation, and methods for increasing or decreasing expression of polypeptides involved with mitochondria activity or function. In some cases, the nutritional supplement compositions and potato polysaccharide preparations provided herein can be used to increase or decrease expression of polypeptides involved with mitochondria activity or function. For example, a nutritional supplement composition containing a potato polysaccharide preparation provided herein or a potato polysaccharide preparation provided herein can be used to increase expression of a transcription factor A, mitochondrial polypeptide (a TFAM polypeptide), an ATP synthase, H^+ transporting, mitochondrial F1 complex, alpha subunit 1 polypeptide (an ATP5A1 polypeptide), a pyruvate dehydrogenase (lipoamide) alpha 1 polypeptide (a

PDHA1 polypeptide), a pyruvate dehydrogenase (lipoamide) alpha 2 polypeptide (a PDHA2 polypeptide), a thimet oligopeptidase 1 polypeptide (a THOP1 polypeptide), or a combination thereof. In some cases, a nutritional supplement composition containing a potato polysaccharide preparation provided herein or a potato polysaccharide preparation provided herein can be used to decrease expression of a forkhead box O1 polypeptide (a FOX01A polypeptide), a nuclear factor of kappa light polypeptide gene enhancer in B-cells 1 polypeptide (a NFKB1 polypeptide), a pyruvate dehydrogenase kinase, isozyme 2 polypeptide (a PDK2 polypeptide), a pyruvate dehydrogenase kinase, isozyme 4 polypeptide (a PDK4 polypeptide), a 3-hydroxy-3-methylglutaryl-CoA reductase polypeptide (a HMGCR polypeptide), or a combination thereof. In some case, a nutritional supplement composition containing a potato polysaccharide preparation provided herein or a potato polysaccharide preparation provided herein can be used to increase one or more polypeptides (e.g., one or more of a TFAM polypeptide, an ATP5A1 polypeptide, a PDHA1 polypeptide, a PDHA2 polypeptide, or a THOP1 polypeptide) and decrease one or more polypeptides (e.g., one or more of a FOX01A polypeptide, a NFKB1 polypeptide, a PDK2 polypeptide, a PDK4 polypeptide, or a HMGCR polypeptide).

In some cases, the nutritional supplement compositions and potato polysaccharide preparations provided herein can be used to increase or decrease expression of polypeptides involved with obesity and/or diabetes. For example, a nutritional supplement composition containing a potato polysaccharide preparation provided herein or a potato polysaccharide preparation provided herein can be used to increase expression of a lipase, hormone-sensitive polypeptide (an LIPE polypeptide) in adipocytes, to increase expression of a phosphoenolpyruvate carboxykinase 2 (mitochondrial) polypeptide (a PCK2 polypeptide), to increase expression of a monoacylglycerol O-acyltransferase 1 polypeptide (an MOGAT1 polypeptide), to increase expression of a peroxisome proliferator-activated receptor gamma, coactivator 1 alpha polypeptide (a PPARGC1a polypeptide), to increase expression of a peroxisome proliferator-activated receptor gamma, coactivator 1 beta polypeptide (a PPARGC1b polypeptide), to increase expression of a superoxide dismutase 2, mitochondrial polypeptide (an SOD2 polypeptide), to increase expression of a nuclear receptor subfamily 4, group A, member 1 polypeptide (an NR4A1 polypeptide) in adipocytes, to increase expression of an acetyl-CoA acetyltransferase 2 polypeptide (an ACAT2 polypeptide), to increase expression of a 3-hydroxy-3-methylglutaryl-

CoA reductase polypeptide (an HMGCR polypeptide) in muscle cells, or a combination thereof. In some cases, a nutritional supplement composition containing a potato polysaccharide preparation provided herein or a potato polysaccharide preparation provided herein can be used to decrease expression of a 1-acylglycerol-3-phosphate O-acyltransferase 1 polypeptide (an AGPAT1 polypeptide), to decrease expression of an oxidized low density lipoprotein (lectin-like) receptor 1 polypeptide (an OLR1 polypeptide), to decrease expression of a branched chain amino-acid transaminase 2, mitochondrial polypeptide (a BCAT2 polypeptide), to decrease expression of a nuclear factor of kappa light polypeptide gene enhancer in B-cells 1 polypeptide (an NFKB1 polypeptide), to decrease expression of a SH2B adaptor protein 1 polypeptide (an SH2B1 polypeptide), to decrease expression of a lipoprotein lipase polypeptide (an LPL polypeptide), to decrease expression of a 3-hydroxy-3-methylglutaryl-CoA reductase polypeptide (an HMGCR polypeptide) in adipocytes, to decrease expression of a lipase, hormone-sensitive polypeptide (an LIPE polypeptide) in muscle cells, to decrease expression of a nuclear receptor subfamily 4, group A, member 1 polypeptide (an NR4A1 polypeptide) in muscle cells, to decrease expression of a phosphatase and tensin homolog polypeptide (a PTEN polypeptide), to decrease expression of a caspase 8, apoptosis-related cysteine peptidase polypeptide (a CASP8 polypeptide), or a combination thereof.

In some case, a nutritional supplement composition containing a potato polysaccharide preparation provided herein or a potato polysaccharide preparation provided herein can be used to increase one or more polypeptides (e.g., one or more of an LIPE polypeptide (in adipocytes), a PCK2 polypeptide, an MOGAT1 polypeptide, a PPARGC1a polypeptide, a PPARGC1b polypeptide, an SOD2 polypeptide, an NR4A1 polypeptide (in adipocytes), an ACAT2 polypeptide, or an HMGCR polypeptide (in muscle cells)) and decrease one or more polypeptides (e.g., one or more of an AGPAT1 polypeptide, an OLR1 polypeptide, a BCAT2 polypeptide, an NFKB1 polypeptide, an SH2B1 polypeptide, an LPL polypeptide, an HMGCR polypeptide (in adipocytes), an LIPE polypeptide (in muscle cells), an NR4A1 polypeptide (in muscle cells), a PTEN polypeptide, or a CASP8 polypeptide).

In general, one aspect of this document features a nutritional supplement composition comprising, or consisting essentially of, a potato polysaccharide preparation in an amount that, when administered to a mammal, results in between 0.05 mg and 50 mg of the potato polysaccharide component of the potato

polysaccharide preparation being administered to the mammal per kg of body weight of the mammal. The composition can comprise between 1 mg and 100 mg of the potato polysaccharide preparation. The composition can comprise between 6 mg and 20 mg of the potato polysaccharide preparation. The composition can comprise between 1 mg and 100 mg of the potato polysaccharide component of the potato polysaccharide preparation. The composition can comprise between 6 mg and 20 mg of the potato polysaccharide component of the potato polysaccharide preparation. The composition can be in the form of a tablet. The composition can comprise alpha lipoic acid. The composition can comprise alpha tocopherol. The potato polysaccharide preparation can be a preparation obtained from raw potatoes. The potato polysaccharide preparation can be in an amount that, when administered to a mammal, results in between 0.075 mg and 0.5 mg of the potato polysaccharide component of the potato polysaccharide preparation being administered to the mammal per kg of body weight of the mammal. At least about 80 percent of the potato polysaccharide preparation can be potato polysaccharide. At least about 90 percent of the potato polysaccharide preparation can be potato polysaccharide. At least about 95 percent of the potato polysaccharide preparation can be potato polysaccharide. The mammal can be a human.

In another aspect, this document features a nutritional supplement composition comprising, or consisting essentially of, a potato polysaccharide preparation obtained from raw potatoes. The composition can comprise between 1 mg and 100 mg of the potato polysaccharide preparation. The composition can comprise between 6 mg and 20 mg of the potato polysaccharide preparation. The composition can comprise between 1 mg and 100 mg of the potato polysaccharide component of the potato polysaccharide preparation. The composition can comprise between 6 mg and 20 mg of the potato polysaccharide component of the potato polysaccharide preparation. The composition can be in the form of a tablet. The composition can comprise alpha lipoic acid. The composition can comprise alpha tocopherol. The potato polysaccharide preparation can be in an amount that, when administered to a mammal, results in between 0.05 mg and 0.5 mg of the potato polysaccharide component of the potato polysaccharide preparation being administered to the mammal per kg of body weight of the mammal. The potato polysaccharide preparation can be in an amount that, when administered to a mammal, results in between 0.075 mg and 0.25 mg of the potato polysaccharide component of the potato

polysaccharide preparation being administered to the mammal per kg of body weight of the mammal. The mammal can be a human. At least about 80 percent of the potato polysaccharide preparation can be potato polysaccharide. At least about 90 percent of the potato polysaccharide preparation can be potato polysaccharide. At least about 95 percent of the potato polysaccharide preparation can be potato polysaccharide.

In another aspect, this document features a method for increasing polypeptide expression in cells. The method comprises, or consists essentially of, contacting cells with a potato polysaccharide preparation obtained from raw potatoes under conditions wherein expression of one or more of the polypeptides selected from the group consisting of a TFAM polypeptide, an ATP5A1 polypeptide, a PDHA1 polypeptide, a PDHA2 polypeptide, and a THOP1 polypeptide is increased.

In another aspect, this document features a method for reducing polypeptide expression in cells. The method comprises, or consists essentially of, contacting cells with a potato polysaccharide preparation obtained from raw potatoes under conditions wherein expression of one or more of the polypeptides selected from the group consisting of a FOX01A polypeptide, a NFKB1 polypeptide, a PDK2 polypeptide, a PDK4 polypeptide, and a HMGCR polypeptide is reduced.

In another aspect, this document features a method for treating obesity, diabetes, and/or polycystic ovary syndrome. The method comprises, or consists essentially of, (a) identifying a mammal with obesity, diabetes, and/or polycystic ovary syndrome, and (b) administering to the mammal a potato polysaccharide preparation obtained from raw potatoes.

Unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention pertains. Although methods and materials similar or equivalent to those described herein can be used in the practice or testing of the present invention, suitable methods and materials are described below. All publications, patent applications, patents, and other references mentioned herein are incorporated by reference in their entirety. In case of conflict, the present specification, including definitions, will control. In addition, the materials, methods, and examples are illustrative only and not intended to be limiting.

Other features and advantages of the invention will be apparent from the following detailed description, and from the claims.

DESCRIPTION OF DRAWINGS

Figure 1 is an HPLC chromatogram of a 10% ACN extract of raw potato (Russet Burbank).

Figure 2 is an HPLC chromatogram of collected and re-purified 3.5 minute peak material from a 10% ACN extract of raw potato shown in Figure 1.

Figure 3 is a representative real time PCR amplification plot for TFAM expression.

Figure 4 is an LC/MS trace of 3.5 minute HPLC peak material.

Figure 5 is a full NMR spectrum of 3.5 minute HPLC peak material.

Figure 6 is an expanded NMR spectrum of 3.5 minute HPLC peak material.

Figure 7 is a total ion chromatogram of derivatized carbohydrate fragments of 3.5 minute HPLC peak material obtained from raw potato Russet Burbank).

Figure 8 is a fragmentation pattern of diacetamide. The peak fragmentation pattern is in the top panel, the compound library fragmentation match is in the bottom panel, and an overlay of the two is in the center panel.

Figure 9 is a fragmentation pattern of 3-acetoxy pyridine. The peak fragmentation pattern is in the top panel, the compound library fragmentation match is in the bottom panel, and an overlay of the two is in the center panel.

Figure 10 is a fragmentation pattern of 3,4-furan dimethanol, diacetate. The peak fragmentation pattern is in the top panel, the compound library fragmentation match is in the bottom panel, and an overlay of the two is in the center panel.

Figure 11 is a fragmentation pattern of 1,2,3-propanetriol diacetate. The peak fragmentation pattern is in the top panel, the compound library fragmentation match is in the bottom panel, and an overlay of the two is in the center panel.

Figure 12 is a fragmentation pattern of imidazole, 2-acetamino-5-methyl. The peak fragmentation pattern is in the top panel, the compound library fragmentation match is in the bottom panel, and an overlay of the two is in the center panel.

Figure 13 is a fragmentation pattern of 6,7-dihydro-5H-pyrrol[2,1,c][1,2,4] triazole-3-carboxylic acid. The peak fragmentation pattern is in the top panel, the compound library fragmentation match is in the bottom panel, and an overlay of the two is in the center panel.

Figure 14 is a fragmentation pattern of acetic acid, 1-(2-methyltetrazol-5-yl) ethenyl ester. The peak fragmentation pattern is in the top panel, the compound library fragmentation match is in the bottom panel, and an overlay of the two is in the center panel.

Figure 15 is a fragmentation pattern of 1,2,3,4-butanetriol, tetraacetate (isomer 1). The peak fragmentation pattern is in the top panel, the compound library fragmentation match is in the bottom panel, and an overlay of the two is in the center panel.

Figure 16 is a fragmentation pattern of 1,2,3,4-butanetriol, tetraacetate (isomer 2). The peak fragmentation pattern is in the top panel, the compound library fragmentation match is in the bottom panel, and an overlay of the two is in the center panel.

Figure 17 is a fragmentation pattern of pentaerythritol tetraacetate. The peak fragmentation pattern is in the top panel, the compound library fragmentation match is in the bottom panel, and an overlay of the two is in the center panel.

Figure 18 is a fragmentation pattern of 1,2,3,4,5-penta-o-acetyl-D-xylitol (isomer 1). The peak fragmentation pattern is in the top panel, the compound library fragmentation match is in the bottom panel, and an overlay of the two is in the center panel.

Figure 19 is a fragmentation pattern of 1,2,3,4,5-penta-o-acetyl-D-xylitol (isomer 2). The peak fragmentation pattern is in the top panel, the compound library fragmentation match is in the bottom panel, and an overlay of the two is in the center panel.

Figure 20 is a fragmentation pattern of 3,5-diacetoxy benzyl alcohol. The peak fragmentation pattern is in the top panel, the compound library fragmentation match is in the bottom panel, and an overlay of the two is in the center panel.

Figure 21 is a fragmentation pattern of β-D-galactopyranose, pentaacetate. The peak fragmentation pattern is in the top panel, the compound library fragmentation match is in the bottom panel, and an overlay of the two is in the center panel.

Figure 22 is a fragmentation pattern of D-mannitol hexaacetate. The peak fragmentation pattern is in the top panel, the compound library fragmentation match is in the bottom panel, and an overlay of the two is in the center panel.

Figure 23 is a fragmentation pattern of galacticol, hexaacetate. The peak

fragmentation pattern is in the top panel, the compound library fragmentation match is in the bottom panel, and an overlay of the two is in the center panel.

Figure 24 is a fragmentation pattern of cyclohexane carboxylic acid, 1,2,4,5-tetrakis(acetoxy), (1α,3α,4α,5β)-(-). The peak fragmentation pattern is in the top panel, the compound library fragmentation match is in the bottom panel, and an overlay of the two is in the center panel.

Figure 25 is a fragmentation pattern of muco-inositol, hexaacetate. The peak fragmentation pattern is in the top panel, the compound library fragmentation match is in the bottom panel, and an overlay of the two is in the center panel.

Figure 26 is a fragmentation pattern of D-glucitol-hexaacetate. The peak fragmentation pattern is in the top panel, the compound library fragmentation match is in the bottom panel, and an overlay of the two is in the center panel.

Figure 27 is a fragmentation pattern of myo-inositol, hexaacetate. The peak fragmentation pattern is in the top panel, the compound library fragmentation match is in the bottom panel, and an overlay of the two is in the center panel.

Figure 28 is an HPLC chromatogram of a 10% ACN extract of raw Organic Yellow potato.

Figure 29 is an HPLC chromatogram of a 10% ACN extract of raw Purple potato.

Figure 30 is an HPLC chromatogram of a 10% ACN extract of raw Idaho Russet potato.

Figure 31 is an HPLC chromatogram of a 10% ACN extract of raw Yukon Gold potato.

Figure 32 is an HPLC chromatogram of a 10% ACN extract of raw sweet potato.

Figure 33 is an HPLC chromatogram of a 10% ACN extract of boiled Purple potato.

Figure 34 is an HPLC chromatogram of two pooled fraction collections from Idaho Russet potatoes.

Figure 35 is an HPLC chromatogram of fractions collections from 3 g of purple potatoes.

Figure 36 is an HPLC chromatogram of media collected from cells exposed to a potosaccharide preparation for 4 hours.

DETAILED DESCRIPTION

The document provides nutritional supplement compositions. For example, this document provides nutritional supplement compositions containing a potato polysaccharide preparation, methods for obtaining potato polysaccharide preparations, methods for making nutritional supplement compositions containing a potato polysaccharide preparation, and methods and materials for increasing or decreasing expression of polypeptides involved with mitochondria activity or function.

The nutritional supplement compositions provided herein can include one or more potato polysaccharide preparations. A potato polysaccharide preparation can be a preparation that is obtained from a water extract of potato and that contains polysaccharide material having the ability to be eluted from a C18 cartridge (e.g., a Sep-Pak Plus C-18 cartridge) with 10% acetonitrile. In some cases, a potato polysaccharide preparation can be a preparation that is obtained from potato and that contains polysaccharide material having HPLC characteristics of that of the peak eluted at 3.5 minutes as described in Example 1 (see, also, Figures 1, 2, and 28-34). In some cases, a polysaccharide of a potato polysaccharide preparation provided herein can be a polar, water-soluble polysaccharide. In some cases, a polysaccharide of a potato polysaccharide preparation provided herein can be a highly substituted complex xyloglucan material.

In some cases, a potato polysaccharide preparation can be a preparation that is obtained from potato and that contains polysaccharide material that, when derivatized, results in at least the following acylated carbohydrates as assessed using GC/MS: (a) myo-inositol (set to 1X to serve as an internal standard), (b) glucose at about 40X to about 60X the myo-inositol content (e.g., glucose at about 50X the myo-inositol content), (c) xylose at about 10X to about 20X the myo-inositol content (e.g., xylose at about 15X the myo-inositol content), (d) mannose at about 5X to about 15X the myo-inositol content (e.g., mannose at about 10X the myo-inositol content), and (e) galactose at about 3X to about 7X the myo-inositol content (e.g., galactose at about 5X the myo-inositol content). The derivatization procedure can include forming a dry residue of the polysaccharide material that is then hydrolyzed using trifluoroacetic acid. The resulting material is then reduced using sodium borohydride, and after borate removal, the end product is acylated using acetic anhydride and pyridine. The end products of the reaction are then injected directly on GC/MS to identify the acylated carbohydrates.

In some cases, a potato polysaccharide preparation can be a preparation that is obtained from potato and that contains polysaccharide material that, when derivatized and assessed using GC/MS, results in at least four major components (3,4-furan dimethanol, diacetate; 1,2,3,4,5-penta-o-acetyl-D-xylitol (isomer 1); 3,5-diacetoxy-benzyl alcohol; and D-glucitol-hexaacetate). See, e.g., Example 1. In some cases, a potato polysaccharide preparation can be a preparation that is obtained from potato and that contains polysaccharide material that, when derivatized and assessed using GC/MS, results in the compounds listed in Table 3 or results in the profile shown in Figure 7.

In some cases, a potato polysaccharide preparation provided herein can be a substantially pure potato polysaccharide preparation. Typically, a substantially pure potato polysaccharide preparation is a preparation that contains a single peak of material (e.g., a single peak of polysaccharide material) when assessed using, for example, HPLC (see, e.g., Figures 2 and 34). In some cases, greater than 60, 70, 75, 80, 85, 90, 95, or 99 percent of a potato polysaccharide preparation provided herein can be polysaccharide material obtained from a potato.

Any appropriate potato species or variety can be used to obtain a potato polysaccharide preparation provided herein. For example, *Solanum tuberosum*, *Ipomoea batatas*, *S. acaule*, *S. bukasovii*, *S. leptophyes*, *S. megistacrolobum*, *S. commersonii*, or *S. infundibuliforme* can be used to obtain a potato polysaccharide preparation provided herein. In some cases, potato varieties of *S. tunerosum* such as Organic Yellow, Purple or blue varieties, Cream of the Crop, Adirondack Blue, Adirondack Red, Agata, Almond, Andes Gold, Andes Sun, Apline, Alturas, Amandine, Annabelle, Anya, Arran Victory, Atlantic, Avalanche, Bamberg, Bannock Russet, Belle de Fontenay, BF-15, Bildtstar, Bintje, Blazer Russet, Blue Congo, Bonnotte, British Queens, Cabritas, Camota, Canela Russet, Cara, Carola, Chelina, Chiloé, Cielo, Clavela Blanca, Désirée, Estima, Fianna, Fingerling, Flava, German Butterball, Gelden Wonder, Goldrush, Home Guard, Innovator, Irish Cobbler, Jersey Royal, Kennebec, Kerr's Pink, Kestrel, Keuka Gold, King Edward, Kipfler, Lady Balfour, Langlade, Linda, Marcy, Marfona, Maris Piper, Marquis, Megachip, Monalisa, Nicola, Pachacoña, Pike, Pink Eye, Pink Fir Apple, Primura, Ranger Russet, Ratte, Record, Red LaSoda, Red Norland, Red Pontiac, Rooster, Russet Burbank, Russet Norkotah, Selma, Shepody, Sieglinde, Silverton Russet, Sirco, Snowden, Spunta, Up to date, Stobrawa, Superior, Vivaldi, Vitelotte, Yellow Finn, or

Yukon Gold can be used to obtain a potato polysaccharide preparation provided herein.

Any appropriate method can be used to obtain a potato polysaccharide preparation provided herein. For example, raw potato material can be homogenized (e.g., homogenized with a Polytron homogenizer) in water and maintained at room temperature for a period of time (e.g., about 1 hour) with occasional shaking. The homogenate can be centrifuged (e.g., centrifuged at 4000 g for 10 minutes) to remove any larger solid material. The resulting supernatant can be loaded onto a Solid Phase Extraction cartridge (e.g., a C18 cartridge such as a Sep-Pak Plus C-18 cartridge), and the polysaccharide material eluted with 10 percent acetonitrile. Once eluted, the polysaccharide material can be dried and stored (e.g., stored at about 4°C).

This document also provides nutritional supplement compositions containing one or more potato polysaccharide preparations provided herein. For example, a potato polysaccharide preparation provided herein obtained from Idaho Russet potatoes can be formulated into a nutritional supplement composition. Any appropriate dose of a potato polysaccharide preparation provided herein can be used to formulate a nutritional supplement composition. For example, a potato polysaccharide preparation provided herein can be used to formulate a nutritional supplement composition such that the nutritional supplement composition contains between about 1 mg and about 750 mg (e.g., between about 1 mg and about 500 mg, between about 1 mg and about 250 mg, between about 5 mg and about 40 mg, between about 5 mg and about 30 mg, between about 5 mg and about 20 mg, between about 6 mg and about 50 mg, between about 6 mg and about 20 mg, between about 10 mg and about 25 mg, or between about 15 mg and about 20 mg) of the potato polysaccharide component of the potato polysaccharide preparation. In some case, a nutritional supplement composition can be formulated to deliver about 0.05 mg of the potato polysaccharide component per kg of body weight to about 0.5 mg of the potato polysaccharide component per kg of body weight to a mammal (e.g., a human) per day. For example, such nutritional supplement compositions can be formulated into a single oral composition that a human can swallow once a day to provide between about 0.05 mg of the potato polysaccharide component per kg of body weight to about 0.5 mg of the potato polysaccharide component per kg of body weight.

Any appropriate method can be used to formulate a nutritional supplement composition provided herein. For example, common formulation mixing and

preparation techniques can be used to make a nutritional supplement composition having the components described herein. In addition, a nutritional supplement composition provided herein can be in any form. For example, a nutritional supplement composition provided herein can be formulated into a pill, capsule, tablet, gelcap, nutritional shake, nutritional bar, rectal supository, sublingual suppository, nasal spray, inhalant, or injectable ampule. A nutritional supplement composition provided herein can include one or more potato polysaccharide preparations provided herein alone or in combination with other ingredients including, without limitation, gelatin, cellulose, starch, sugar, bentonite, lactic acid, mannitol, alpha lipoic acid, alpha tocopherol, L-ascorbate, or combinations thereof.

This document also provides methods for increasing or decreasing expression of polypeptides involved with mitochondria activity or function. For example, a potato polysaccharide preparation provided herein or a nutritional supplement composition provided herein can be used to increase or decrease expression of polypeptides involved with mitochondria activity or function. In some cases, a potato polysaccharide preparation provided herein or a nutritional supplement composition provided herein can be used to increase expression of a TFAM polypeptide, an ATP5A1 polypeptide, a PDHA1 polypeptide, a PDHA2 polypeptide, a THOP1 polypeptide, or a combination thereof. In some cases, a potato polysaccharide preparation provided herein or a nutritional supplement composition provided herein can be used to decrease expression of a FOX01A polypeptide, a NFKB1 polypeptide, a PDK2 polypeptide, a PDK4 polypeptide, a HMGCR polypeptide, or a combination thereof. In some case, a potato polysaccharide preparation provided herein or a nutritional supplement composition provided herein can be used to increase one or more polypeptides (e.g., one or more of a TFAM polypeptide, an ATP5A1 polypeptide, a PDHA1 polypeptide, a PDHA2 polypeptide, or a THOP1 polypeptide) and decrease one or more polypeptides (e.g., one or more of a FOX01A polypeptide, a NFKB1 polypeptide, a PDK2 polypeptide, a PDK4 polypeptide, or a HMGCR polypeptide).

In humans, a potato polysaccharide preparation provided herein or a nutritional supplement composition provided herein can be used to increase one or more human polypeptides (e.g., one or more of a human TFAM polypeptide, a human ATP5A1 polypeptide, a human PDHA1 polypeptide, a human PDHA2 polypeptide, a human THOP1 polypeptide, a human LIPE polypeptide (in adipocytes), a human

PCK2 polypeptide, a human MOGAT1 polypeptide, a human PPARGC1a polypeptide, a vPPARGC1b polypeptide, an human SOD2 polypeptide, a human NR4A1 polypeptide (in adipocytes), a human ACAT2 polypeptide, or a human HMGCR polypeptide (in muscle cells)) and/or decrease one or more human polypeptides (e.g., one or more of a human FOX01A polypeptide, a human NFKB1 polypeptide, a human PDK2 polypeptide, a human PDK4 polypeptide, a human HMGCR polypeptide (in adipocytes), a human AGPAT1 polypeptide, a human OLR1 polypeptide, a human BCAT2 polypeptide, a human SH2B1 polypeptide, a human LPL polypeptide, a human HMGCR polypeptide (in adipocytes), a human LIPE polypeptide (in muscle cells), a human NR4A1 polypeptide (in muscle cells), a human PTEN polypeptide, or a human CASP8 polypeptide).

A human TFAM polypeptide can have the amino acid sequence set forth in GenBank® Accession No. CAG28581.1 (GI No. 47115243) and can be encoded by the nucleic acid sequence set forth in GenBank® Accession No. NM_003201.1 (GI No. 4507400). A human ATP5A1 polypeptide can have the amino acid sequence set forth in GenBank® Accession No.AAH08028.2 (GI No. 34782901) and can be encoded by the nucleic acid sequence set forth in GenBank® Accession No.NM_001001937.1 (GI No. 50345983). A human PDHA1 polypeptide can have the amino acid sequence set forth in GenBank® Accession No. ABQ58815.1 (GI No. 148300624) and can be encoded by the nucleic acid sequence set forth in GenBank® Accession No. NM_001173454.1 (GI No. 291084741). A human PDHA2 polypeptide can have the amino acid sequence set forth in GenBank® Accession No. AAH94760.1 (GI No. 66267554) and can be encoded by the nucleic acid sequence set forth in GenBank® Accession No. NM_005390.4 (GI No. 134031963). A human THOP1 polypeptide can have the amino acid sequence set forth in GenBank® Accession No. AAH00583.2 (GI No. 38014202) and can be encoded by the nucleic acid sequence set forth in GenBank® Accession No. NM_003249.3 (GI No. 34222291). A human LIPE polypeptide can have the amino acid sequence set forth in GenBank® Accession No. AAH70041.1 (GI No. 47124456) and can be encoded by the nucleic acid sequence set forth in GenBank® Accession No. NM_005357.2 (GI No. 21328445). A human PCK2 polypeptide can have the amino acid sequence set forth in GenBank® Accession No. CAG33194.1 (GI No. 48145943) and can be encoded by the nucleic acid sequence set forth in GenBank® Accession No. NM_004563.1 (GI No. 66346720). A human MOGAT1 polypeptide can have the

amino acid sequence set forth in GenBank® Accession No. NP_477513.2 (GI No. 148746191) and can be encoded by the nucleic acid sequence set forth in GenBank® Accession No. NM_058165.1 (GI No. 148746190). A human PPARGC1a polypeptide can have the amino acid sequence set forth in GenBank® Accession No. NP_037393.1 (GI No. 7019499) and can be encoded by the nucleic acid sequence set forth in GenBank® Accession No. NM_013261.2 (GI No. 116284374). A human PPARGC1b polypeptide can have the amino acid sequence set forth in GenBank® Accession No. AAI44252.1 (GI No. 219518198) and can be encoded by the nucleic acid sequence set forth in GenBank® Accession No. NM_133263.2 (GI No. 289577087). A human SOD2 polypeptide can have the amino acid sequence set forth in GenBank® Accession No. AAH16934.1 (GI No. 16877367) and can be encoded by the nucleic acid sequence set forth in GenBank® Accession No. NM_000636.1 (GI No. 67782304). A human NR4A1 polypeptide can have the amino acid sequence set forth in GenBank® Accession No. CAG32985.1 (GI No. 48145525) and can be encoded by the nucleic acid sequence set forth in GenBank® Accession No. NM_173158.1 (GI No. 320202954). A human ACAT2 polypeptide can have the amino acid sequence set forth in GenBank® Accession No. AAH00408.1 (GI No. 12653279) and can be encoded by the nucleic acid sequence set forth in GenBank® Accession No. NM_005891.1 (GI No. 148539871). A human FOX01A polypeptide can have the amino acid sequence set forth in GenBank® Accession No. NP_002006.2 (GI No. 9257222) and can be encoded by the nucleic acid sequence set forth in GenBank® Accession No. NM_002015.3 (GI No. 133930787). A human NFKB1 polypeptide can have the amino acid sequence set forth in GenBank® Accession No. CAB94757.1 (GI No. 8574070) and can be encoded by the nucleic acid sequence set forth in GenBank® Accession No. NM_001165412.1 (GI No. 25955301). A human PDK2 polypeptide can have the amino acid sequence set forth in GenBank® Accession No. NP_002602.2 (GI No. 19923736) and can be encoded by the nucleic acid sequence set forth in GenBank® Accession No. NM_00211.4 (GI No. 315630394). A human PDK4 polypeptide can have the amino acid sequence set forth in GenBank® Accession No. AAH40239.1 (GI No. 25955471) and can be encoded by the nucleic acid sequence set forth in GenBank® Accession No. NM_002612.2 (GI No. 94421466). A human HMGCR polypeptide can have the amino acid sequence set forth in GenBank® Accession No. AAH33692.1 (GI No.21707182) and can be encoded by the nucleic acid sequence set forth in GenBank® Accession No.

NM_000859.2 (GI No. 196049378). A human AGPAT1 polypeptide can have the amino acid sequence set forth in GenBank® Accession No. NP_116130.2 (GI No. 15100175) and can be encoded by the nucleic acid sequence set forth in GenBank® Accession No. NM_006411.3 (GI No. 301336168). A human OLR1 polypeptide can have the amino acid sequence set forth in GenBank® Accession No. NP_002534.1 (GI No. 4505501) and can be encoded by the nucleic acid sequence set forth in GenBank® Accession No. NM_002543.2 (GI No. 119392084). A human BCAT2 polypeptide can have the amino acid sequence set forth in GenBank® Accession No. AAH04243.2 (GI No. 48257075) and can be encoded by the nucleic acid sequence set forth in GenBank® Accession No. NM_001190.1 (GI No. 258614013). A human SH2B1 polypeptide can have the amino acid sequence set forth in GenBank® Accession No. AAH10704.1 (GI No. 14715079) and can be encoded by the nucleic acid sequence set forth in GenBank® Accession No. NM_001145797.1 (GI No. 224926829). A human LPL polypeptide can have the amino acid sequence set forth in GenBank® Accession No. CAG33335.1 (GI No. 4814622) and can be encoded by the nucleic acid sequence set forth in GenBank® Accession No. NM_000237.1 (GI No. 145275217). A human HMGCR polypeptide can have the amino acid sequence set forth in GenBank® Accession No. AAH33692.1 (GI No. 21707182) and can be encoded by the nucleic acid sequence set forth in GenBank® Accession No. NM_001130996.1 (GI No. 196049379). A human PTEN polypeptide can have the amino acid sequence set forth in GenBank® Accession No. AAD13528.1 (GI No. 4240387) and can be encoded by the nucleic acid sequence set forth in GenBank® Accession No. NM_000314.2 (GI No. 110224474). A human CASP8 polypeptide can have the amino acid sequence set forth in GenBank® Accession No. AAH68050.1 (GI No. 45751586) and can be encoded by the nucleic acid sequence set forth in GenBank® Accession No. NM_001228.4 (GI No. 122056470).

The potato polysaccharide preparations provided herein or nutritional supplement compositions provided herein can be administered to any mammal (e.g., rat, mouse, dog, cat, horse, cow, goat, pig, chicken, duck, rabbit, sheep, monkey, or human). In addition, any route of administration (e.g., oral or parenteral administration) can be used to administer a potato polysaccharide preparation provided herein or a nutritional supplement composition provided herein to a mammal. For example, a potato polysaccharide preparation provided herein or a nutritional supplement composition provided herein can be administered orally.

The document will provide addition description in the following examples, which do not limit the scope of the invention described in the claims.

EXAMPLES

Example 1 – Identification of a potato polysaccharide preparation having the ability to alter expression of polypeptides involved with mitochondria activity and function

6 grams of a Russet potato variety of the *Solanum tuberosum* species were homogenized with a Polytron homogenizer in 20 mL water in a 50 mL centrifuge tube and kept at room temperature for 1 hour. The homogenate was centrifuged at 4000 rpm for 10 minutes. A Sep-Pak Plus C-18 cartridge was activated with 10 mL 100% acetonitrile (ACN) and washed with 10 mL 0.05% trifluoroacetic acid in water (TFA water). 10 mL of the supernatant was loaded onto the cartridge, and all H_2O that passes through cartridge was collected in 1.5 mL Eppendorf tubes. Next, 10 mL of 2% ACN (in 0.05%TFA water) was passed through the column, and the elutriate was collected in 1.5 mL Eppendorf tubes. Next, 10 mL of 5% ACN (in 0.05%TFA water) was used to wash the column, and the elutriate was collected in 1.5 mL Eppendorf tubes. Finally, 10 mL of 10% ACN (in 0.05% TFA water) was collected in 1.5 mL Eppendorf tubes after passing through the column. All of the fractions were dried, and the dried fractions of the same ACN concentration were reconstituted into 1 tube in 1 mL of 0.05% TFA water for further purification via HPLC or reconstituted in 1 mL of phosphate buffered saline for use in cell treatments.

A Waters 2695 separations module with a photodiode array detector was used to purify the 10% ACN extract. An XterraRP C18 column (4.6 X 150 mm) was used for the separation with 0.05% TFA water as the mobile phase. Each HPLC run was a 20 minute gradient ranging from 0 to 2.5% ACN. The injection volume was 100 µL, and the flow rate was 0.5 mL/minute. HPLC fractionation of the 10% ACN extract yielded three major UV absorbing peaks eluted at 3.5, 3.9, and 12.1 minutes (Figure 1). Collection and HPLC re-purification of the 3.5 minute fraction yielded a symmetrical peak displaying a maximum absorbance at 198.3 nm (Figure 2).

The three peaks were evaluated to determine whether or not they obtained material having the ability to alter the expression levels of polypeptides involved in mitochondria activity and function. Briefly, 5×10^5 neuroblastoma cells obtained from American Type Culture Collection (ATCC) were plated into each well of 6-well plates with 2 mL of RPMI media and incubated for 4 hours in the presence or absence

of different aliquots of the HPLC purified material. Following the incubation, total RNA was isolated and purified using the RNeasy mini kit (Qiagen, Valencia, CA). In particular, pelleted cells were resuspended in 600 µL of RLT lysis buffer (Qiagen) and homogenized by passing the lysate 20 times through a 1 mL pipette tip. The samples were then processed according to the manufacturer's instructions (Qiagen, Valencia, Ca). In the final step, the RNA was eluted with 40 µL of RNase-free water by centrifugation for 1 minute at 13,000g. The RNA was analyzed on a model 2100 bioanalyzer (Agilent, Santa Clara, CA) using a total RNA nanochip according to the manufacturer's protocol. Afterwards, 2 µg of total RNA was reverse transcribed using Superscript III reverse transcriptase and random primers.

DNA microarray analyses also were performed using a system provided by Agilent. Arrays included four arrays per chip (Agilent 4X44K chips). Total RNA was reverse transcribed (400 ng) using T7 primers and labeled and transcribed using Cyanine-3 dye. Each array was hybridized with at least 1.65 µg of labeled cRNA at 65°C for 18 hours. Arrays were scanned using an Agilent array scanner. A 10% or greater change in gene expression was capable of being determined using both microarray platforms.

Incubation of cultured cells with the HPLC purified fraction eluted at 3.5 minutes produced changes in the expression of mitochondrial and cellular metabolic genes (Table 1). The extracted potato material that eluted at 3.5 minutes is referred to herein as potosaccharide material or a potosaccharide preparation since it was determined to a polysaccharide as indicated below. The 3.5 minute fraction (a potosaccharide preparation) was the only fraction of the three determined to possess significant biological activity when tested using real time PCR for TFAM, NFKB, and HMGCR expression.

Table 1. Gene expression changes in HTB-11 cells as determined by microarray following a four-hour incubation with a potosaccharide preparation.

Gene symbol	Gene name	% change
TFAM	transcription factor A, mitochondrial	+15
FOX01A	forkhead box O1	-28
NFKB1	nuclear factor of kappa light polypeptide gene enhancer in B-cells 1	-14
ATP5A1	ATP synthase, H+ transporting, mitochondrial F1 complex, alpha subunit 1	+30
PDHA1	pyruvate dehydrogenase (lipoamide) alpha 1	+8

PDHA2	pyruvate dehydrogenase (lipoamide) alpha 2	+41
PDK2	pyruvate dehydrogenase kinase, isozyme 2	-24
PDK4	pyruvate dehydrogenase kinase, isozyme 4	-41
HMGCR	3-hydroxy-3-methylglutaryl-CoA reductase	-18
THOP1	thimet oligopeptidase 1	+23

Real-time PCR was performed in triplicate with TFAM, HMGCR, and NFKB1 detector sets. Beta-actin or GAPDH was used as a reference gene. The real-time PCR master mix included 25 µL 2x universal master mix, 2.5 µL 20x detector set (with the primer and probe), and 21.5 µL of water. PCR was performed in an Applied Biosystems 7500 sequence detection system. The thermocycler conditions included denaturation at 95°C for 15 seconds and annealing/extension at 60°C for 60 seconds. Forty cycles of PCR were preceded by 95°C for 10 minutes. Reactions were performed in triplicate. The relative quantities of TFAM were found using the formula $2^{-\Delta\Delta Ct}$ using the Applied Biosystems 7500 software. Validation of some of the microarray results by real time PCR used TFAM, HMGCR, and NFKB1 as candidate genes. A representative real time PCR amplification plot demonstrated that TFAM mRNA was present and was differentially expressed (Figure 3). The potosaccharide preparation had a profound effect on TFAM expression and was able to upregulate it by 57% (Table 2). Both HMGCR and NFKB1 gene expression were reduced by approximately 20%, consistent with and validating the DNA microarray data (Table 2).

Table 2. Validation of gene expression changes by real time PCR. HTB-11 cells treated for 4 hours with a potosaccharide preparation.

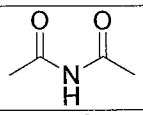
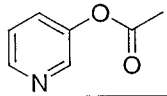
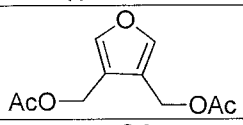
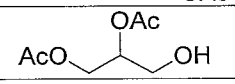
Gene Symbol	% change
TFAM	+57 ± 9
NFKB1	-20 ± 5
HMGCR	-19 ± 4

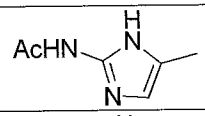
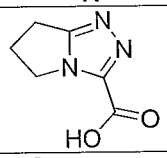
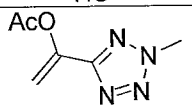
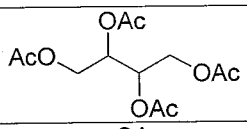
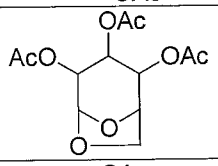
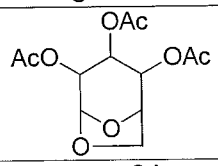
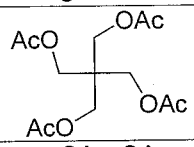
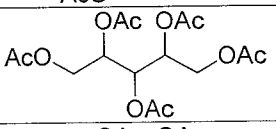
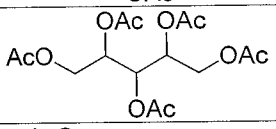
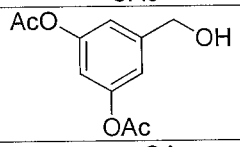
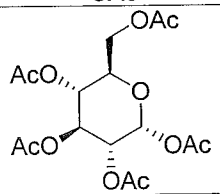
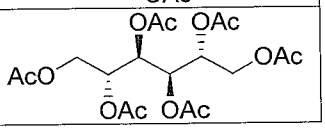
Further chemical characterization of the symmetrical 3.5 minute HPLC peak material was performed. Pooled 3.5 minute HPLC fractions were dried and reconstituted in 1 mL TFA water and subjected to tandem LC/MS/MS (Figure 4) and NMR chemical analyses (Figures 5 and 6). For the NMR analysis, ^{1}H-NMR was run on the sample using deuterium oxide (D_2O) as a solvent to further analyze the sample. The water peak at 4.65 PPM was solvent-suppressed, and the spectrum was acquired for several hours. Acetamide was detected at 3.2 PPM, along with acetonitrile at 1.9 PPM. Minor peaks were detected at 1.05 PPM, 1.17 PPM (broad peak), 1.189 PPM,

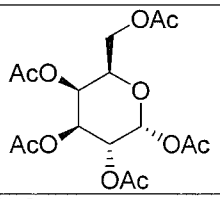
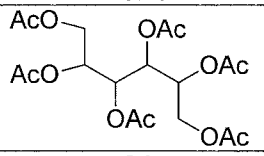
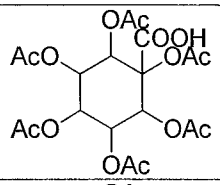
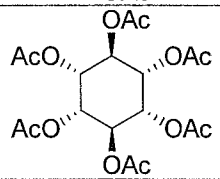
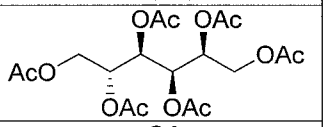
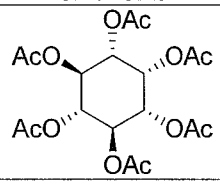
and 1.864 PPM. One characteristic of polymeric materials in a proton NMR was the broadening of peaks such as the shift at 1.17 PPM. These shifts on the NMR could represent the peak at 4.8 PPM and suggested a polar, water-soluble polymer such as a polysaccharide. Taken together, these results confirmed the presence of high molecular weight polysaccharide material contained in HPLC purified fractions eluting at 3.5 minutes.

Further analysis confirmed that the HPLC purified fraction eluting at 3.5 minutes contains polysaccharide material (e.g., highly substituted complex xyloglucan material). To make the polysaccharide material analyzable by gas chromatography/mass spectroscopy (GC/MS), it was converted into its derivatized carbohydrate fragments. Briefly, the sample was concentrated to a dry residue that was hydrolyzed using trifluoroacetic acid. This was then reduced using sodium borohydride, and after borate removal, the end product was acylated using acetic anhydride and pyridine. The end products of the reaction were injected directly on GC/MS to identify any acylated carbohydrates. Based on the end analysis, a larger carbohydrate existed in the sample. The total ion chromatogram (TIC) is shown below in Figure 7 with appropriate peak labels below in Table 3. The major components identified are indicated in bold (peaks 3, 12, 14, and 21). The corresponding fragmentation for each compound is provided in Figures 8-27. For each fragmentation, the peak fragmentation pattern is on the top, the compound library fragmentation match is on the bottom, and an overlay of the two is in the center. Finally, unlabeled peaks were either column bleed or did not have a sufficient match to the compound library.

Table 3: Summary of GC/MS results.

Peak	Retention Time (min)	Compound Name	Structure
1	10.731	Diacetamide	
2	13.669	3-Acetoxy pyridine	
3	**19.568**	**3,4-Furan dimethanol, diacetate**	
4	19.950	1,2,3-propanetriol diacetate	

5	23.387	Imidazole, 2-acetamino-5-methyl	
6	23.499	6,7-dihydro-5H-pyrrol[2,1,c][1,2,4] triazole-3-carboxylic acid	
7	24.304	Acetic acid, 1-(2-methyltetrazol-5-yl) ethenyl ester	
8	25.538	1,2,3,4-butanetriol, tetraacetate	
9	27.412	(1,5)β(1,3)triacetyl D-galactosan (stereoisomer 1)	
10	28.188	(1,5)β(1,3)triacetyl D-galactosan (stereoisomer 2)	
11	29.210	Pentaerythritol tetraacetate	
12	**29.727**	**1,2,3,4,5-penta-o-acetyl-D-xylitol (isomer 1)**	
13	30.697	1,2,345-penta-o-acetyl-D-xylitol (isomer 2)	
14	**32.477**	**3,5-diacetoxy-benzyl alcohol**	
15	32.677	β-D-glucopyranose, pentaacetate	
16	33.012	D-mannitol hexaacetate	

17	33.106	β-D-galactopyranose, pentaacetate	
18	33.206	Galacticol, hexaacetate	
19	33.364	Cyclohexane carboxylic acid, 1,2,45-tetrakis(acetoxy), (1α,3α,4α,5β)-(-)	
20	33.582	Muco-inositol, hexaacetate	
21	**33.006**	**D-glucitol-hexaacetate**	
22	34.463	Myo-inositol, hexaacetate	

These results demonstrate the presence of sugar monomers that serve as building blocks for a larger carbohydrate. It appeared from these multiple lines of analysis that the potosaccharide preparation is a highly substituted complex xyloglucan.

Example 2 – Sweet potatoes and multiple varieties of potatoes exhibit the presence of potosaccharide material

Six grams of potato material from multiple varieties of *Solanum tuberosum* (Organic yellow, Purple, Idaho Russet, and Yukon Gold) and six grams of material from sweet potatoes (*Ipomoea batatas*) were extracted in 20 mL of water. 10 mL of that water was then loaded onto a sep-pak cartridge, and the cartridge was then eluted with 10 mL of 10% ACN. The ACN was then dried, and the residue was dissolved in 1 mL of water. A 100 µL injection of this water was assessed using HPLC.

The HPLC chromatograms demonstrated that the amount of the first peak (at 3.5 minutes at 210 nm) was the same for all five types of potatoes tested (Figures 28-32).

In another experiment, material was extracted from a boiled Purple potato and analyzed. The peak at 3.5 minutes was not reduced in the boiled potato (Figure 33).

The 3.5 minute peak from two pooled fraction collections from Idaho Russet potatoes was collected, dried, and reconstituted in 100 µL of water. The material was then injected into the HPLC yielding a single peak at 3.5 minutes (Figure 34). Taken together, these results demonstrate that potatoes within the *Solanum tuberosum* and *Ipomoea batatas* species contain potosaccharide material.

Example 3 – Highly substituted complex xyloglucan from potato material alters expression of polypeptides in human omental apidocytes obtained from diabetic patients

Human omental apidocytes obtained from normal and diabetic patients were purchased from Zen-Bio, Inc (Research Triangle Park, NC). The cells were either untreated or treated with 62.5 µg/mL of the 3.5 minute peak from purple potatoes for four hours. After the four hour incubations, the cells were harvested, and a microarray analysis was performed to measure changes in gene expression.

Incubation of human omental apidocytes from diabetic patients with the HPLC purified fraction eluted at 3.5 minutes produced changes in the expression of genes involved in obesity and/or diabetes (Table 4). Incubation of human omental apidocytes from normal humans produced minimal changes in the expression of the genes listed in Table 4 (Table 5).

Table 4. Gene expression changes as determined by microarray following a four-hour incubation of human omental apidocytes from diabetic patients with a potosaccharide preparation.

Gene symbol	% change
AGPAT1	-1
OLR1	-45
BCAT2	-9
NFKB1	-6
SH2B1	-17
LPL	-24
HMGCR	-9
LIPE	+15

PCK2	+5
MOGAT1	+52
PPARGC1a	+59
PPARGC1b	+44
SOD2	+18
NR4A1	+12
ACAT2	+13

Table 5. Gene expression changes as determined by microarray following a four-hour incubation of human omental apidocytes from normal humans with a potosaccharide preparation.

Gene symbol	% change
AGPAT1	None detected
OLR1	-18
BCAT2	None detected
NFKB1	-56
SH2B1	-33
LPL	+18
HMGCR	+16
LIPE	+32
PCK2	+30
MOGAT1	+22
PPARGC1a	+26
PPARGC1b	+26
SOD2	+23
NR4A1	+45
ACAT2	+17

Real-time PCR was performed in triplicate with AGPAT1, OLR1, BCAT2, NR4A1, and ACAT2 detector sets. Beta-actin or GAPDH was used as a reference gene. The real-time PCR master mix included 25 μL 2x universal master mix, 2.5 μL 20x detector set (with the primer and probe), and 21.5 μL of water. PCR was performed in an Applied Biosystems 7500 sequence detection system. The thermocycler conditions included denaturation at 95°C for 15 seconds and annealing/extension at 60°C for 60 seconds. Forty cycles of PCR were preceded by 95°C for 10 minutes. Reactions were performed in triplicate. Validation of some of the microarray results by real time PCR used AGPAT1, OLR1, BCAT2, NR4A1, and ACAT2 as candidate genes. Real time PCR amplification plots demonstrated that AGPAT1, OLR1, BCAT2, NR4A1, and ACAT2 mRNAs were present and were differentially expressed (Table 6).

Table 6. Validation of gene expression changes by real time PCR. Human omental apidocytes from diabetic patients treated for 4 hours with a potosaccharide preparation.

Gene Symbol	% change
AGPAT1	-13 ± 1
OLR1	-9 ± 1
BCAT2	-4 ± 1
NR4A1	+34 ± 3
ACAT2	+12 ± 2

Example 4 – Highly substituted complex xyloglucan from potato material alters expression of polypeptides in mouse myocytes

Mouse myoblasts were seeded in 2 mL aliquots into two 75 cm^2 tissue culture flasks. Cells were left to differentiate into myocytes for 4 days in 5% CO_2 at 37 °C.

Myocytes were detached from flask walls using gentle agitation. Suspended cells were transferred to a 15mL conical tube and centrifuged at 500g for 3 minutes. 2 mL aliquots were seeded into 75 cm^2 tissue culture flasks for both control and diabetic model cells. The mouse cells were obtained from normal mice and from mice treated with low dose alloxan. The diabetic mice had high blood glucose compared to the normal mice. A potosaccharide preparation (62.5 µg/mL of the 3.5 minute peak from purple potatoes) was added to one control and one diabetic flask, and the cells were incubated for 24 hours.

After the 24 hour incubation, the cells were harvested, and a microarray analysis was performed to measure changes in gene expression. In addition, images were taken of the cells after treatment using a Nikon EclipseTE300 (Morell) inverted microscope coupled with an Optronics digital cameraware at 20x. The images were analyzed on ImageJ software for cell mortality and fiber size. Cell mortality was calculated using a ratio of the number of inactive cells to the number of active cells. Fiber size was calculated using a polygonal lasso tracer and measured in pixel area.

Incubation of mouse myocytes from the diabetic model with the HPLC purified fraction eluted at 3.5 minutes produced changes in the expression of genes involved in obesity and/or diabetes (Table 7). Incubation of mouse myocytes from normal mice produced minimal changes in the expression of the genes listed in Table 7 (Table 8).

Table 7. Gene expression changes as determined by microarray following a 24-hour incubation of mouse myocytes from the diabetic model with a potosaccharide preparation.

Gene symbol	% change
NFKB1	-46
SH2B1	-35
LPL	-16
HMGCR	+25
LIPE	-46
PCK2	none
SOD2	+74
NR4A1	-33
ACAT2	none
PTEN	-22
CASP8	not detected

Table 8. Gene expression changes as determined by microarray following a 24-hour incubation of mouse myocytes from normal mice with a potosaccharide preparation.

Gene symbol	% change
NFKB1	37
SH2B1	202
LPL	139
HMGCR	105
LIPE	147
PCK2	118
SOD2	None detected
NR4A1	200
ACAT2	75
PTEN	96
CASP8	104

Real-time PCR was performed in triplicate with PTEN and CASP8 detector sets. Beta-actin or GAPDH was used as a reference gene. The real-time PCR master mix included 25 µL 2x universal master mix, 2.5 µL 20x detector set (with the primer and probe), and 21.5 µL of water. PCR was performed in an Applied Biosystems 7500 sequence detection system. The thermocycler conditions included denaturation at 95°C for 15 seconds and annealing/extension at 60°C for 60 seconds. Forty cycles of PCR were preceded by 95°C for 10 minutes. Reactions were performed in triplicate. Validation of some of the microarray results by real time PCR used PTEN and CASP8 as candidate genes. Real time PCR amplification plots demonstrated that PTEN and CASP8 mRNAs were present and were differentially expressed (Table 9).

Table 9. Validation of gene expression changes by real time PCR. Mouse myocytes from the diabetic model treated for 24 hours with a potosaccharide preparation.

Gene Symbol	% change
PTEN	-31 ± 4
CASP8	-72 ± 8

Example 5 – Analysis of a potosaccharide preparation

A potosaccharide preparation was purified using HPLC from 3 g of purple potato. The potosaccharide peak was eluted at about 5 minutes (Figure 35). This peak was obtained using a different chromatographic column (10 mm x150 mm) as compared to the column used to obtain the 3.5 minute peak. Since the column was a larger preparative column and the flow rate was 1.5 mL/minute, the elution time of the potosaccharide was 5 minutes.

The obtained peak was collected, dried, and reconstituted in 60 µL of water. The reconstituted potosaccharide material was then added to HTB-11 cells in culture flasks for 4 hours. The post treatment media was collected and added to another flask of HTB-11 cells. Each group of cells was analyzed for gene expression changes. The initially treated cells exhibited the expected changes in mitochondrial gene expression. No changes were detected in the cells exposed to the post treatment media for 4 hours.

In a separate experiment, the post treatment media was extracted using the techniques used to originally purify the potosaccharide. A chromatogram of the extracted post treatment media demonstrated the absence of a peak at 5 minutes.

Example 6 – Using a potosaccharide preparation to treat obesity

Class I-III obese humans are identified based on the criteria of Table 10.

Table 10. Classification of Overweight and Obesity by BMI, Waist Circumference, and Associated Disease Risks.

			Disease Risk* Relative to Normal Weight and Waist Circumference	
	BMI (kg/m^2)	**Obesity Class**	**Men 102 cm (40 in) or less Women 88 cm (35 in) or less**	**Men > 102 cm (40 in) Women > 88 cm (35 in)**
Underweight	< 18.5		-	-

Normal	18.5–24.9		-	-
Overweight	25.0–29.9		Increased	High
Obesity	30.0–34.9	I	High	Very High
	35.0–39.9	II	Very High	Very High
Extreme Obesity	40.0 +	III	Extremely High	Extremely High

Once identified, a Class I-III obese patient is treated as follows. Potosaccharide is formulated in the presence of alpha lipoic acid or alpha tocopherol or both. Formulated potosaccharide is added to 90% by weight inert binder material and is administered by the oral parenteral route in the form of a tablet, capsule, or liquid, twice daily (bid). Maximal concentrations of potosaccharide are initially administered bid over the course of one month. Positive outcome measures include: (1) significant reduction of BMI, (2) augmentation of serum LDL/HDL ratio, (3) lowering serum triglyceride concentration, (4) lowering systolic and diastolic blood pressure, and (5) lowering fasting blood glucose.

Example 7 – Using a potosaccharide preparation to treat type II diabetes

Once a type II diabetes patient is identified, the patient is treated as follows. Potosaccharide is formulated in the presence of alpha lipoic acid or alpha tocopherol or both. Formulated potosaccharide is added to 90% by weight inert binder material and is administered by the oral parenteral route in the form of a tablet, capsule, or liquid, twice daily (bid). Maximal concentrations of potosaccharide are initially administered bid over the course of one month. Positive outcome measures include: (1) restoration of normal fasting blood glucose, (2) significant weight loss and lowering of BMI, (3) augmentation of serum LDL/HDL ratio, (4) lowering serum triglyceride concentration, (5) lowering serum concentration of free fatty acids, (6) lowering systolic and diastolic blood pressure, (7) enhancement of insulin sensitivity, and (8) lowering insulin requirement in Type II diabetes patients.

Example 8 – Using a potosaccharide preparation to treat a polycystic ovary syndrome

Once a polycystic ovary syndrome (POS) patient is identified, the patient is treated as follows. Potosaccharide is formulated in the presence of alpha lipoic acid or alpha tocopherol or both. Formulated potosaccharide is added to 90% by weight inert binder material and is administered by the oral parenteral route in the form of a tablet, capsule, or liquid, twice daily (bid). Maximal concentrations of potosaccharide are initially administered bid over the course of one month. Positive outcome measures include: (1) restoration of normal reproductive function, (2) restoration of normal ovarian follicle maturation, (3) restoration of normal fasting blood glucose levels, (4) significant weight loss and lowering of BMI, (5) augmentation of serum LDL/HDL ratio, (6) lowering serum triglyceride concentration, (7) lowering serum concentration of free fatty acids, (8) lowering systolic and diastolic blood pressure, (9) enhancement of insulin sensitivity, and (10) lowering insulin requirement in comorbid POS patients with type II diabetes.

OTHER EMBODIMENTS

It is to be understood that while the invention has been described in conjunction with the detailed description thereof, the foregoing description is intended to illustrate and not limit the scope of the invention, which is defined by the scope of the appended claims. Other aspects, advantages, and modifications are within the scope of the following claims.

WHAT IS CLAIMED IS:

1. A nutritional supplement composition comprising a potato polysaccharide preparation in an amount that, when administered to a mammal, results in between 0.05 mg and 50 mg of the potato polysaccharide component of said potato polysaccharide preparation being administered to said mammal per kg of body weight of said mammal.

2. The composition of claim 1, wherein said composition comprises between 1 mg and 100 mg of said potato polysaccharide preparation.

3. The composition of claim 1, wherein said composition comprises between 6 mg and 20 mg of said potato polysaccharide preparation.

4. The composition of claim 1, wherein said composition comprises between 1 mg and 100 mg of the potato polysaccharide component of said potato polysaccharide preparation.

5. The composition of claim 1, wherein said composition comprises between 6 mg and 20 mg of the potato polysaccharide component of said potato polysaccharide preparation.

6. The composition of claim 1, wherein said composition is in the form of a tablet.

7. The composition of claim 1, wherein said composition comprises alpha lipoic acid.

8. The composition of claim 1, wherein said composition comprises alpha tocopherol.

9. The composition of claim 1, wherein said potato polysaccharide preparation is a preparation obtained from raw potatoes.

10. The composition of claim 1, wherein said potato polysaccharide preparation is in an amount that, when administered to a mammal, results in between 0.075 mg and 0.5 mg of the potato polysaccharide component of said potato polysaccharide preparation being administered to said mammal per kg of body weight of said mammal.

11. The composition of claim 1, wherein at least about 80 percent of said potato polysaccharide preparation is potato polysaccharide.

12. The composition of claim 1, wherein at least about 90 percent of said potato polysaccharide preparation is potato polysaccharide.

13. The composition of claim 1, wherein at least about 95 percent of said potato polysaccharide preparation is potato polysaccharide.

14. The composition of claim 1, wherein said mammal is a human.

15. A nutritional supplement composition comprising a potato polysaccharide preparation obtained from raw potatoes.

16. The composition of claim 15, wherein said composition comprises between 1 mg and 100 mg of said potato polysaccharide preparation.

17. The composition of claim 15, wherein said composition comprises between 6 mg and 20 mg of said potato polysaccharide preparation.

18. The composition of claim 15, wherein said composition comprises between 1 mg and 100 mg of the potato polysaccharide component of said potato polysaccharide preparation.

19. The composition of claim 15, wherein said composition comprises between 6 mg and 20 mg of the potato polysaccharide component of said potato polysaccharide preparation.

20. The composition of claim 15, wherein said composition is in the form of a tablet.

21. The composition of claim 15, wherein said composition comprises alpha lipoic acid.

22. The composition of claim 15, wherein said composition comprises alpha tocopherol.

23. The composition of claim 15, wherein said potato polysaccharide preparation is in an amount that, when administered to a mammal, results in between 0.05 mg and 0.5 mg of the potato polysaccharide component of said potato polysaccharide preparation being administered to said mammal per kg of body weight of said mammal.

24. The composition of claim 15, wherein said potato polysaccharide preparation is in an amount that, when administered to a mammal, results in between 0.075 mg and 0.25 mg of the potato polysaccharide component of said potato polysaccharide preparation being administered to said mammal per kg of body weight of said mammal.

25. The composition of claim 23 or 24, wherein said mammal is a human.

26. The composition of claim 15, wherein at least about 80 percent of said potato polysaccharide preparation is potato polysaccharide.

27. The composition of claim 15, wherein at least about 90 percent of said potato polysaccharide preparation is potato polysaccharide.

28. The composition of claim 15, wherein at least about 95 percent of said potato polysaccharide preparation is potato polysaccharide.

29. A method for increasing polypeptide expression in cells, wherein said method comprises contacting cells with a potato polysaccharide preparation obtained from

raw potatoes under conditions wherein expression of one or more of the polypeptides selected from the group consisting of a TFAM polypeptide, an ATP5A1 polypeptide, a PDHA1 polypeptide, a PDHA2 polypeptide, and a THOP1 polypeptide is increased.

30. A method for reducing polypeptide expression in cells, wherein said method comprises contacting cells with a potato polysaccharide preparation obtained from raw potatoes under conditions wherein expression of one or more of the polypeptides selected from the group consisting of a FOX01A polypeptide, a NFKB1 polypeptide, a PDK2 polypeptide, a PDK4 polypeptide, and a HMGCR polypeptide is reduced.

31. A method for treating obesity, diabetes, and/or polycystic ovary syndrome, wherein said method comprises:

(a) identifying a mammal with obesity, diabetes, and/or polycystic ovary syndrome, and

(b) administering to said mammal a potato polysaccharide preparation obtained from raw potatoes.

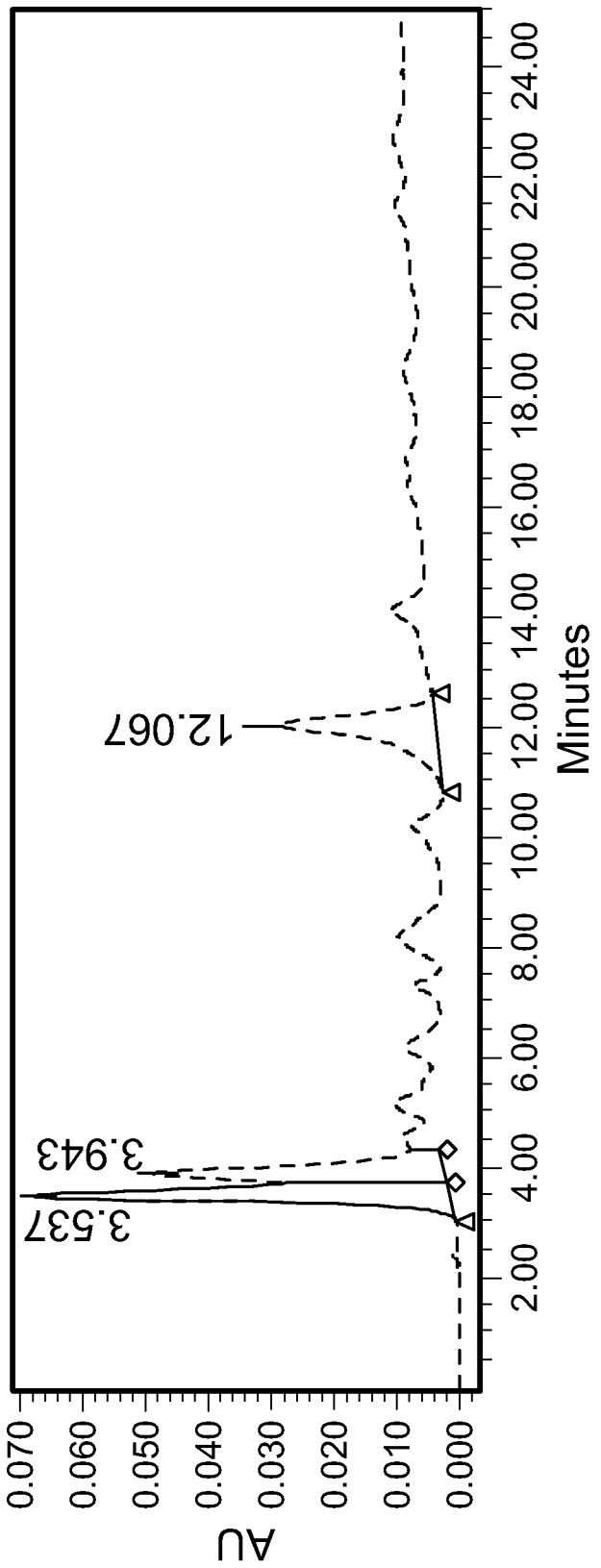

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FIG. 1

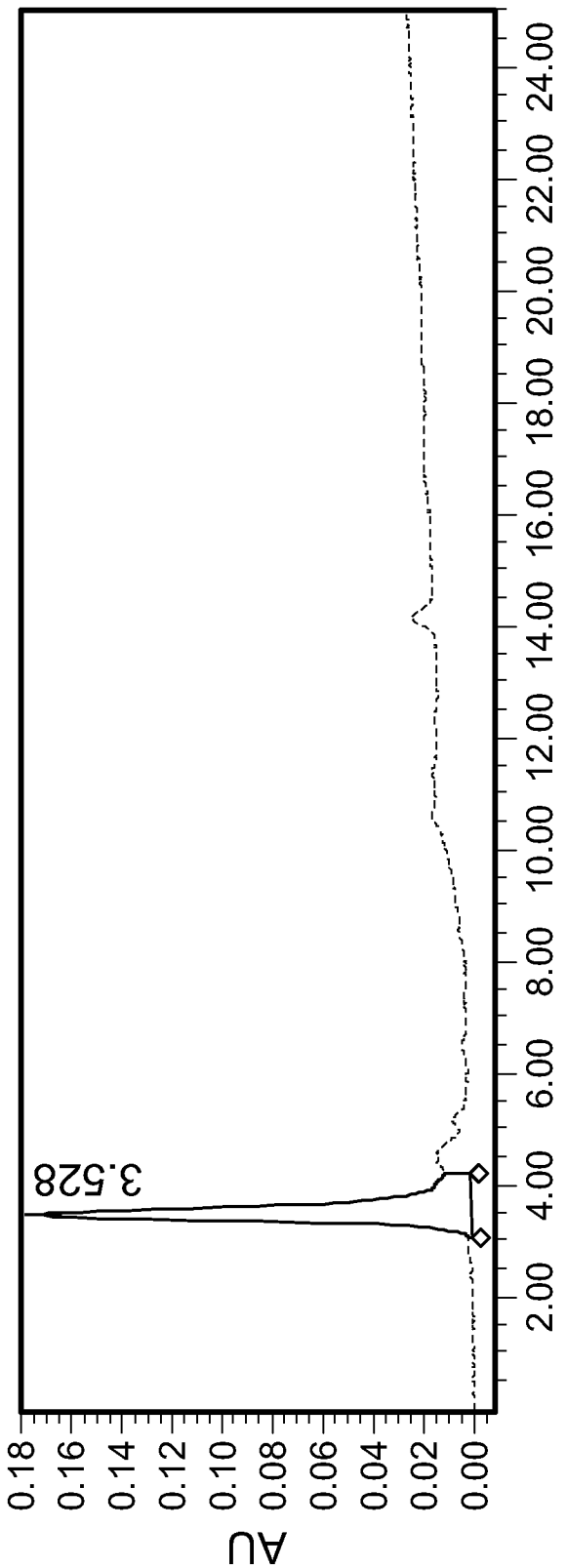
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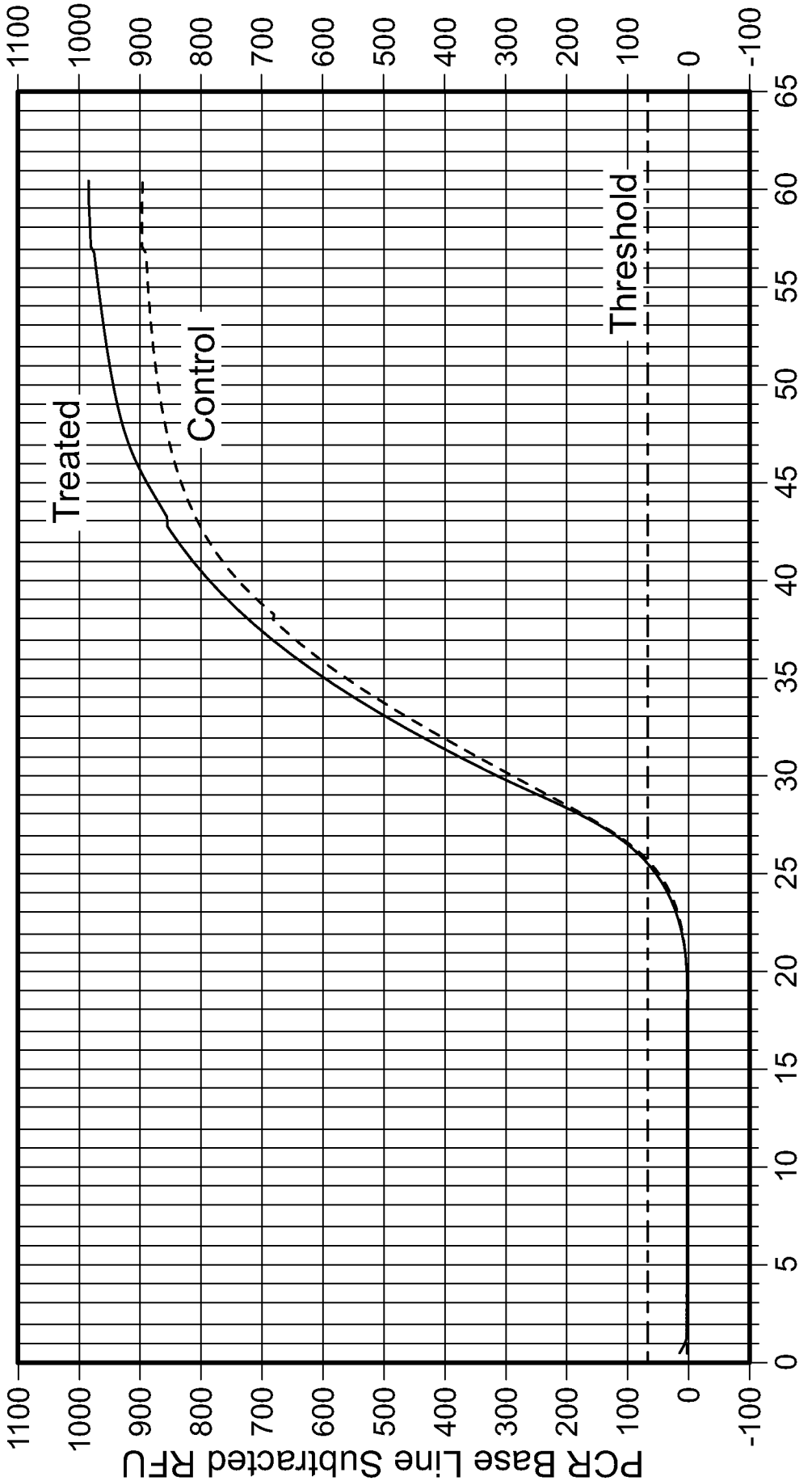
FIG. 2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Treated
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Threshold

FIG. 3

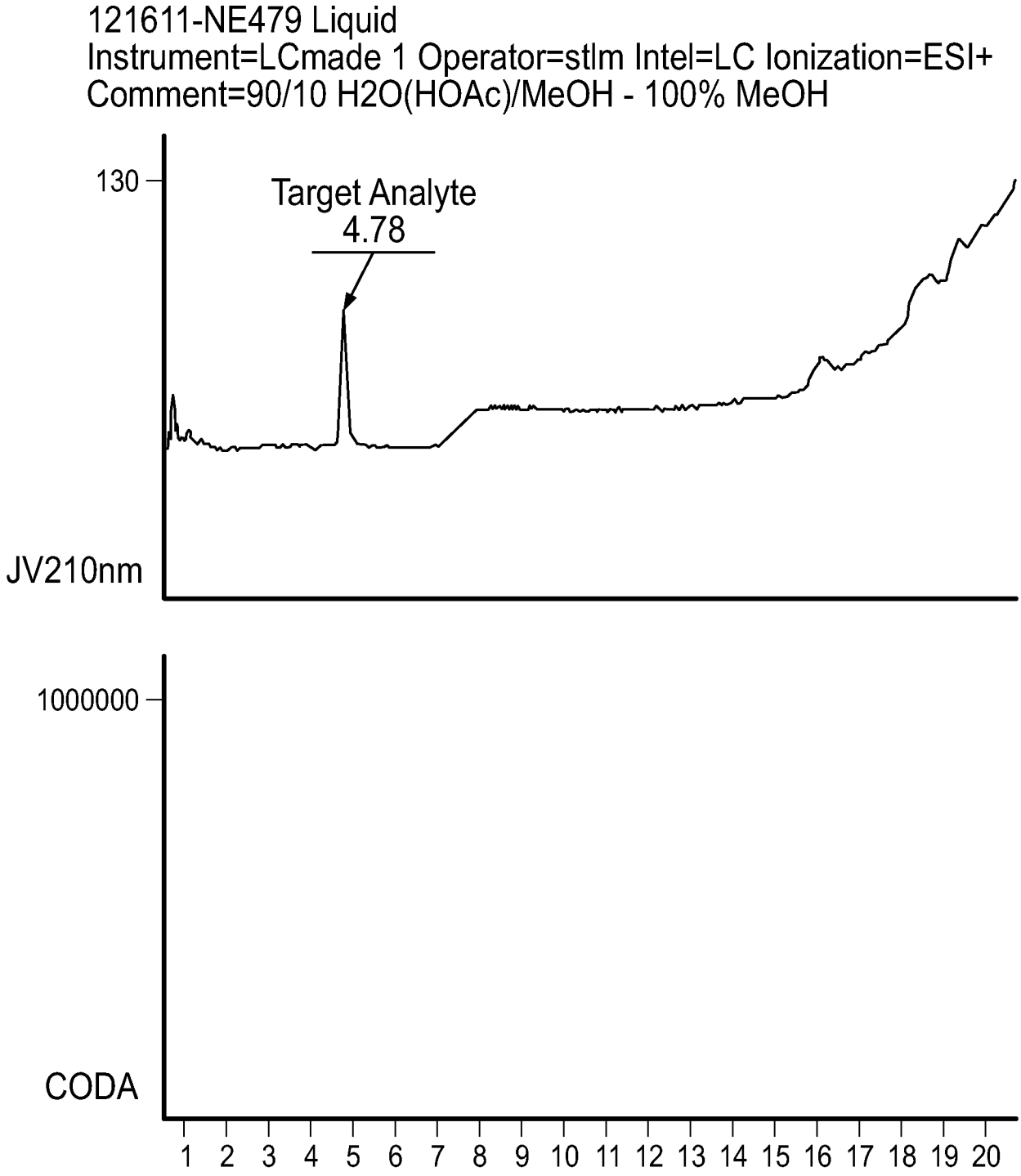
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FIG. 4

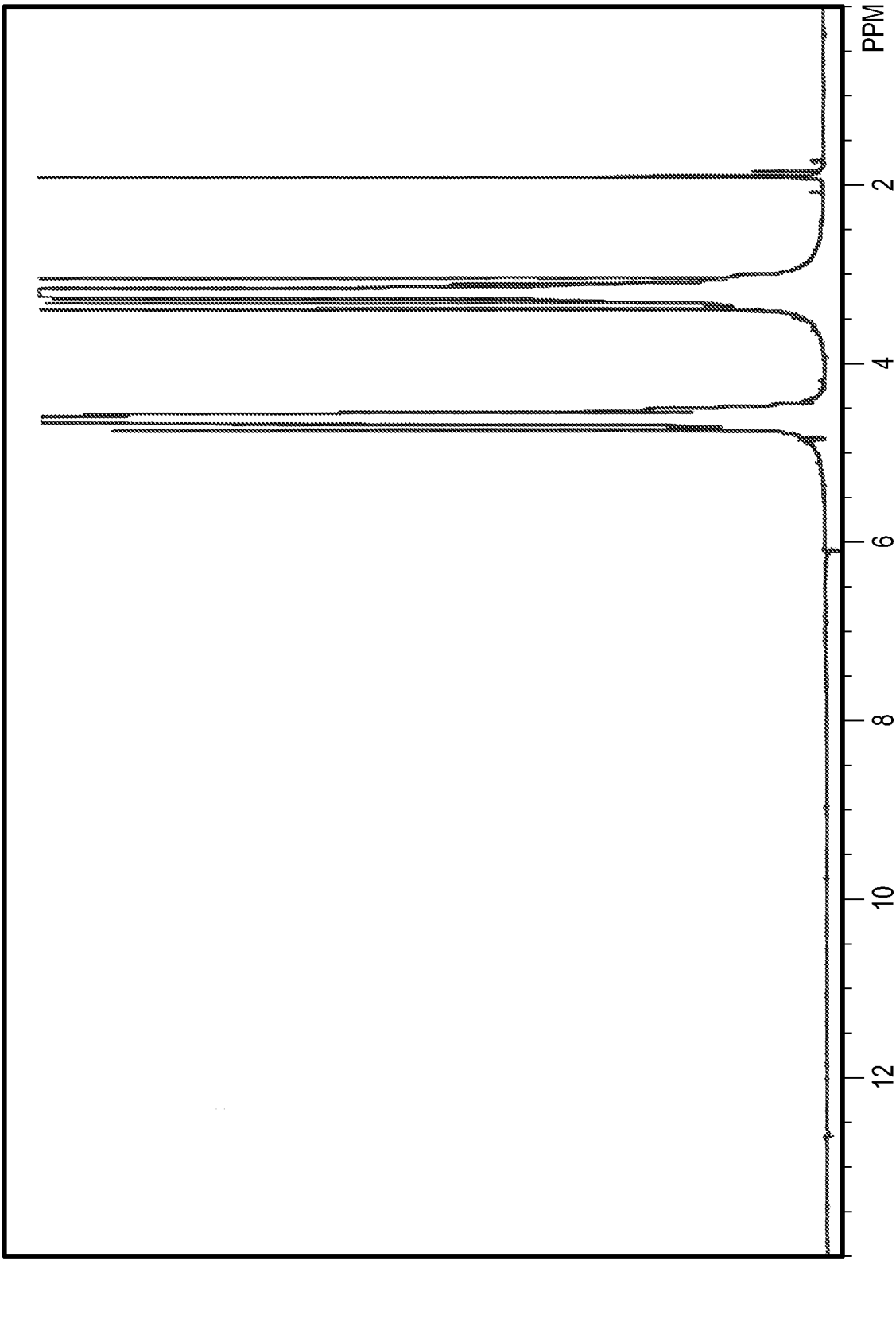
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FIG. 5

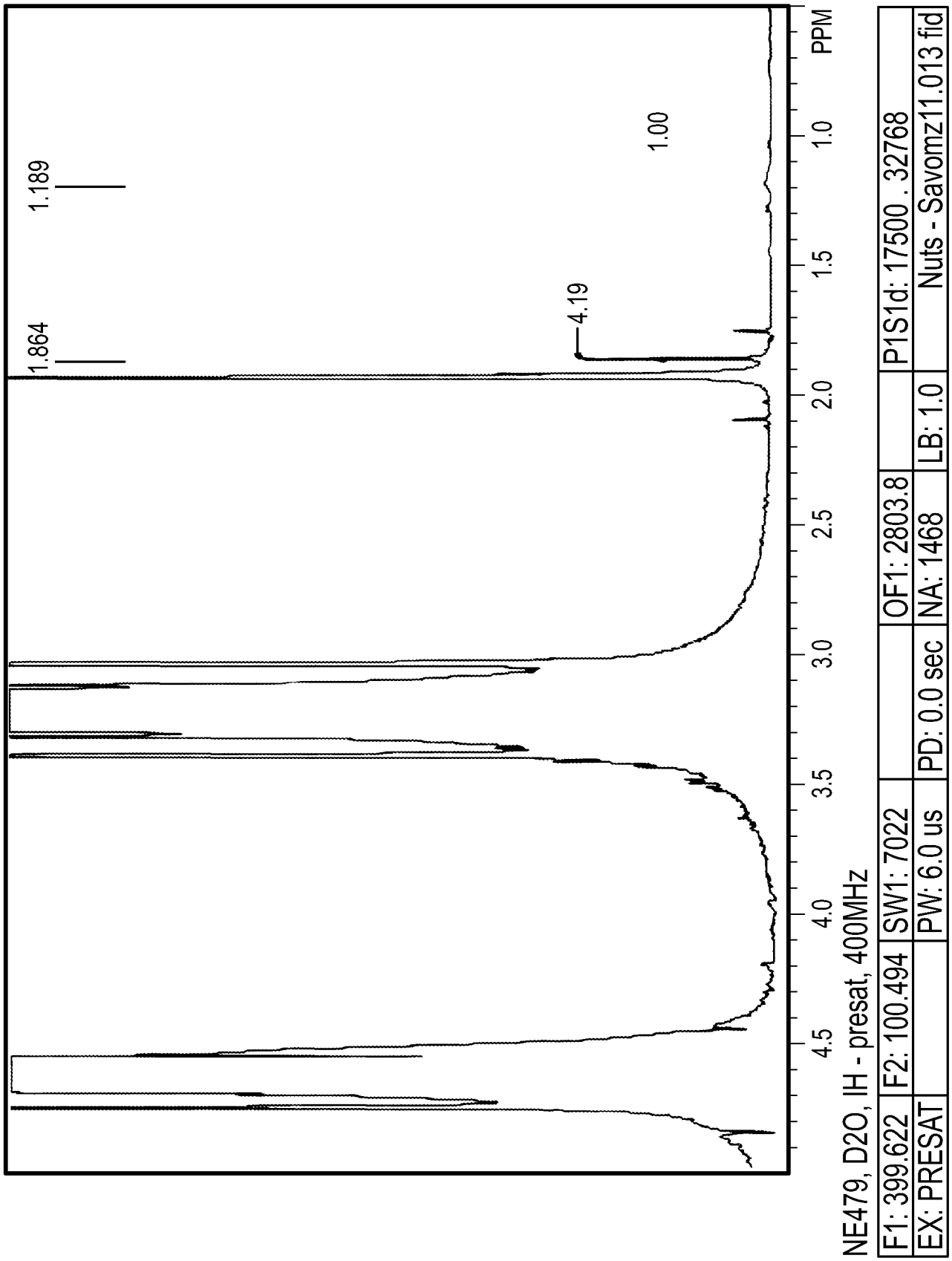
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FIG. 6

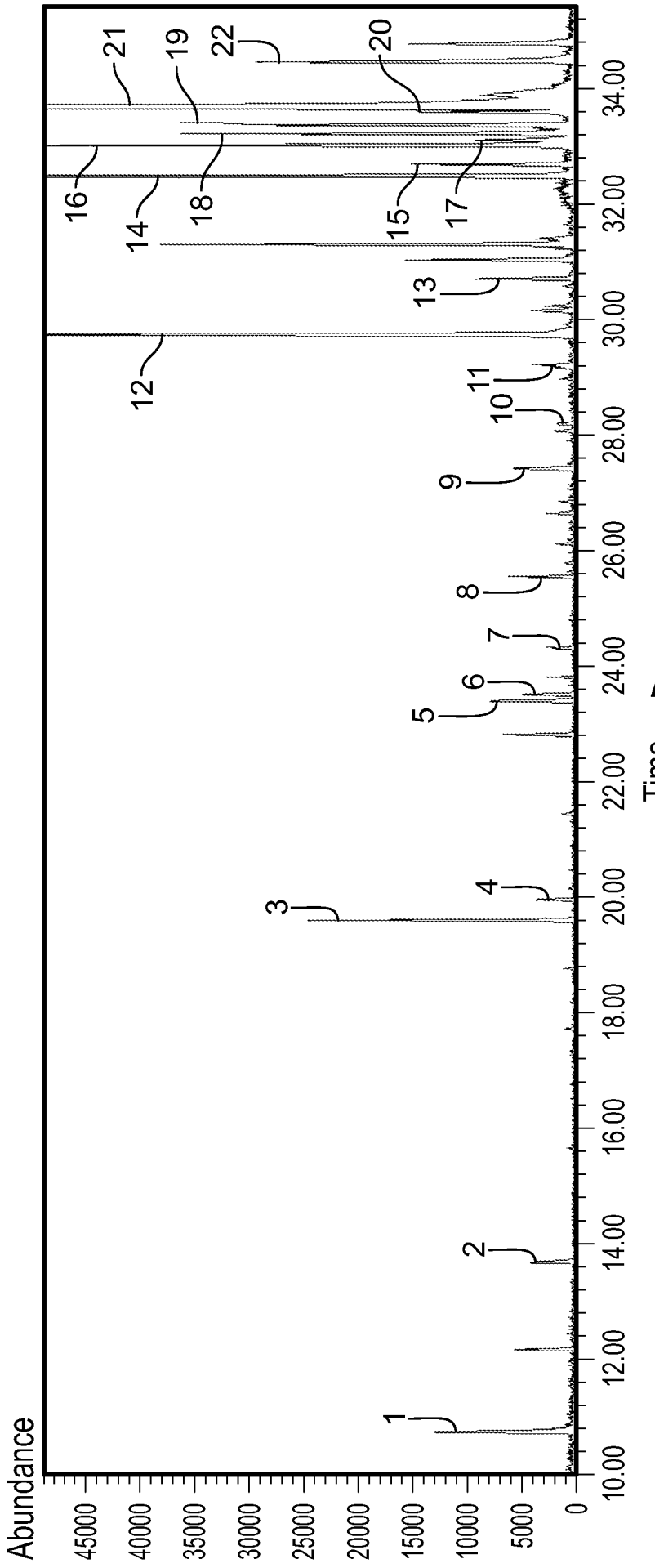
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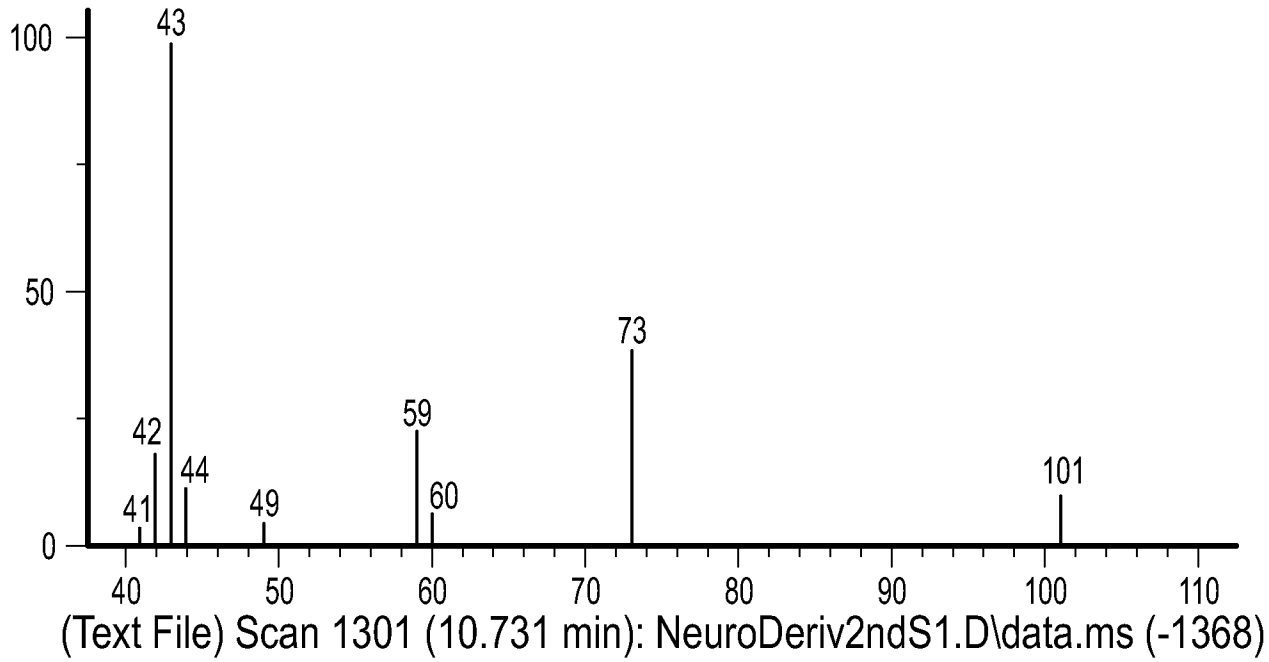
FIG. 7



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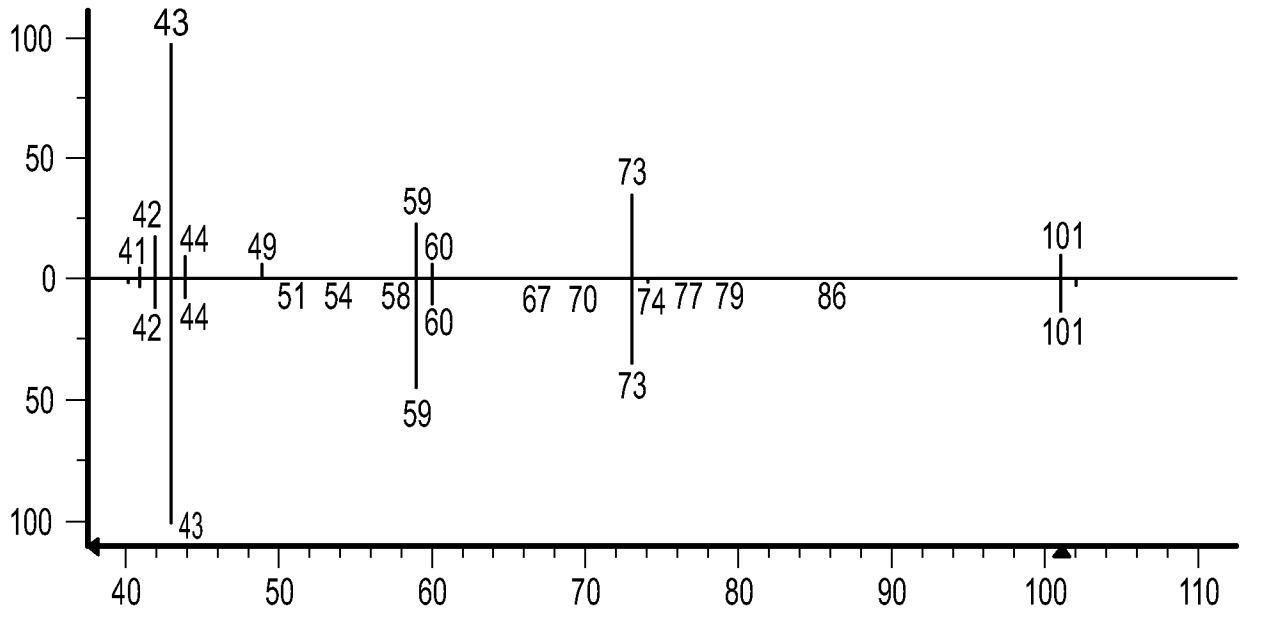

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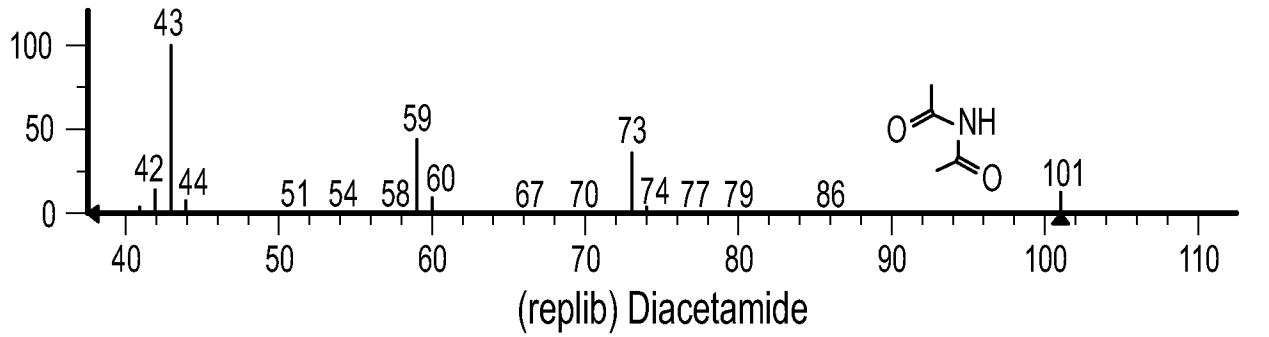

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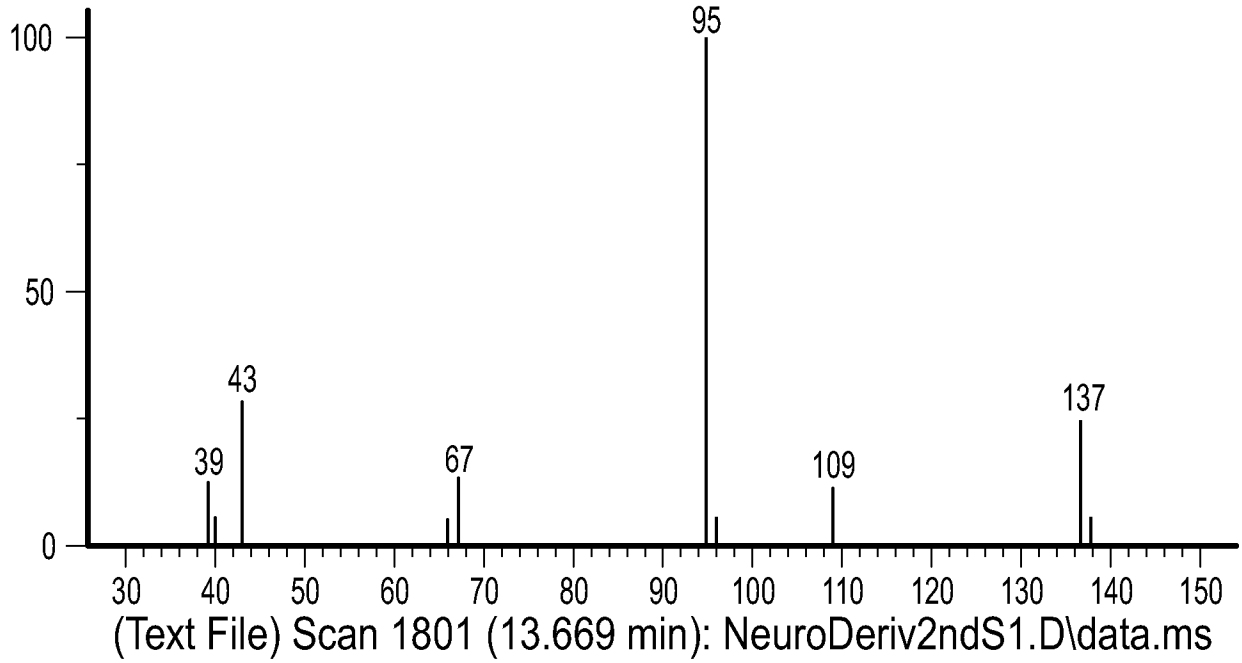
FIG. 8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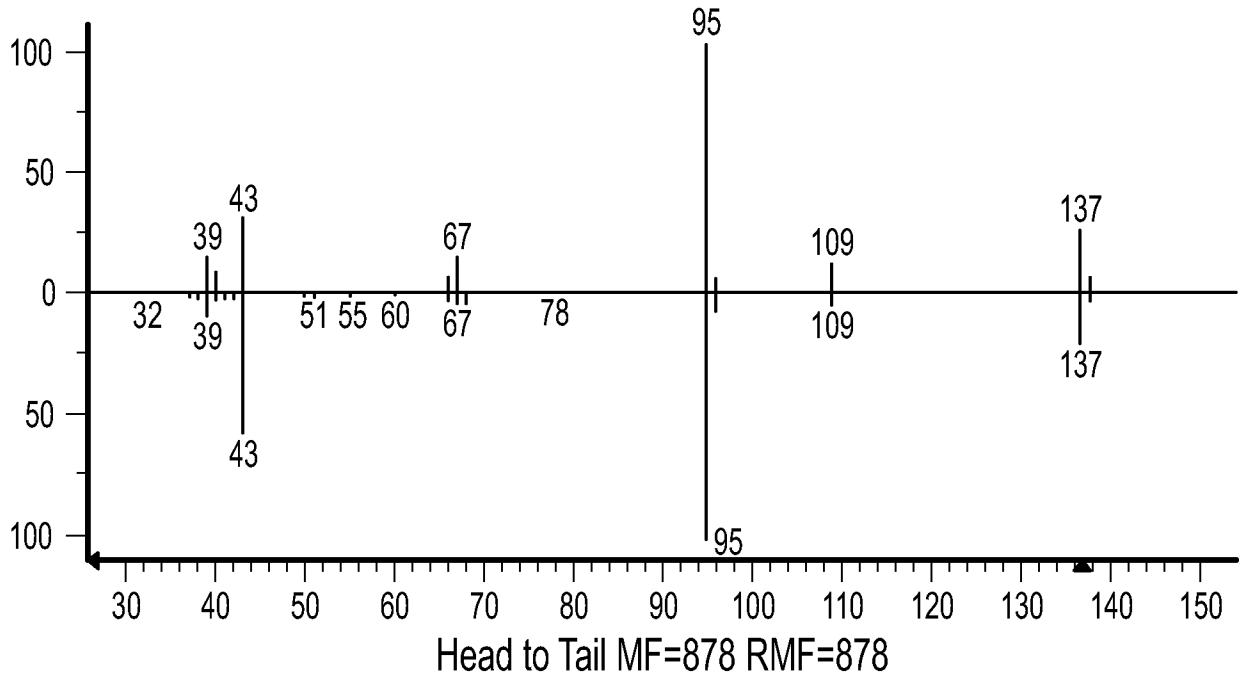
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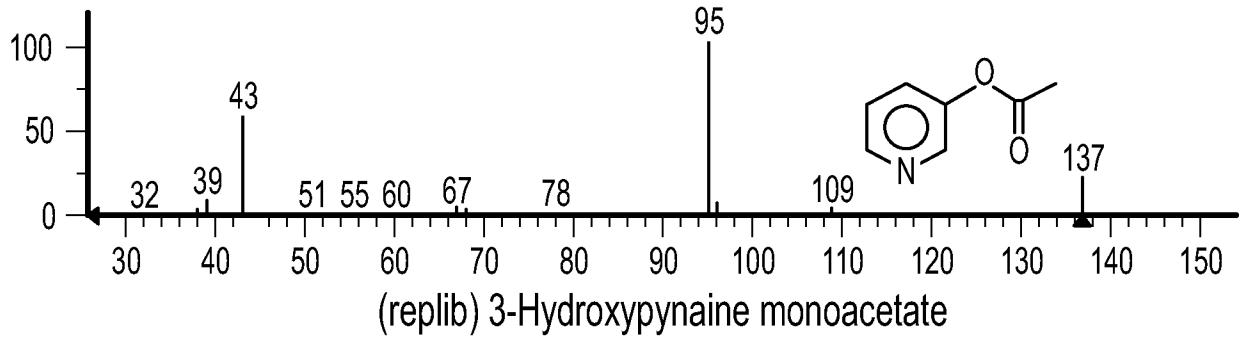
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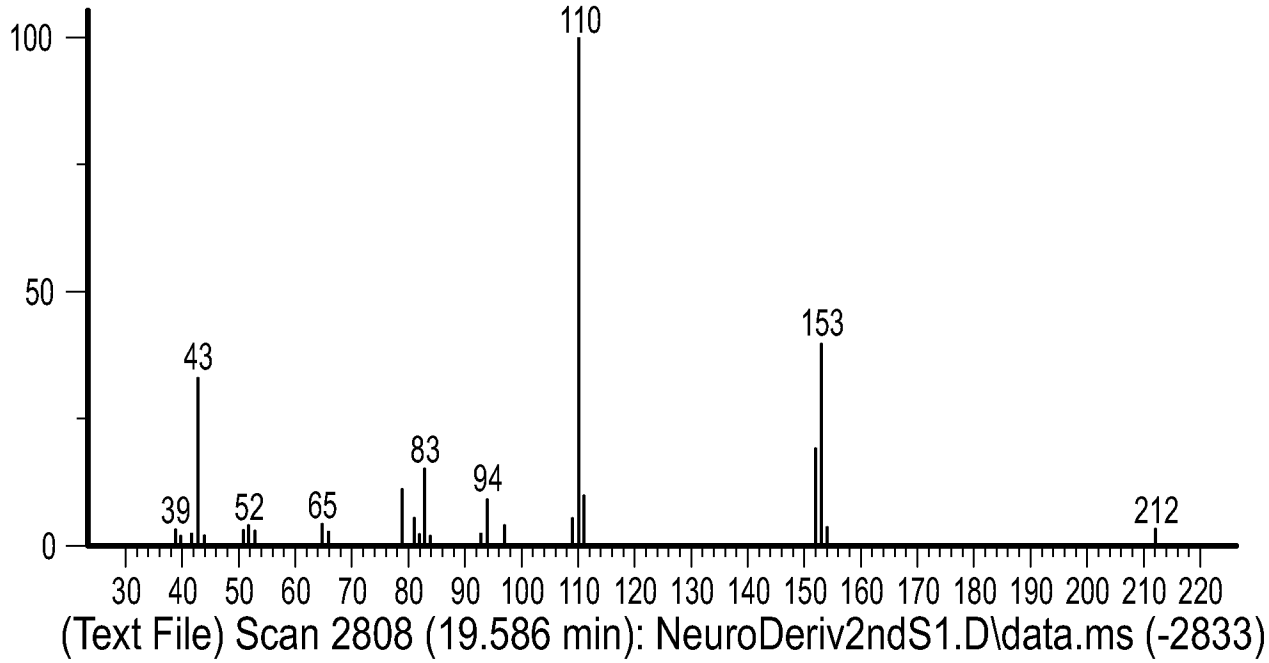
FIG. 9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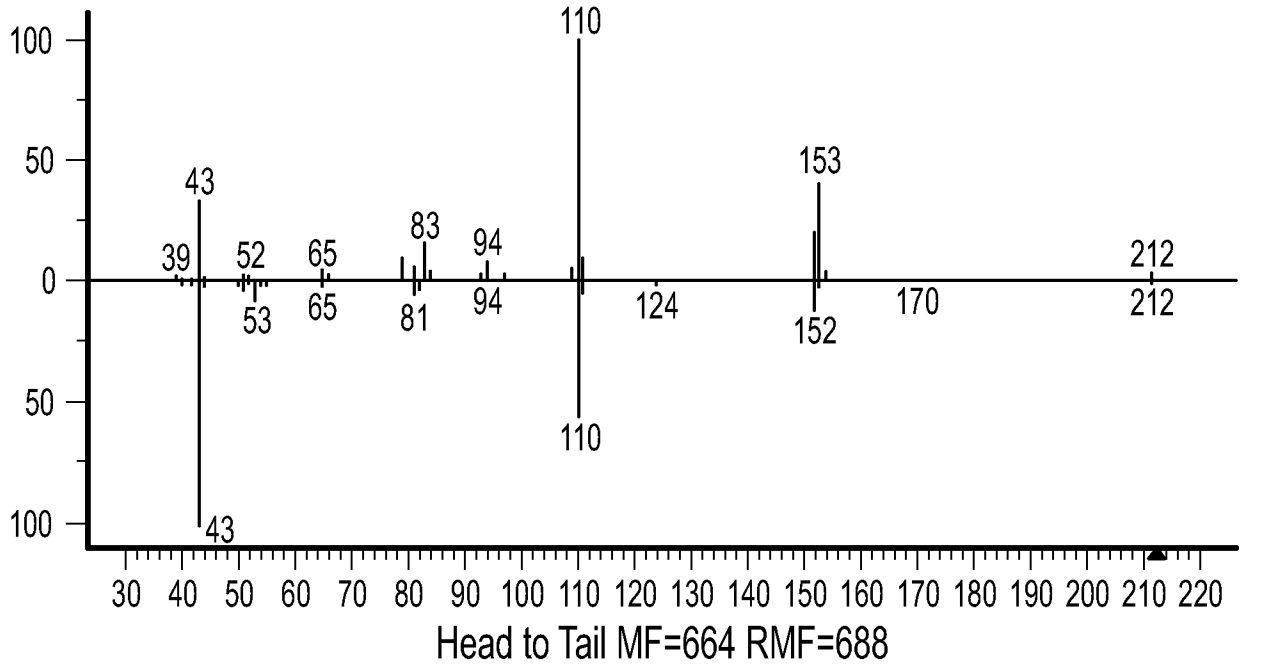
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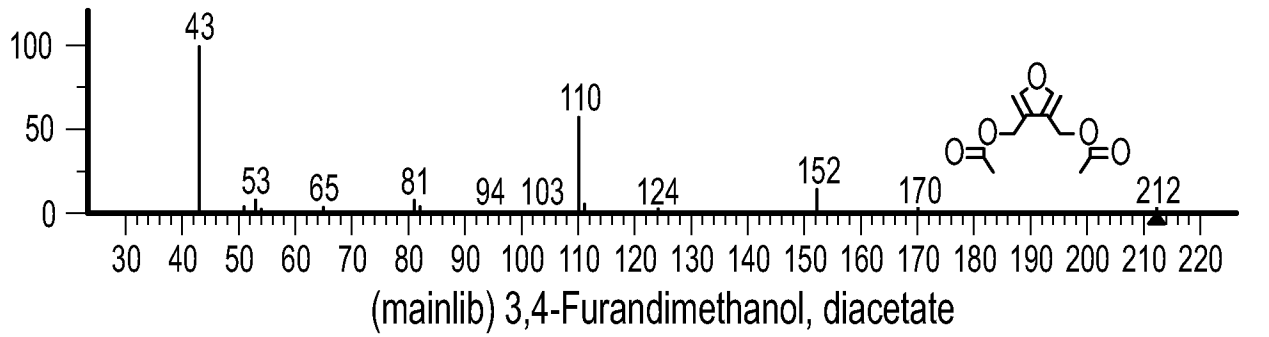
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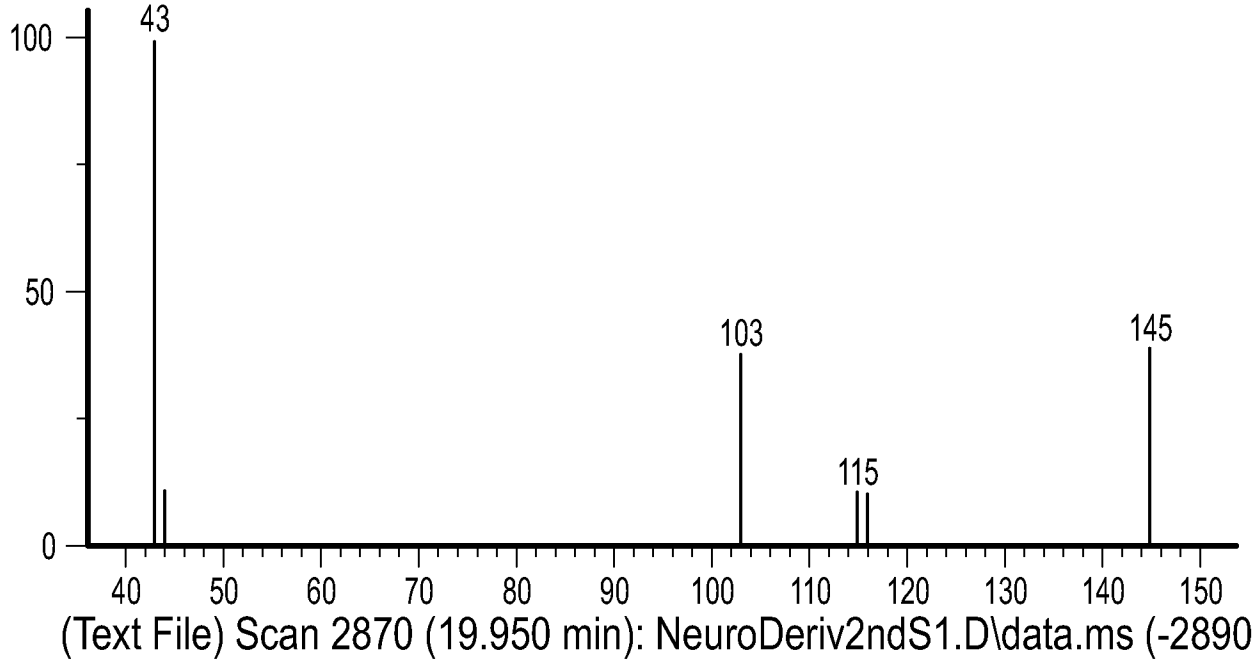
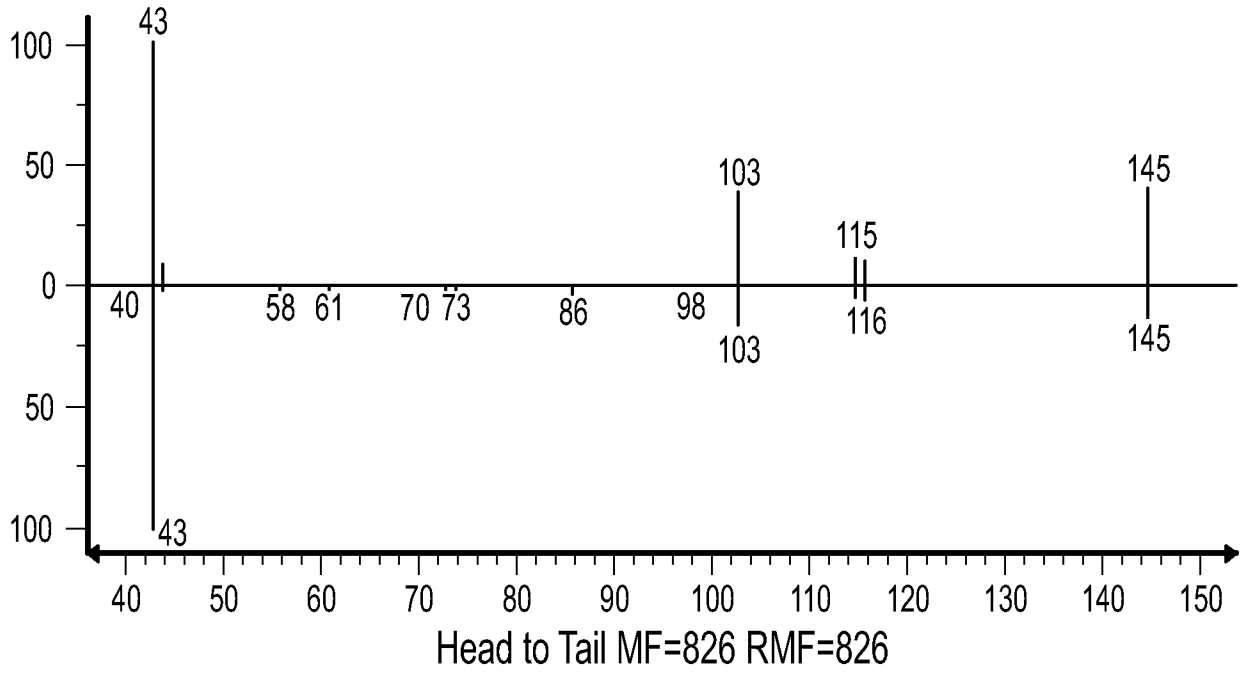
(mainlib) 3,4-Furandimethanol, diacetate

FIG. 10


100
50
0
43
103
115
145
40 50 60 70 80 90 100 110 120 130 140 150
(Text File) Scan 2870 (19.950 min): NeuroDeriv2ndS1.D\data.ms (-2890)


100
50
0
50
100
43
103
115
145
40
58 61 70 73 86 98
103
116
145
43
40 50 60 70 80 90 100 110 120 130 140 150
Head to Tail MF=826 RMF=826

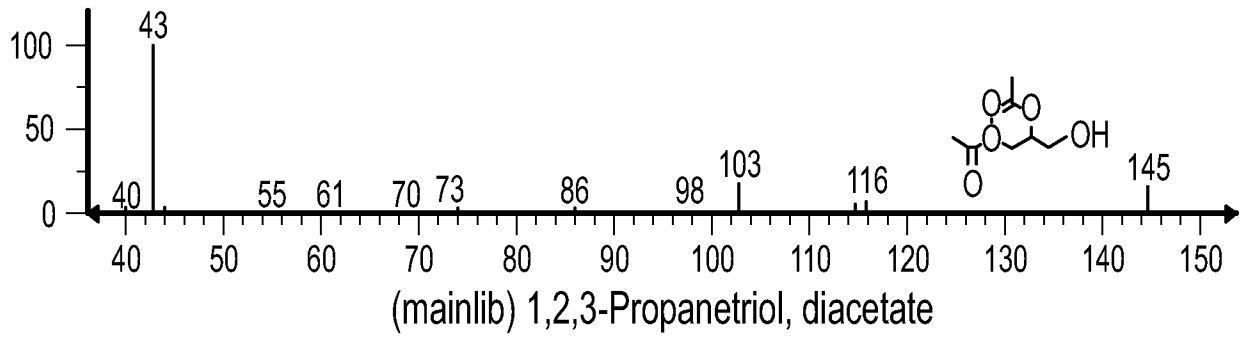
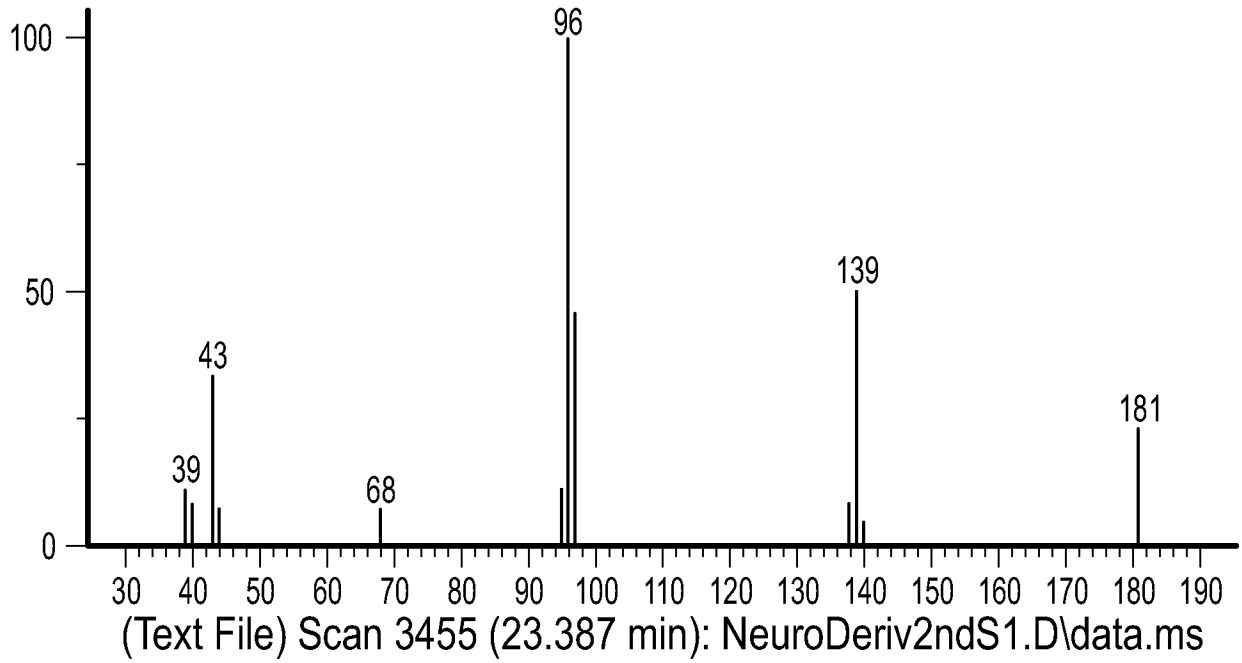
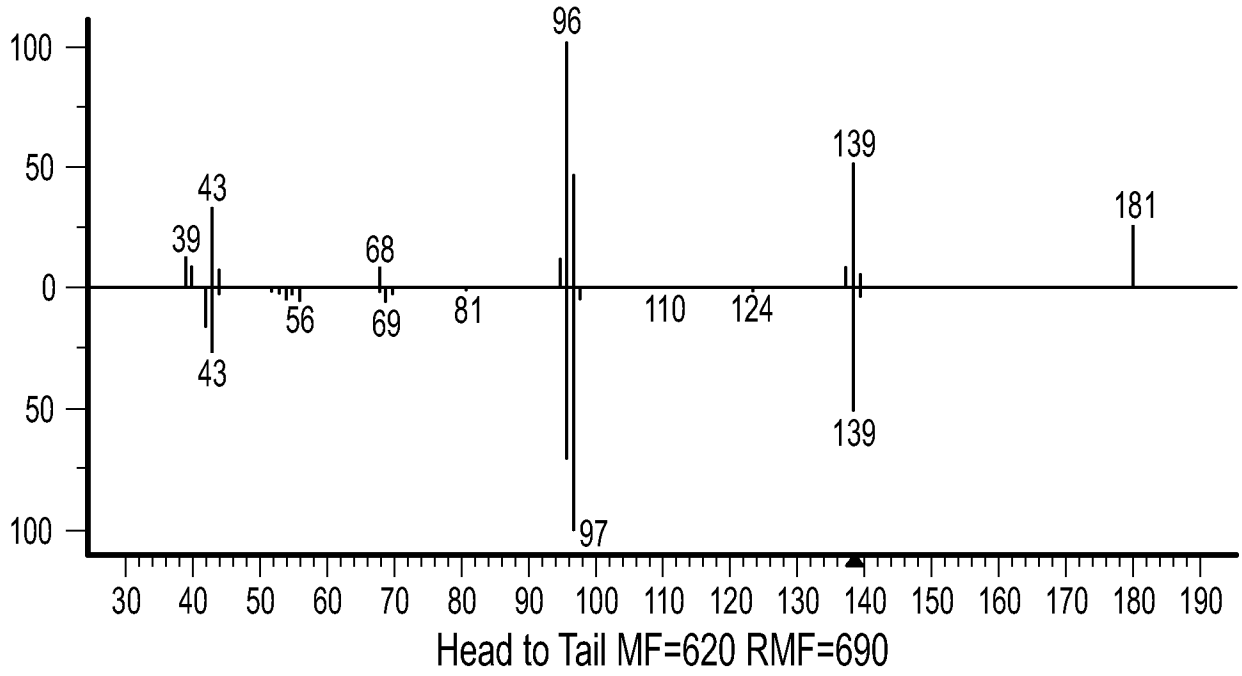

100
50
0
43
40
55 61 70 73 86 98
103
116
145
OH
40 50 60 70 80 90 100 110 120 130 140 150
(mainlib) 1,2,3-Propanetriol, diacetate

FIG. 11


96
139
43
181
39
68
100
50
0
30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190
(Text File) Scan 3455 (23.387 min): NeuroDeriv2ndS1.D\data.ms


96
139
43
181
39
68
56
69
81
110
124
43
139
97
100
50
0
50
100
30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190
Head to Tail MF=620 RMF=690

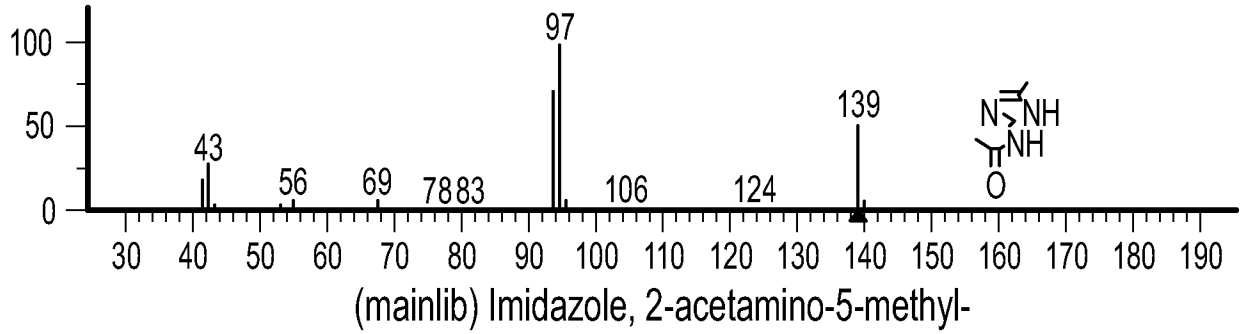
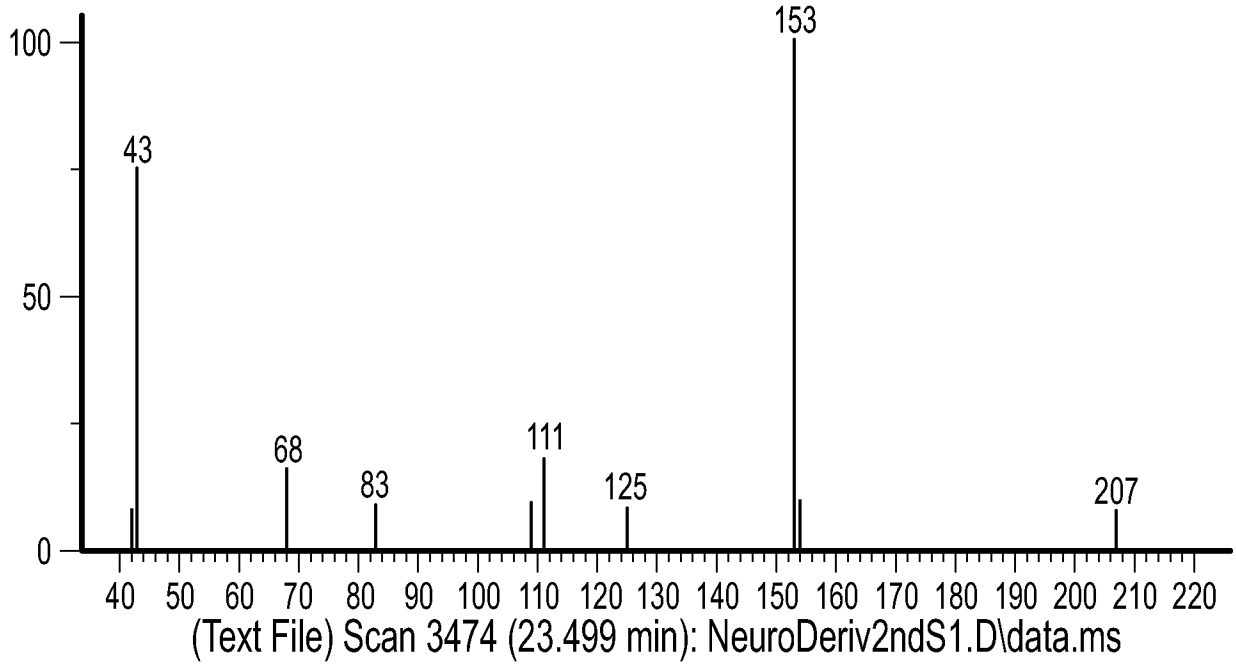
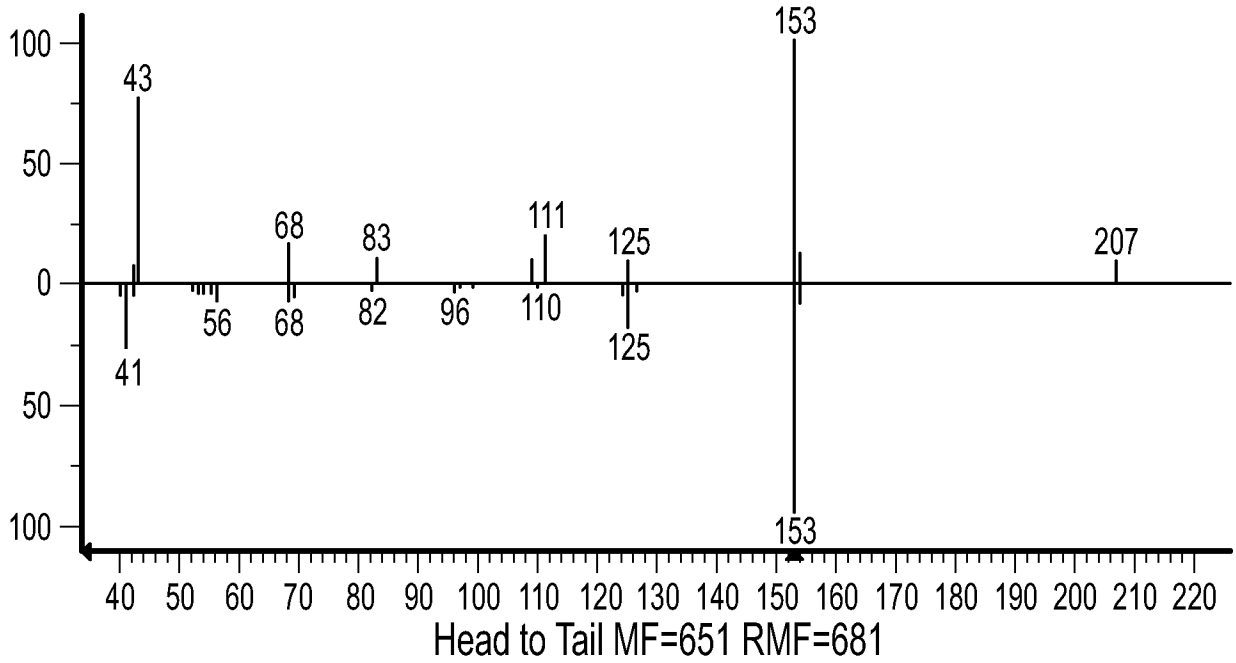

97
139
43
56
69
78 83
106
124
NH
NH
O
100
50
0
30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190
(mainlib) Imidazole, 2-acetamino-5-methyl-

FIG. 12


153
100
43
50
68
111
83
125
207
0
40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220
(Text File) Scan 3474 (23.499 min): NeuroDeriv2ndS1.D\data.ms


153
100
43
50
68
83
111
125
207
0
56
68
82
96
110
125
41
50
100
153
40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220
Head to Tail MF=651 RMF=681

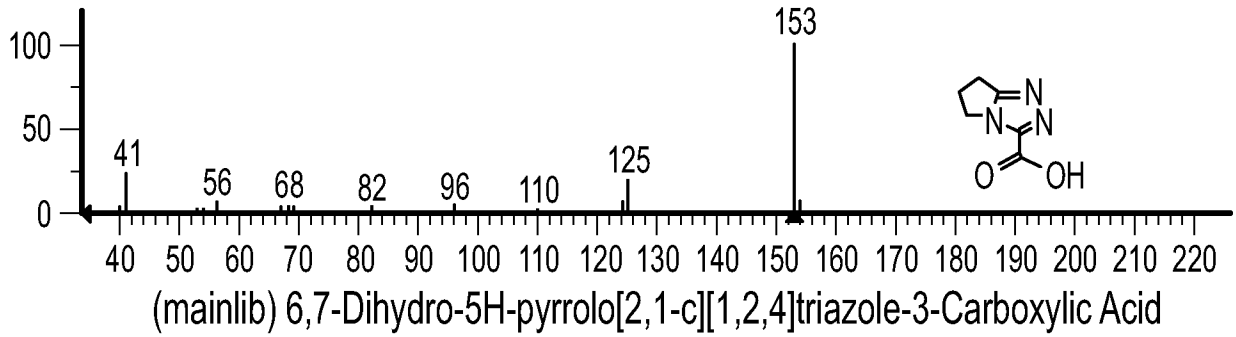
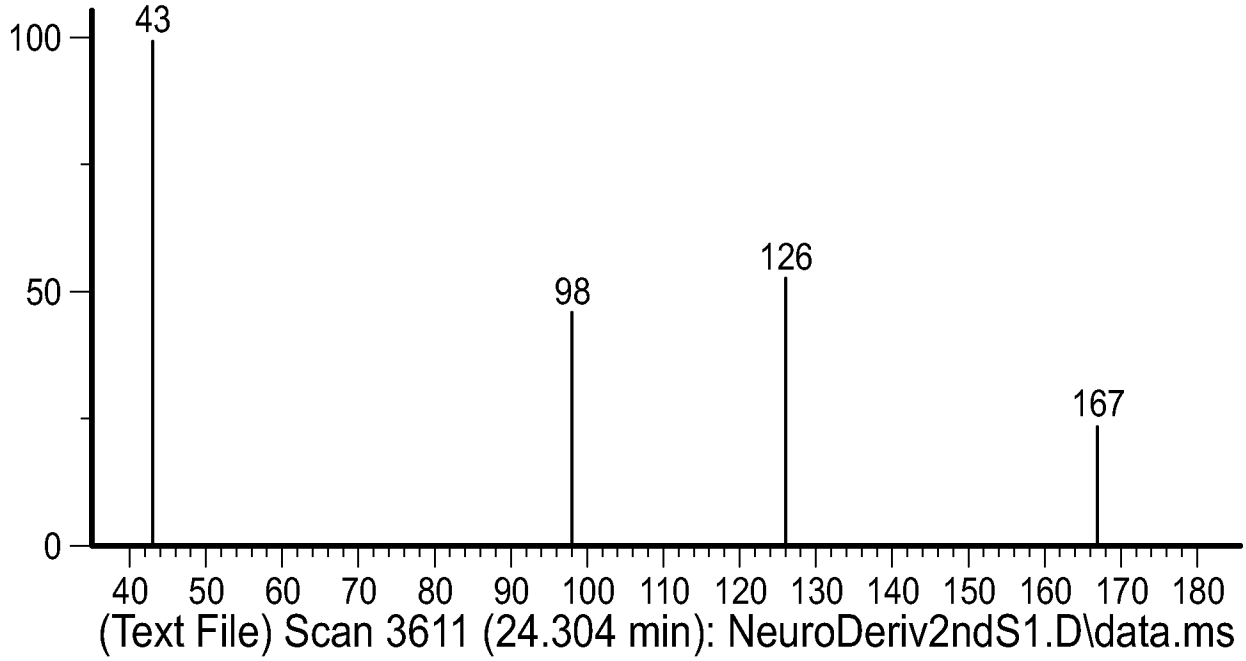
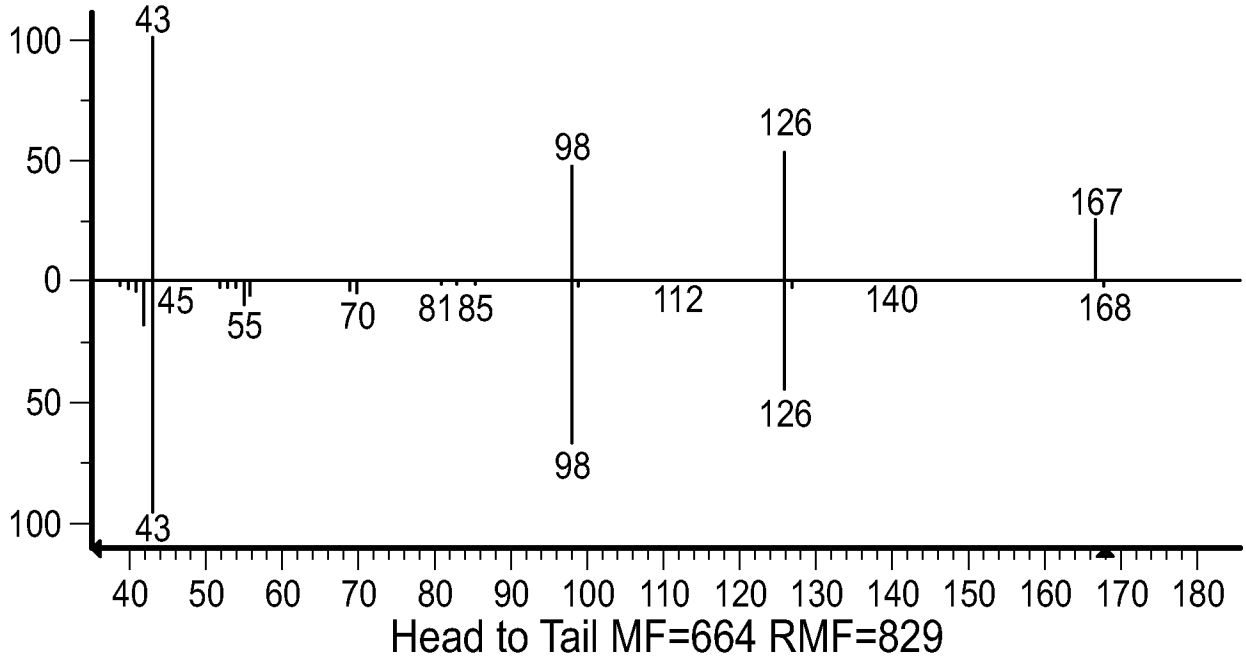

153
100
50
41
56
68
82
96
110
125
0
N
N
N
O
OH
40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220
(mainlib) 6,7-Dihydro-5H-pyrrolo[2,1-c][1,2,4]triazole-3-Carboxylic Acid

FIG. 13


100
50
0
43
98
126
167
40 50 60 70 80 90 100 110 120 130 140 150 160 170 180
(Text File) Scan 3611 (24.304 min): NeuroDeriv2ndS1.D\data.ms


100
50
0
50
100
43
98
126
167
45
55
70
81 85
112
140
168
126
98
43
40 50 60 70 80 90 100 110 120 130 140 150 160 170 180
Head to Tail MF=664 RMF=829

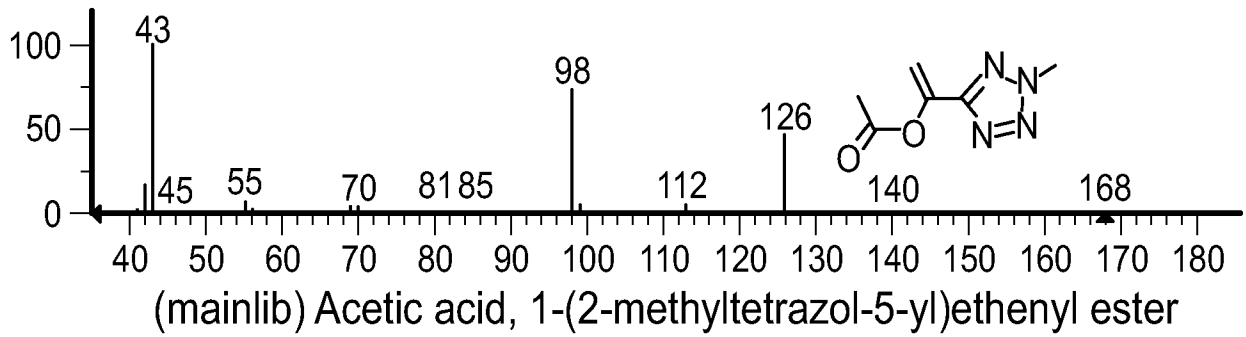
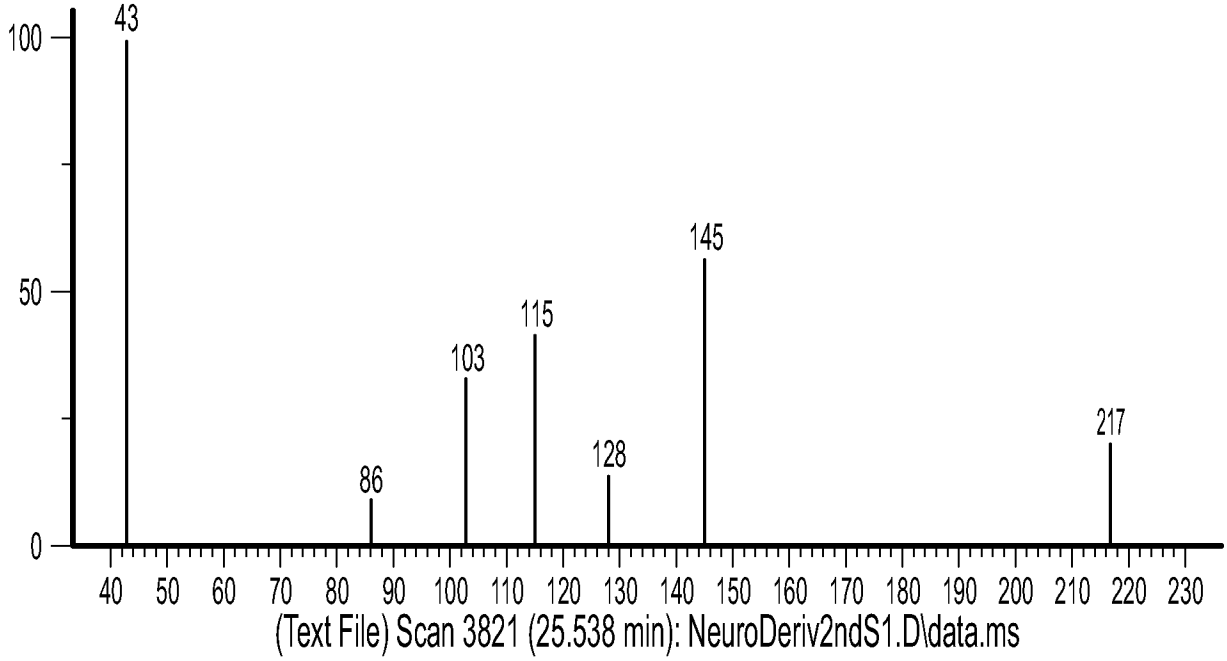
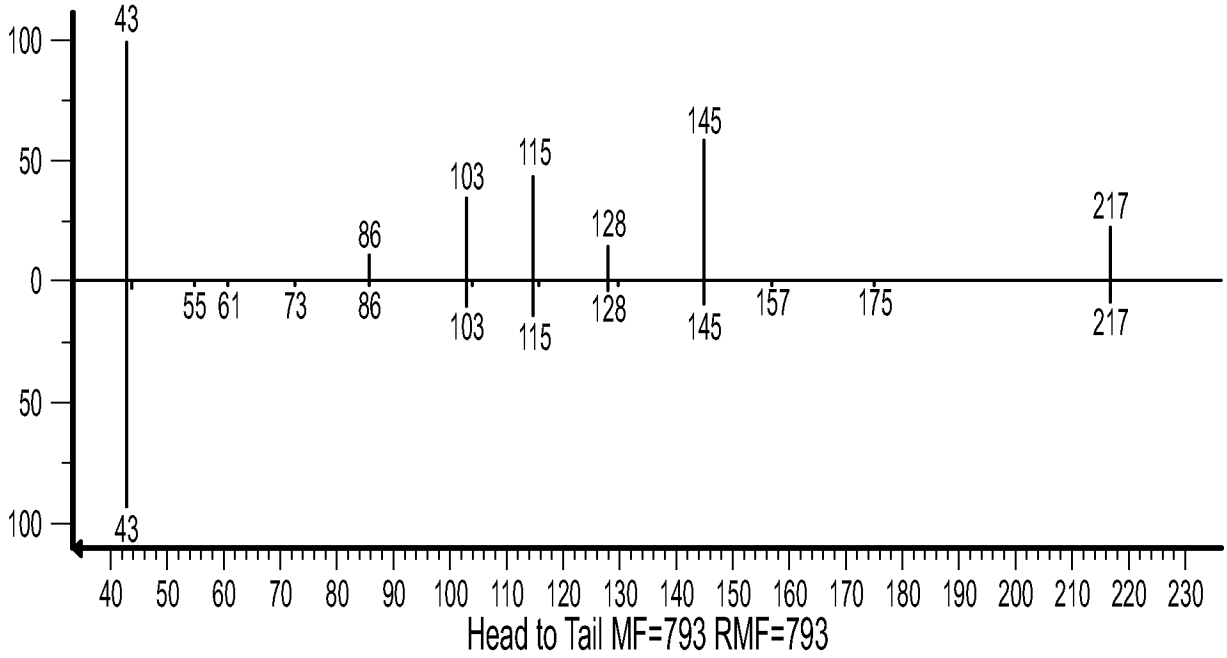

100
50
0
43
98
126
45
55
70
81 85
112
140
168
N
N
N
N
O
O
40 50 60 70 80 90 100 110 120 130 140 150 160 170 180
(mainlib) Acetic acid, 1-(2-methyltetrazol-5-yl)ethenyl ester

FIG. 14


100
50
0
43
86
103
115
128
145
217
40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
(Text File) Scan 3821 (25.538 min): NeuroDeriv2ndS1.D\data.ms


100
50
0
50
100
43
55 61 73 86 103 115 128 145 157 175 217
40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
Head to Tail MF=793 RMF=793

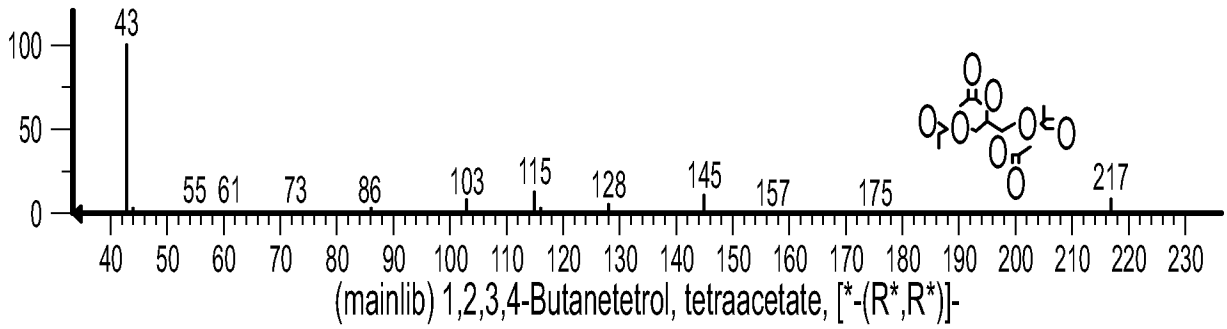
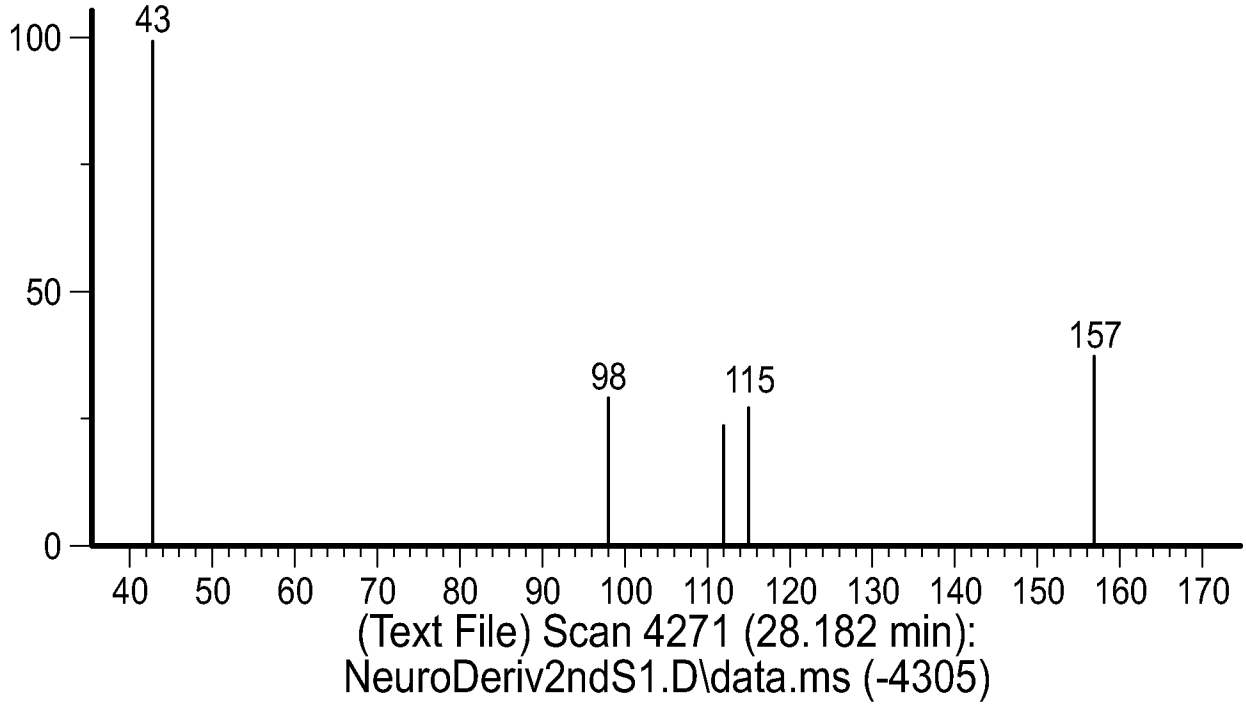
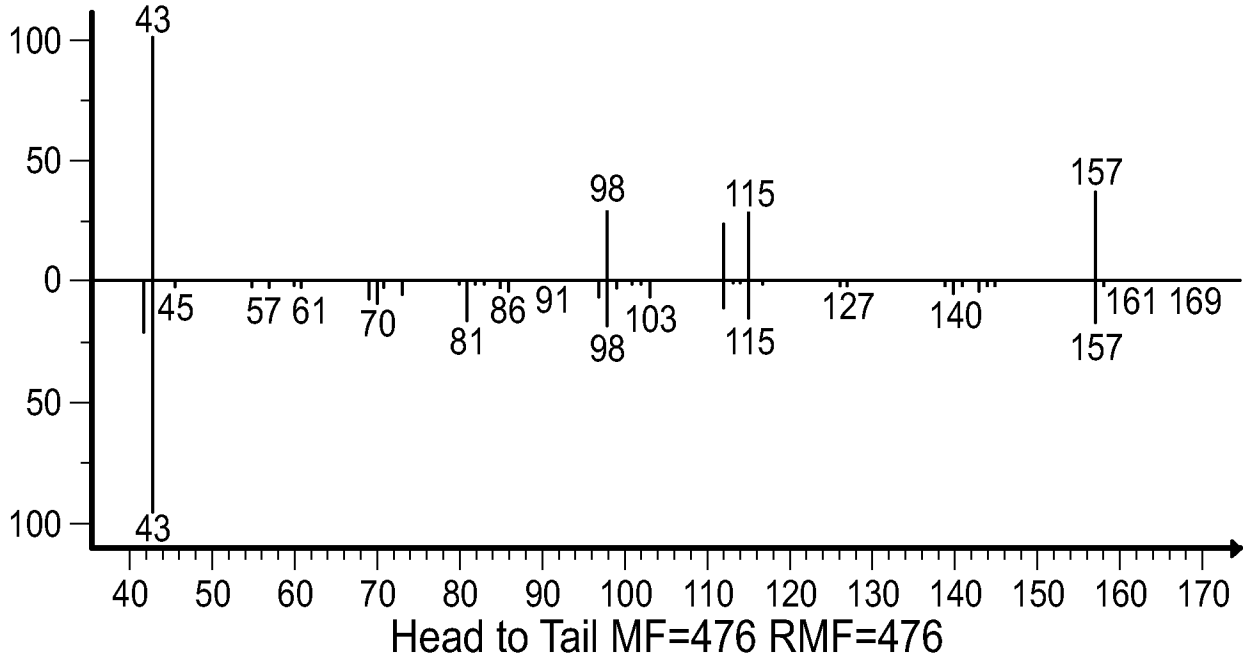

100
50
0
43
55 61 73 86 103 115 128 145 157 175 217
40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230
(mainlib) 1,2,3,4-Butanetetrol, tetraacetate, [*-(R*,R*)]-

FIG. 15


100
50
0
43
98
115
157
40 50 60 70 80 90 100 110 120 130 140 150 160 170
(Text File) Scan 4271 (28.182 min):
NeuroDeriv2ndS1.D\data.ms (-4305)


100
50
0
50
100
43
98
115
157
45
57 61
70
81
86 91
103
127
140
161 169
40 50 60 70 80 90 100 110 120 130 140 150 160 170
Head to Tail MF=476 RMF=476

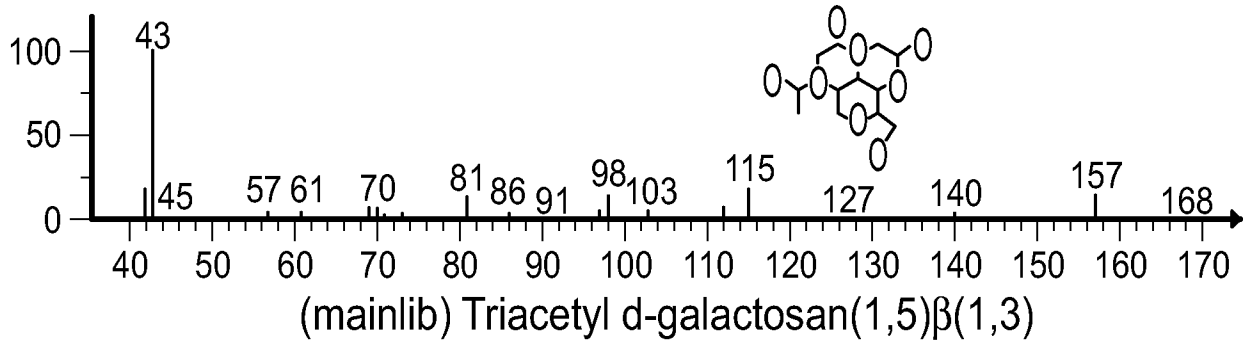
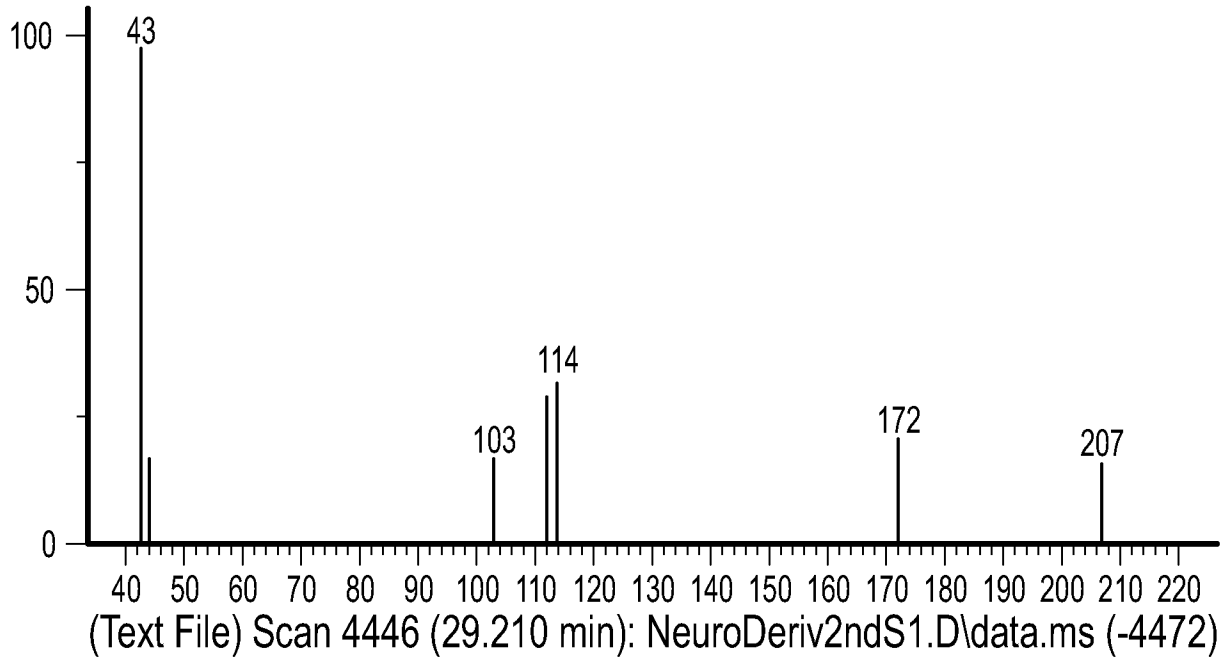
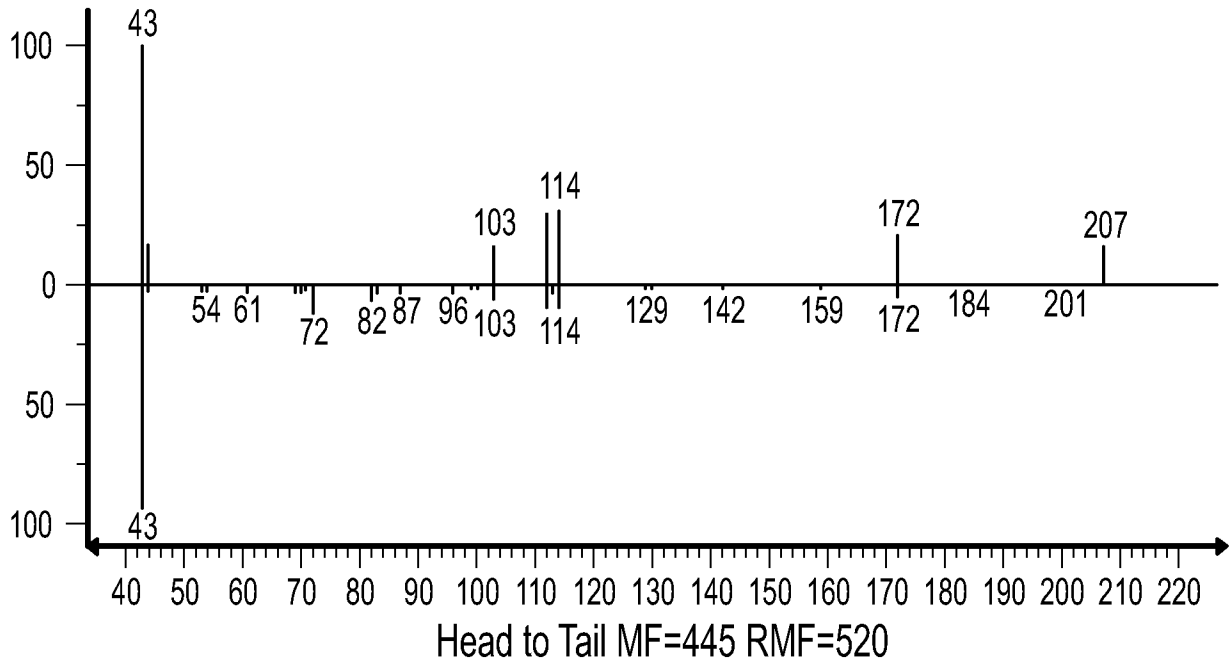

100
50
0
43
45
57 61
70
81
86 91
98
103
115
127
140
157
168
40 50 60 70 80 90 100 110 120 130 140 150 160 170
(mainlib) Triacetyl d-galactosan(1,5)β(1,3)

FIG. 16


100
50
0
43
103
114
172
207
40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220
(Text File) Scan 4446 (29.210 min): NeuroDeriv2ndS1.D\data.ms (-4472)


100
50
0
50
100
43
103
114
172
207
54 61 72 82 87 96 103 114 129 142 159 172 184 201
40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220
Head to Tail MF=445 RMF=520

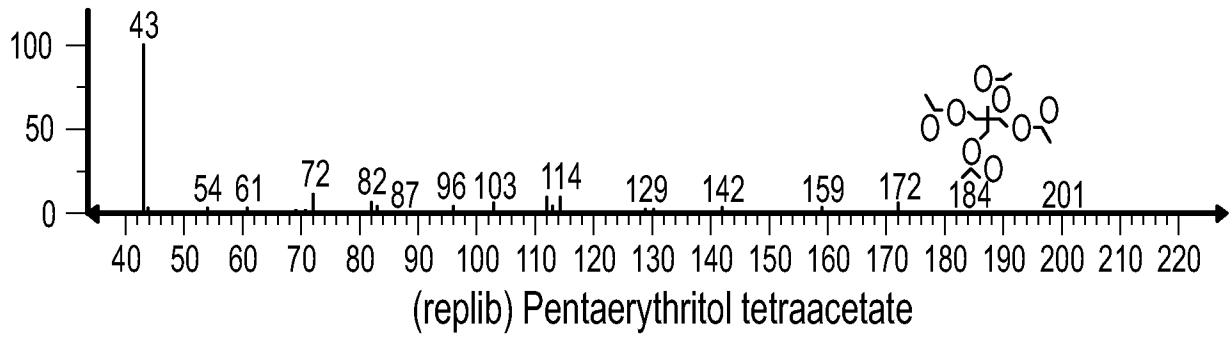
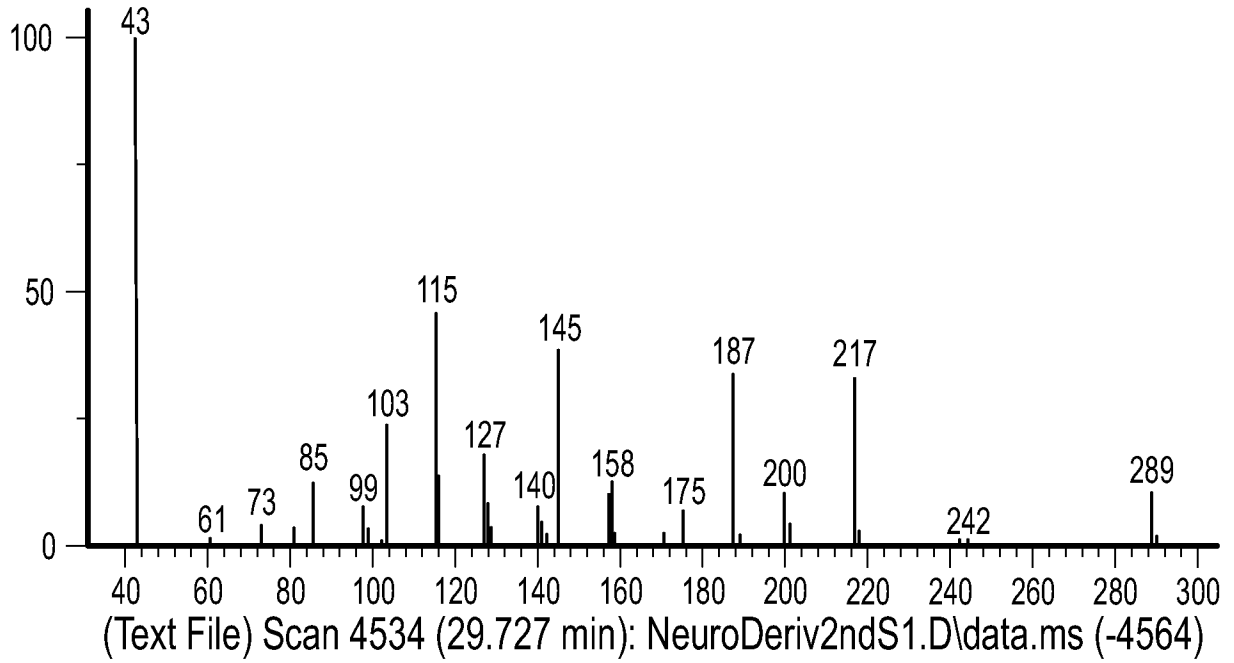
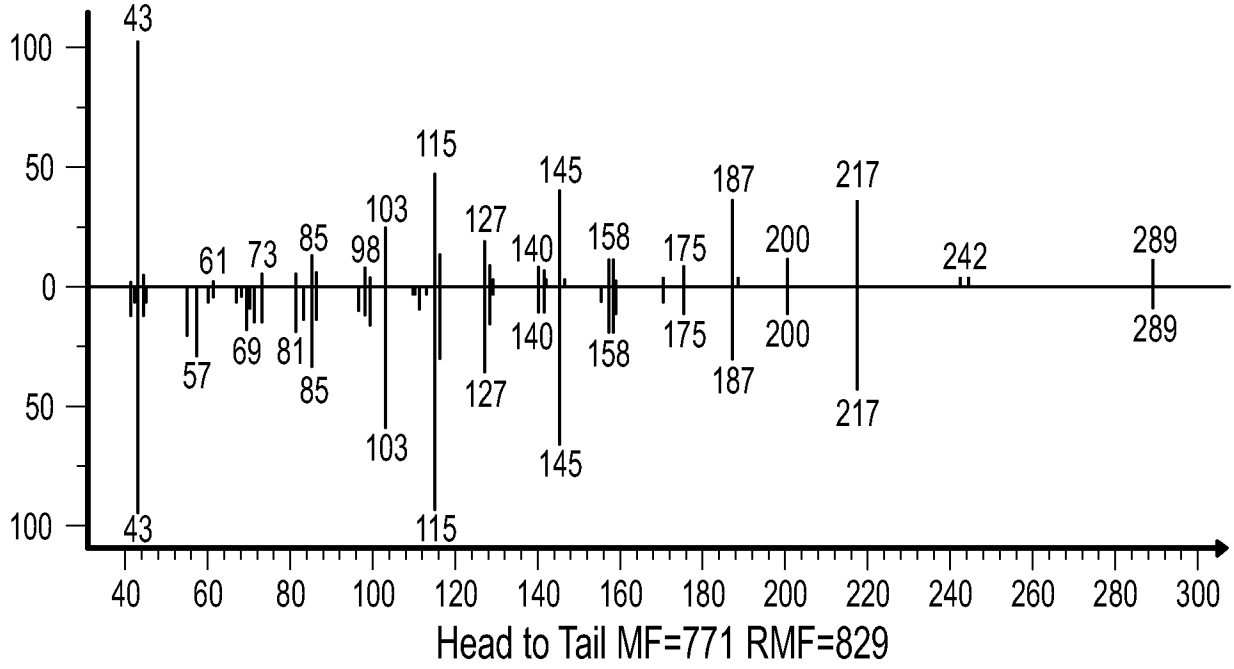

100
50
0
43
54 61 72 82 87 96 103 114 129 142 159 172 184 201
40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220
(replib) Pentaerythritol tetraacetate

FIG. 17


100
50
0
43
61
73
85
99
103
115
127
140
145
158
175
187
200
217
242
289
40 60 80 100 120 140 160 180 200 220 240 260 280 300
(Text File) Scan 4534 (29.727 min): NeuroDeriv2ndS1.D\data.ms (-4564)


100
50
0
50
100
43
57
61
69
73
81
85
98
103
115
127
140
145
158
175
187
200
217
242
289
40 60 80 100 120 140 160 180 200 220 240 260 280 300
Head to Tail MF=771 RMF=829

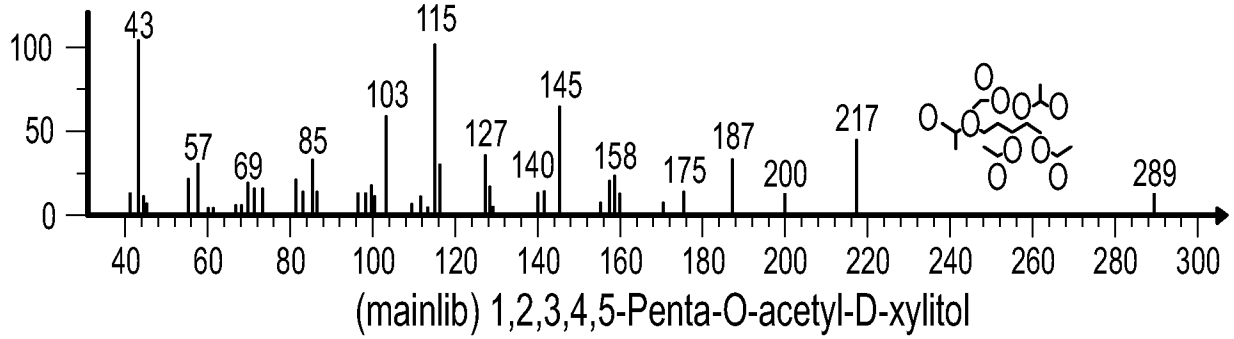
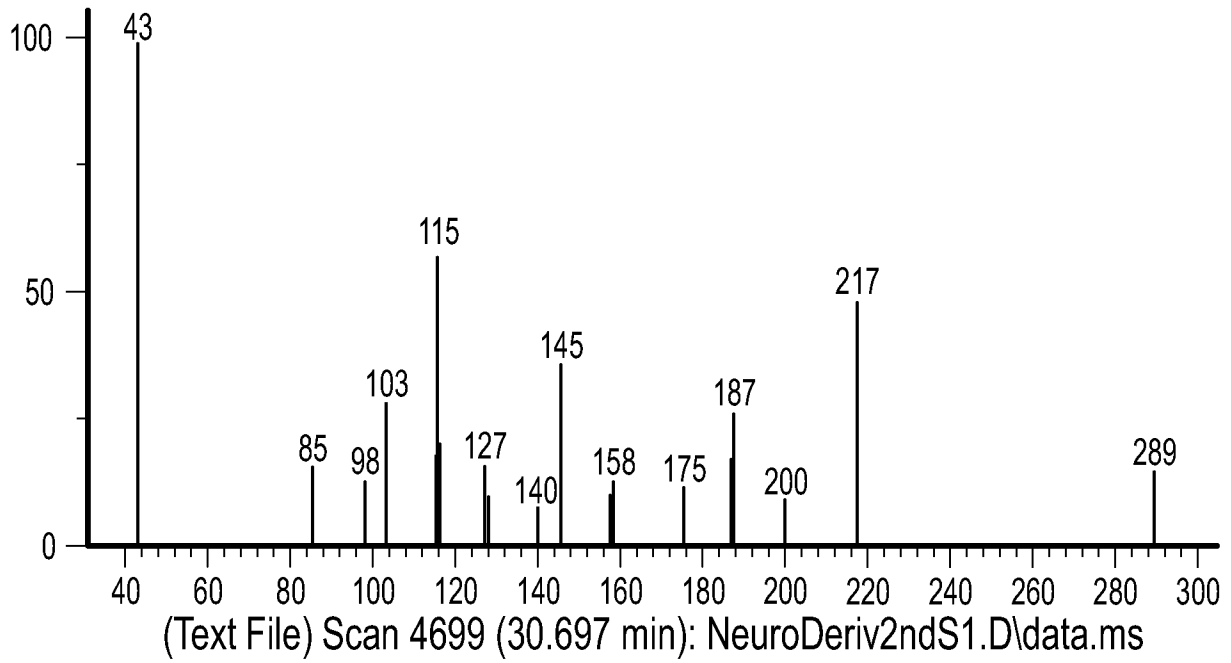
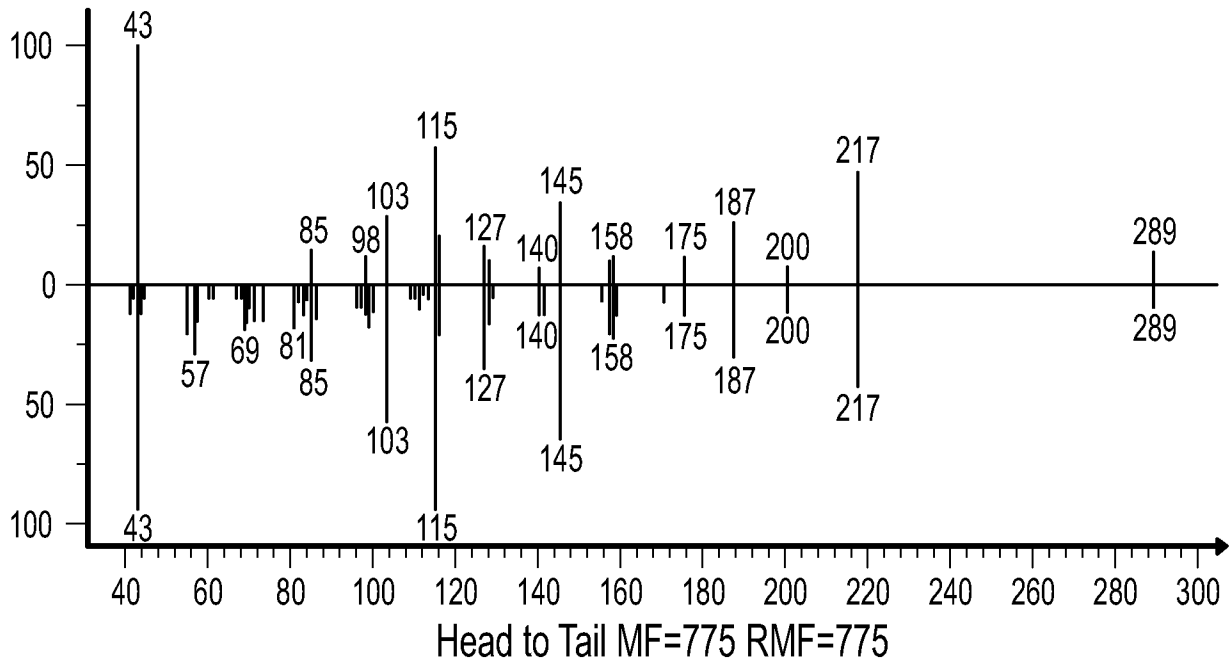

100
50
0
43
57
69
85
103
115
127
140
145
158
175
187
200
217
289
40 60 80 100 120 140 160 180 200 220 240 260 280 300
(mainlib) 1,2,3,4,5-Penta-O-acetyl-D-xylitol

FIG. 18


100
50
0
43
115
217
145
103
187
85
98
127
158
175
200
140
289
40 60 80 100 120 140 160 180 200 220 240 260 280 300
(Text File) Scan 4699 (30.697 min): NeuroDeriv2ndS1.D\data.ms


100
50
0
50
100
43
115
217
145
103
187
85
98
127
158
175
200
140
289
57
69
81
85
103
127
140
145
158
175
187
200
217
289
40 60 80 100 120 140 160 180 200 220 240 260 280 300
Head to Tail MF=775 RMF=775

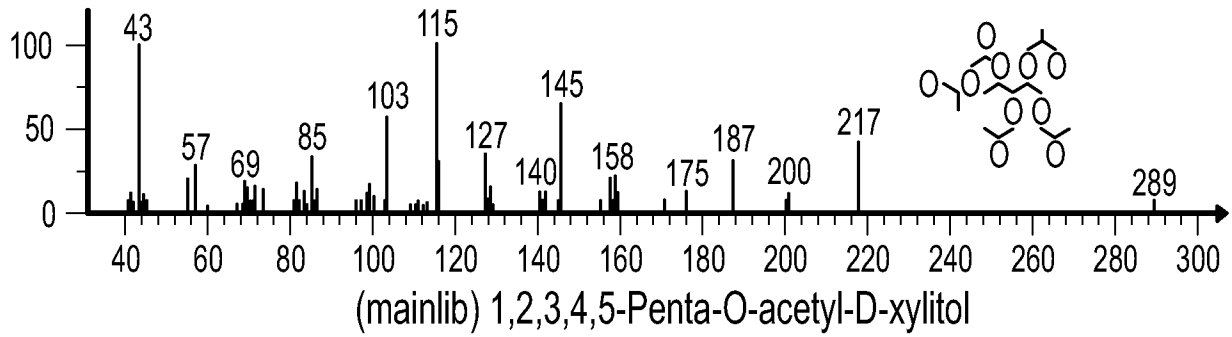
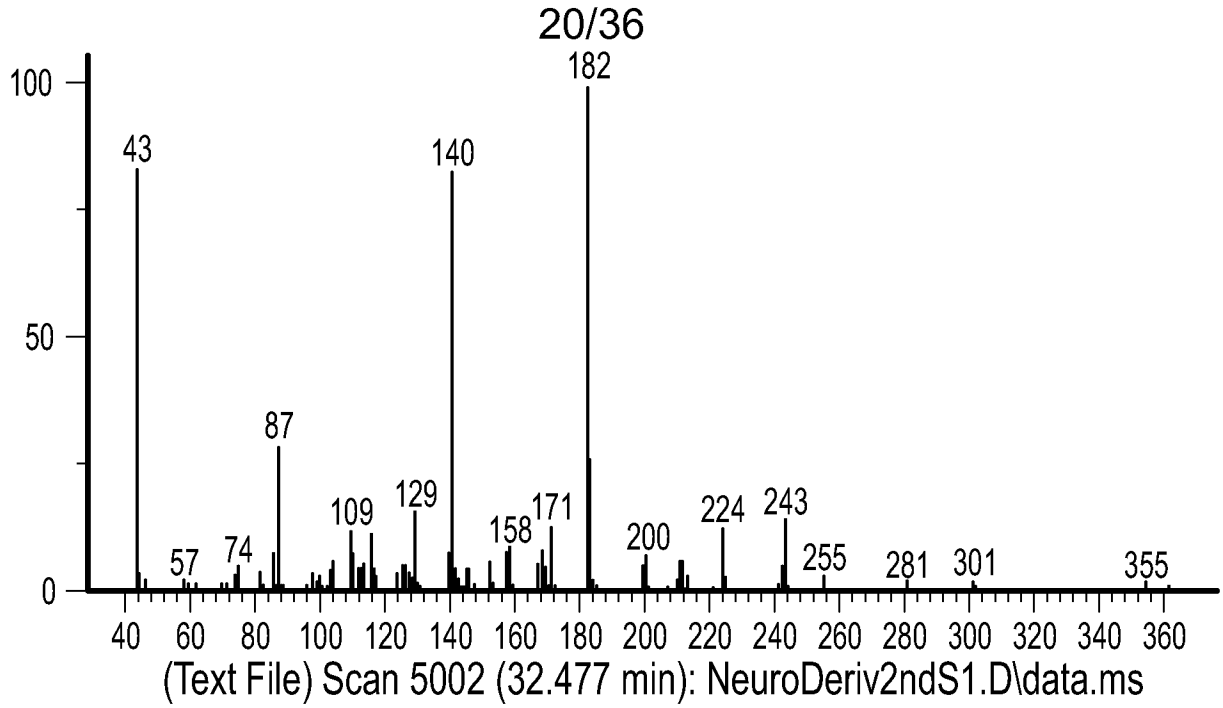
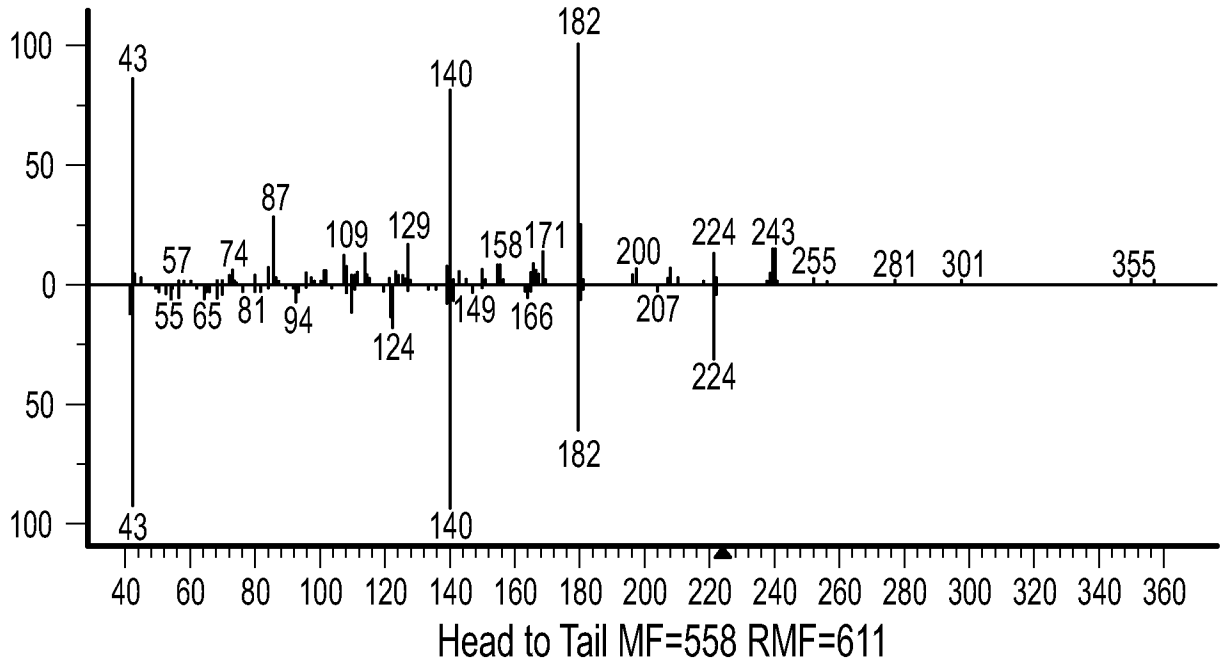

100
50
0
43
115
217
145
103
187
85
127
158
175
200
140
289
57
69
40 60 80 100 120 140 160 180 200 220 240 260 280 300
(mainlib) 1,2,3,4,5-Penta-O-acetyl-D-xylitol

FIG. 19


100
50
0
182
43
140
87
109
129
158
171
200
224
243
57
74
255
281
301
355
40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360
(Text File) Scan 5002 (32.477 min): NeuroDeriv2ndS1.D\data.ms


100
50
0
50
100
182
43
140
87
109
129
158
171
200
224
243
57
74
255
281
301
355
55 65 81 94
124
149 166
207
224
182
43
140
40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360
Head to Tail MF=558 RMF=611

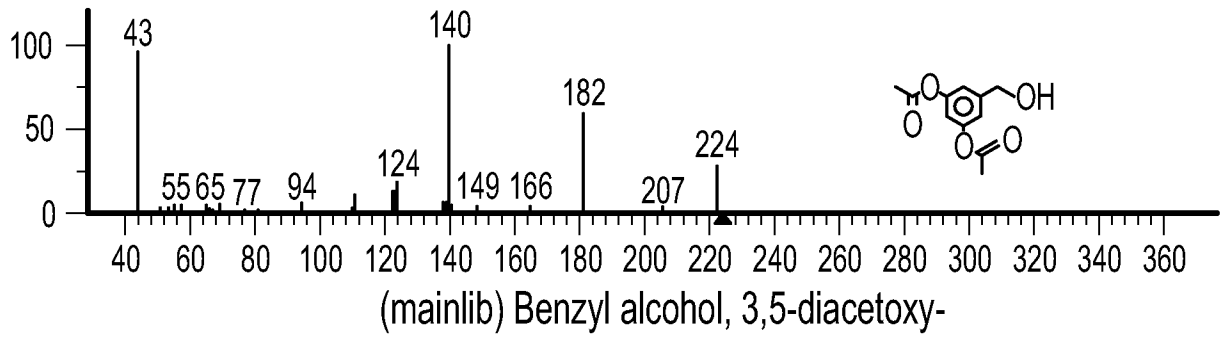
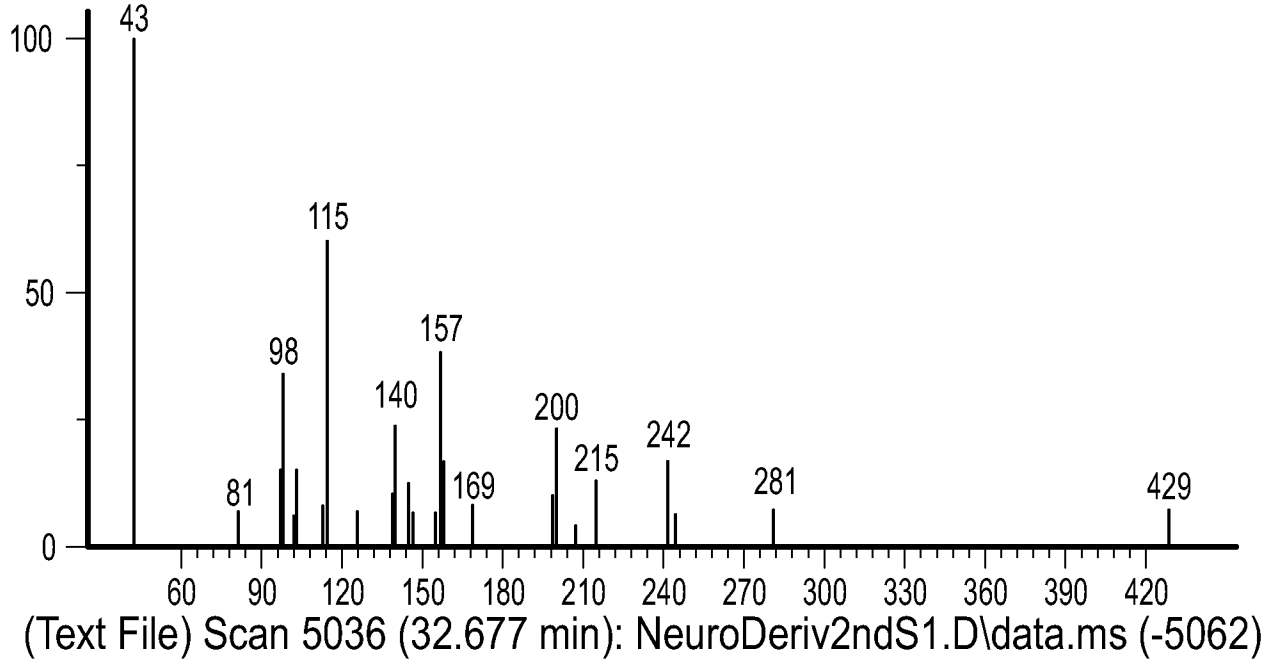
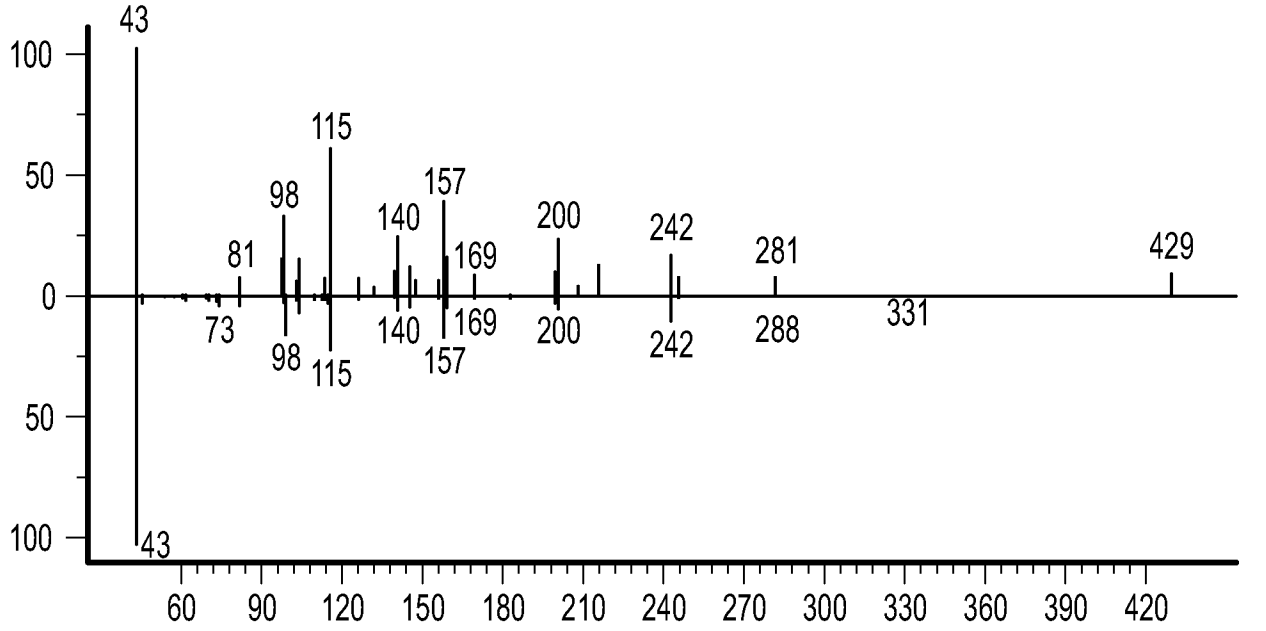

100
50
0
43
140
182
224
124
55 65 77 94
149 166
207
O
OH
O
O
40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360
(mainlib) Benzyl alcohol, 3,5-diacetoxy-

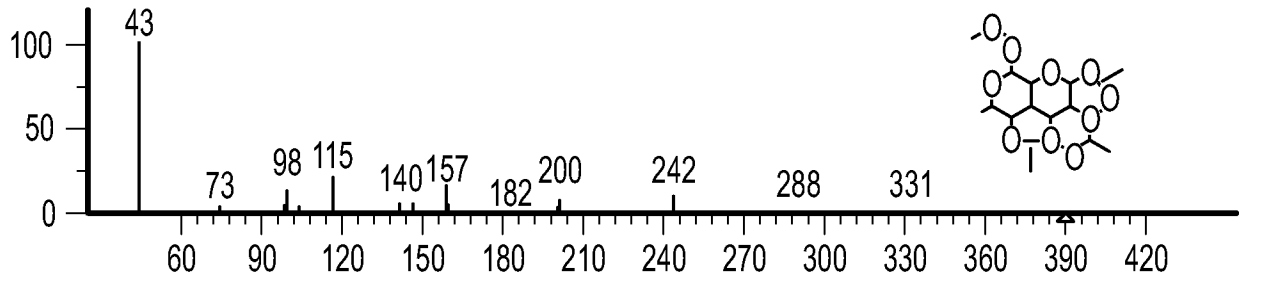
FIG. 20



(Text File) Scan 5036 (32.677 min): NeuroDeriv2ndS1.D\data.ms (-5062)



Head to Tail MF=683 RMF=746



(replib) β-D-Galactopyranose, Pentaacetate

FIG. 21

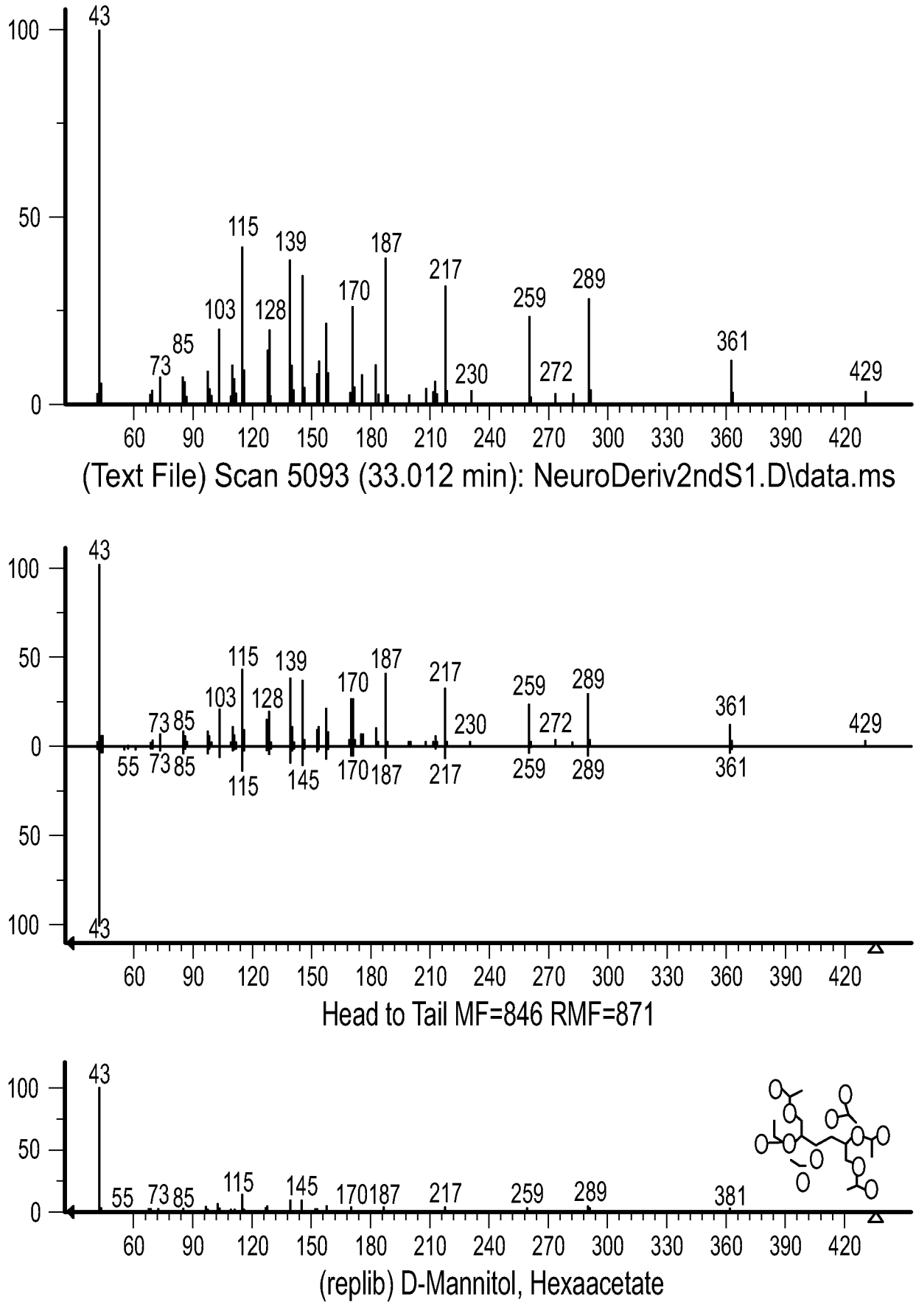
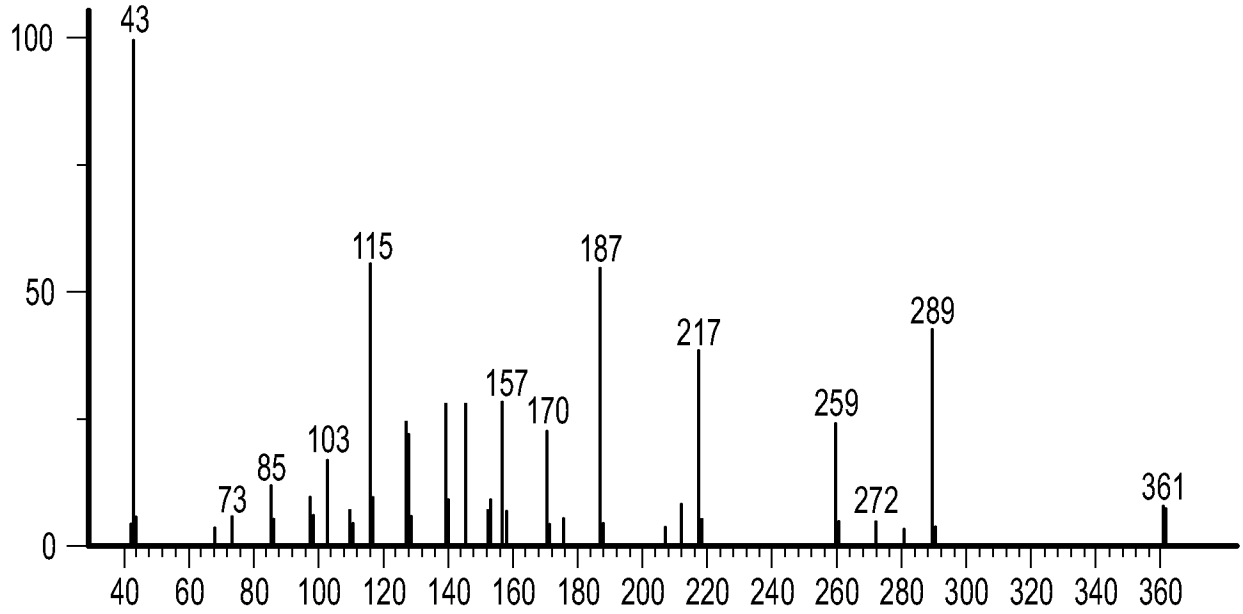
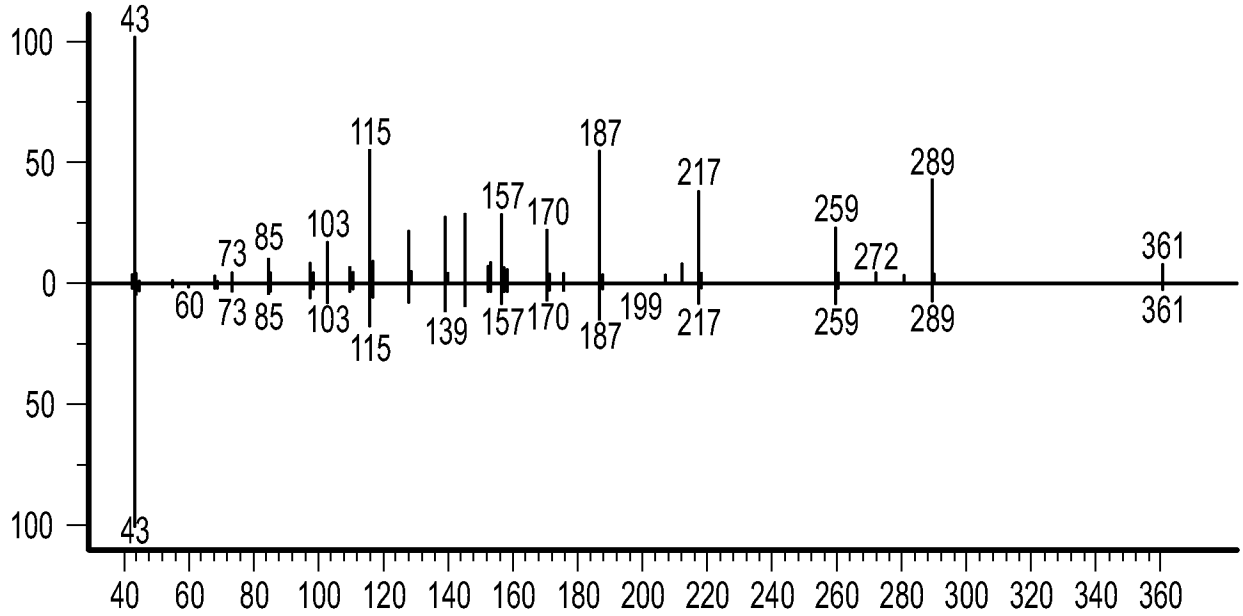

100
50
0
43
115
139
187
217
170
103
128
259
289
85
73
361
230
272
429
60 90 120 150 180 210 240 270 300 330 360 390 420
(Text File) Scan 5093 (33.012 min): NeuroDeriv2ndS1.D\data.ms
100
50
0
50
100
43
115
139
187
217
170
103
128
259
289
73 85
361
230
272
429
55 73 85
115
145
170 187
217
259
289
361
43
60 90 120 150 180 210 240 270 300 330 360 390 420
Head to Tail MF=846 RMF=871
100
50
0
43
55 73 85
115
145
170 187
217
259
289
381
60 90 120 150 180 210 240 270 300 330 360 390 420
(replib) D-Mannitol, Hexaacetate

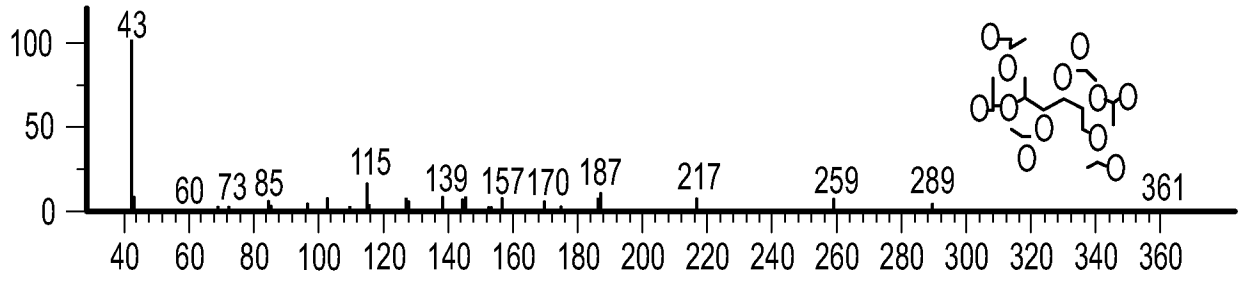
FIG. 22



(Text File) Scan 5126 (33.206 min): NeuroDeriv2ndS1.D\data.ms

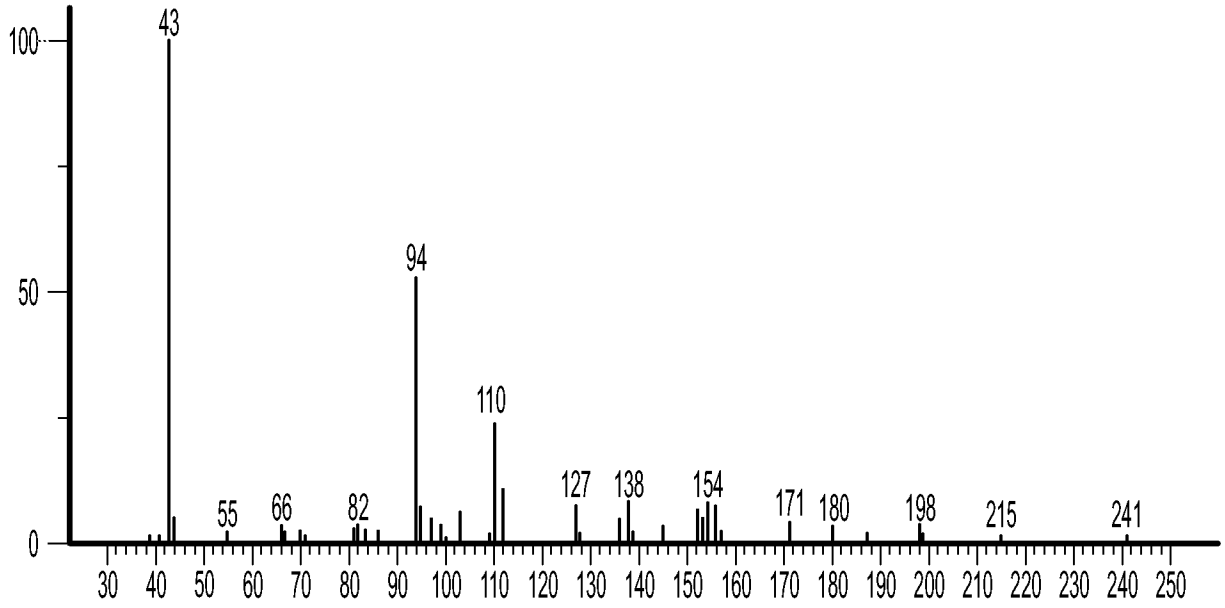


Head to Tail MF=881 RMF=901

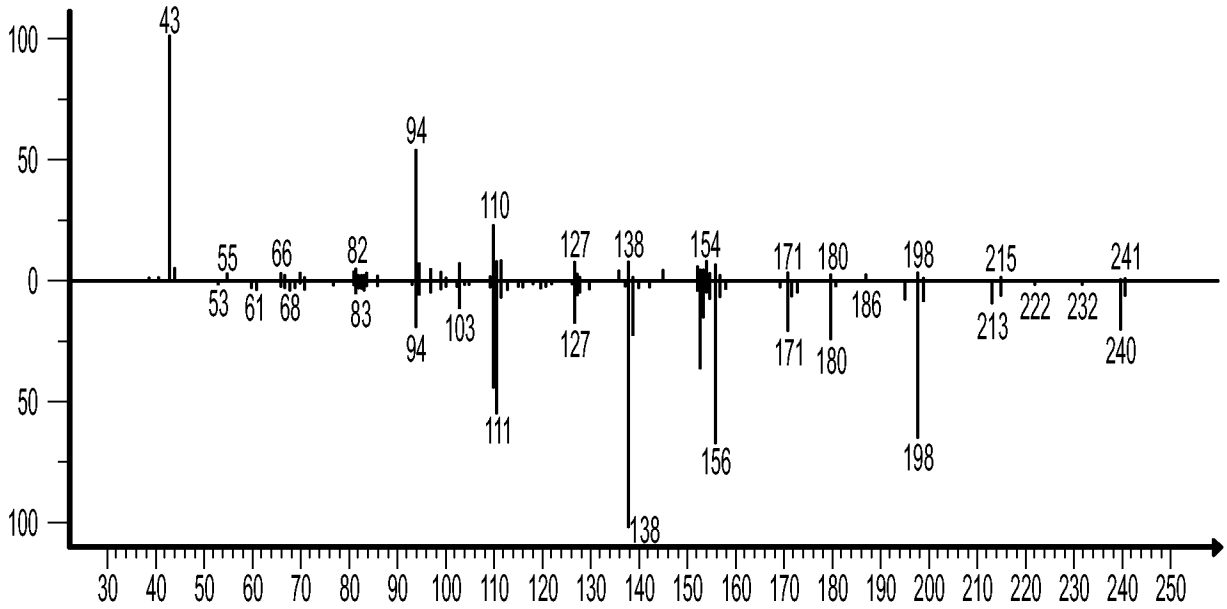


(mainlib) Galactitol, Hexaacetate

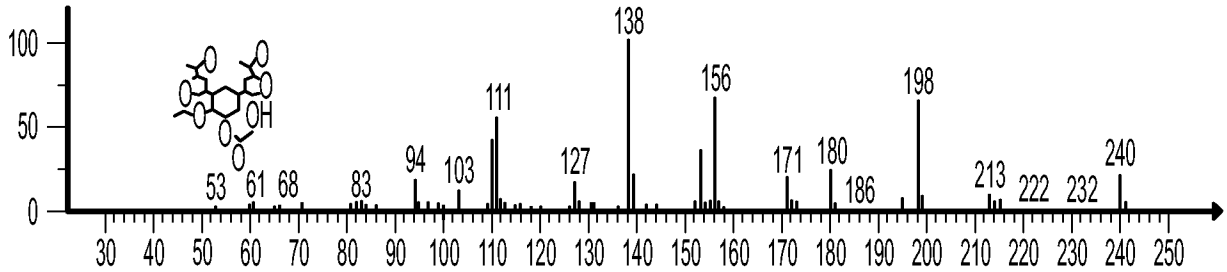
FIG. 23



(Text File) Scan 5153 (33.364 min): NeuroDeriv2ndS1.D\data.ms

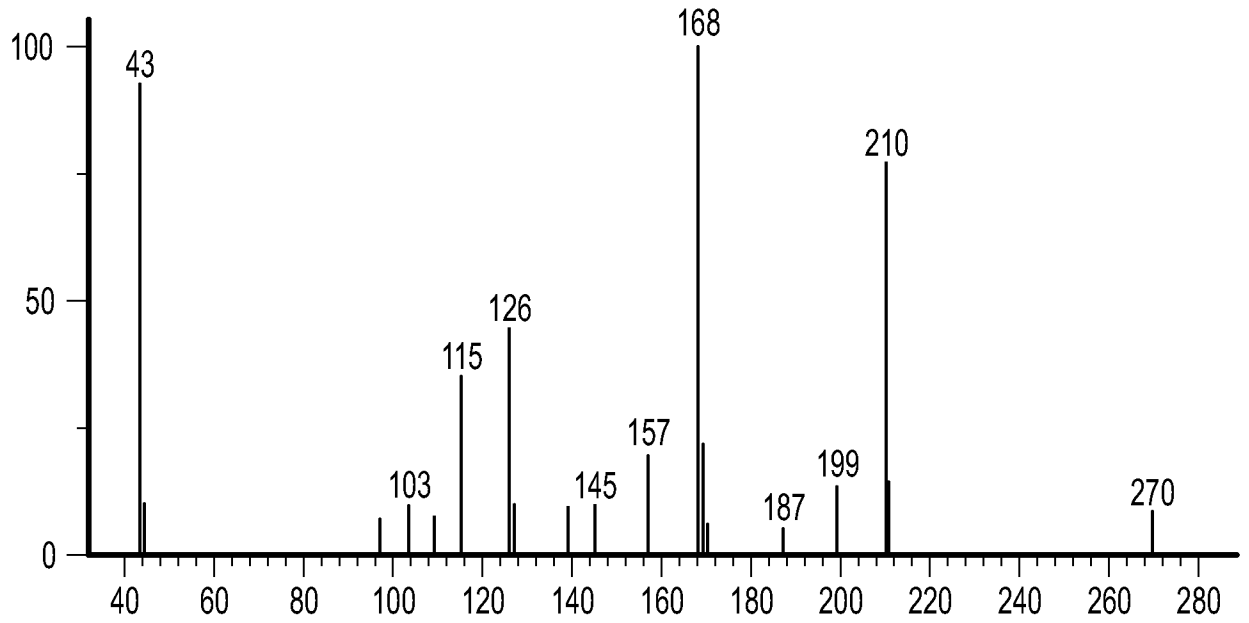


Head to Tail MF=560 RMF=560

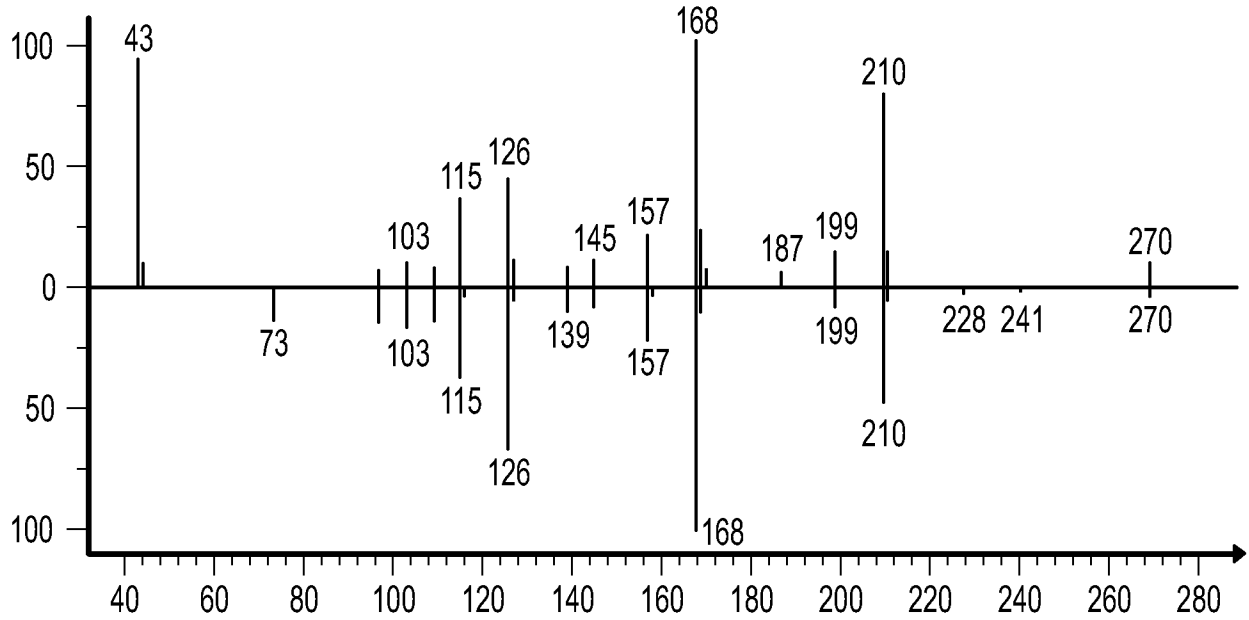


(mainlib) Cyclohexanecarboxylic Acid, 1,3,4,5-tetrakis(Acetyloxy)-, (1α,3α,4α,5β)-(-)-

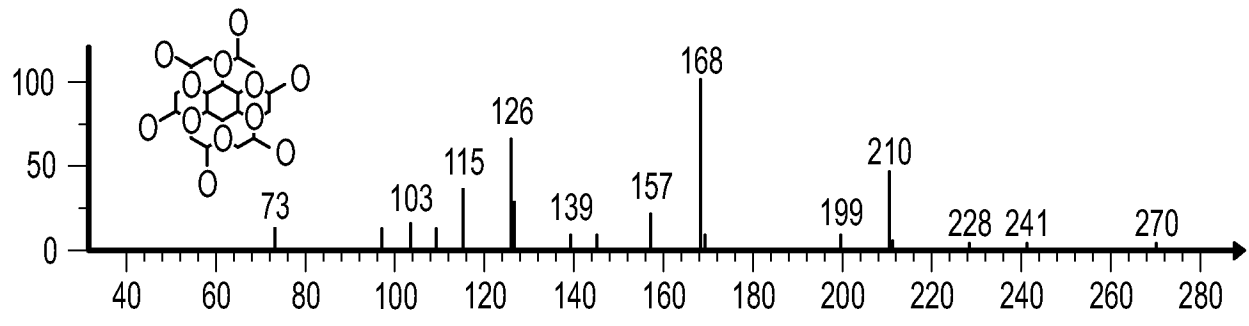
FIG. 24



(Text File) Scan 5190 (33.582 min): NeuroDeriv2ndS1.D\data.ms



Head to Tail MF=835 RMF=846



(mainlib) Muco-inositol, hexaacetate

FIG. 25

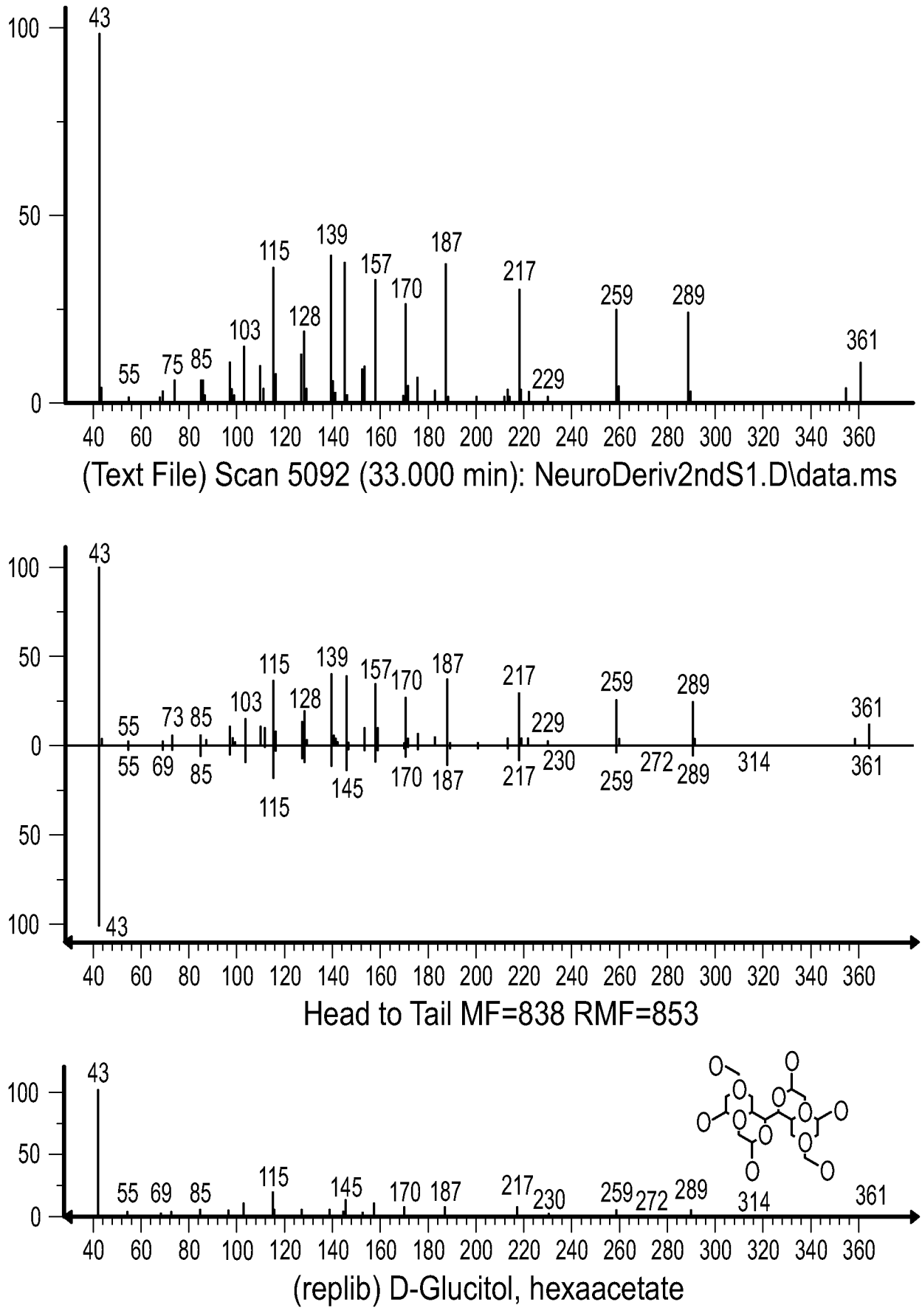

100
50
0
43
55
75
85
103
115
128
139
157
170
187
217
229
259
289
361
40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360
(Text File) Scan 5092 (33.000 min): NeuroDeriv2ndS1.D\data.ms
100
50
0
50
100
43
55
73
85
103
115
128
139
145
157
170
187
217
229
230
259
272
289
314
361
40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360
Head to Tail MF=838 RMF=853
100
50
0
43
55
69
85
115
145
170
187
217
230
259
272
289
314
361
40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360
(replib) D-Glucitol, hexaacetate

FIG. 26

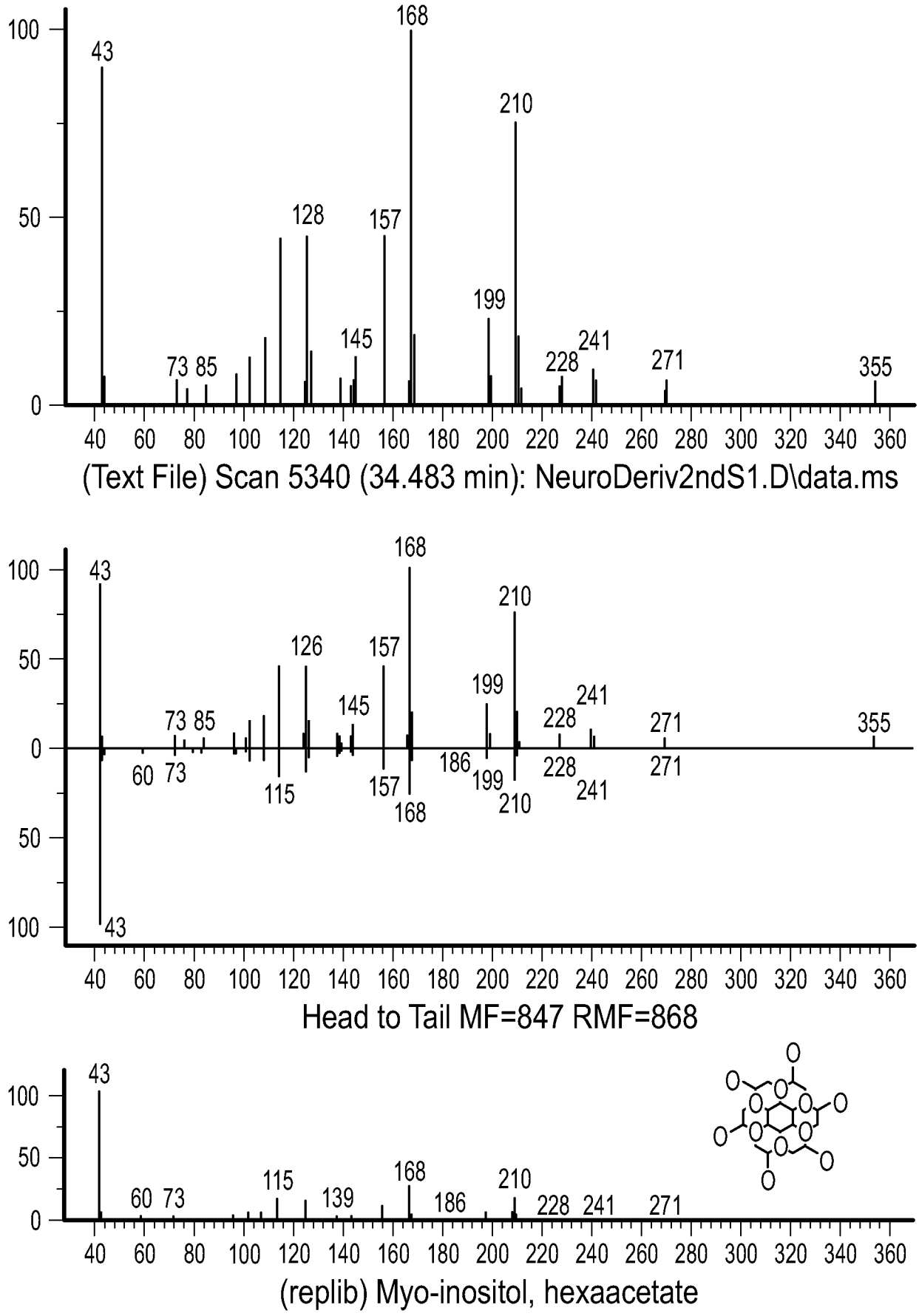

100
50
0
43
168
210
128
157
199
145
73 85
228
241
271
355
40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360
(Text File) Scan 5340 (34.483 min): NeuroDeriv2ndS1.D\data.ms
100
50
0
50
100
43
168
210
126
157
199
145
241
73 85
228
271
355
60 73
115
157
186
199
228
271
168
210
241
43
40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360
Head to Tail MF=847 RMF=868
100
50
0
43
115
168
210
60 73
139
186
228 241
271
40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360
(replib) Myo-inositol, hexaacetate

FIG. 27

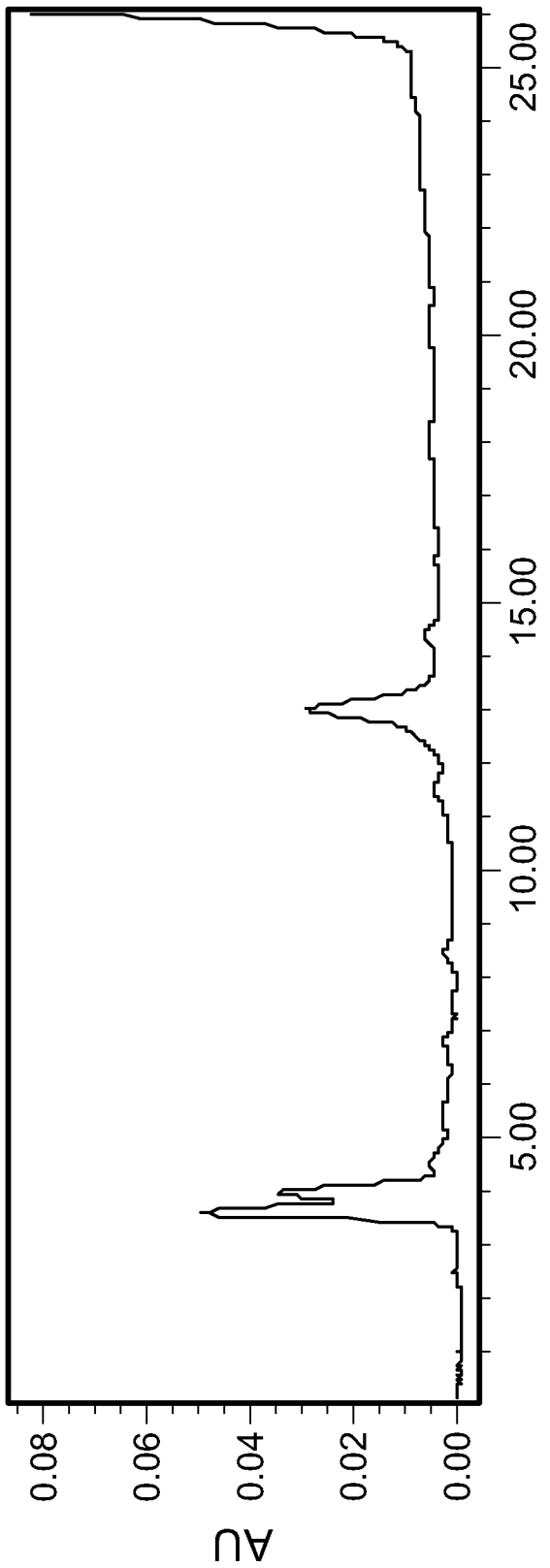


FIG. 28

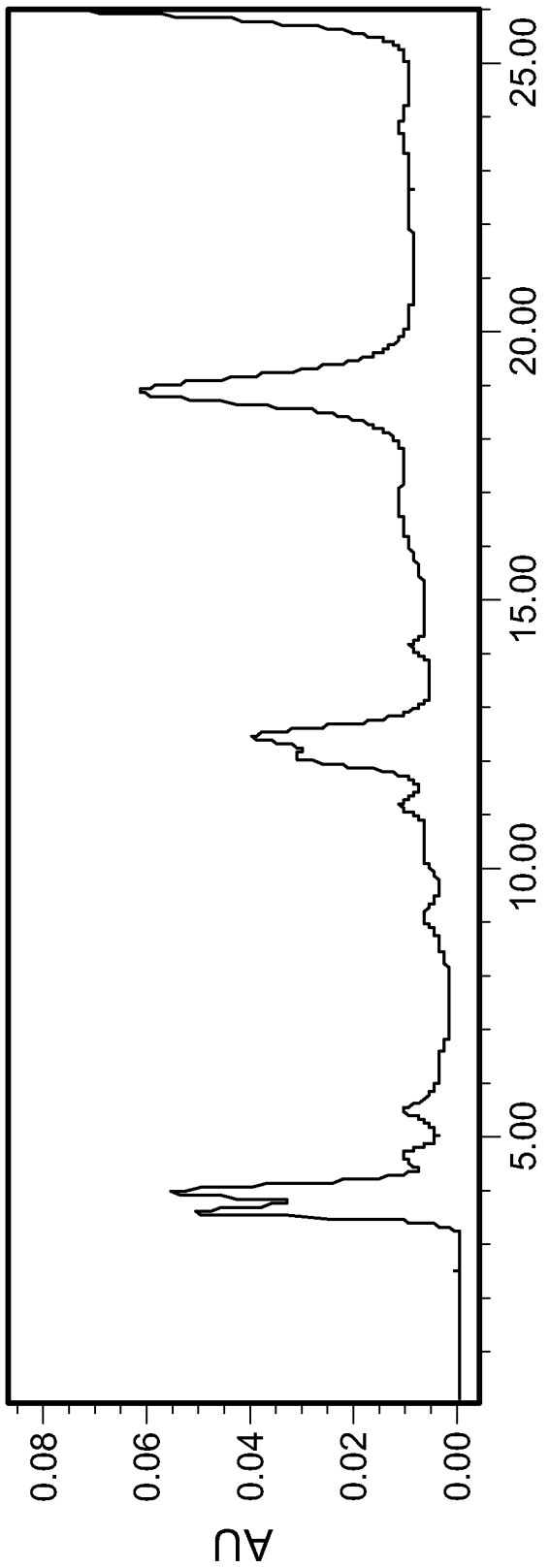
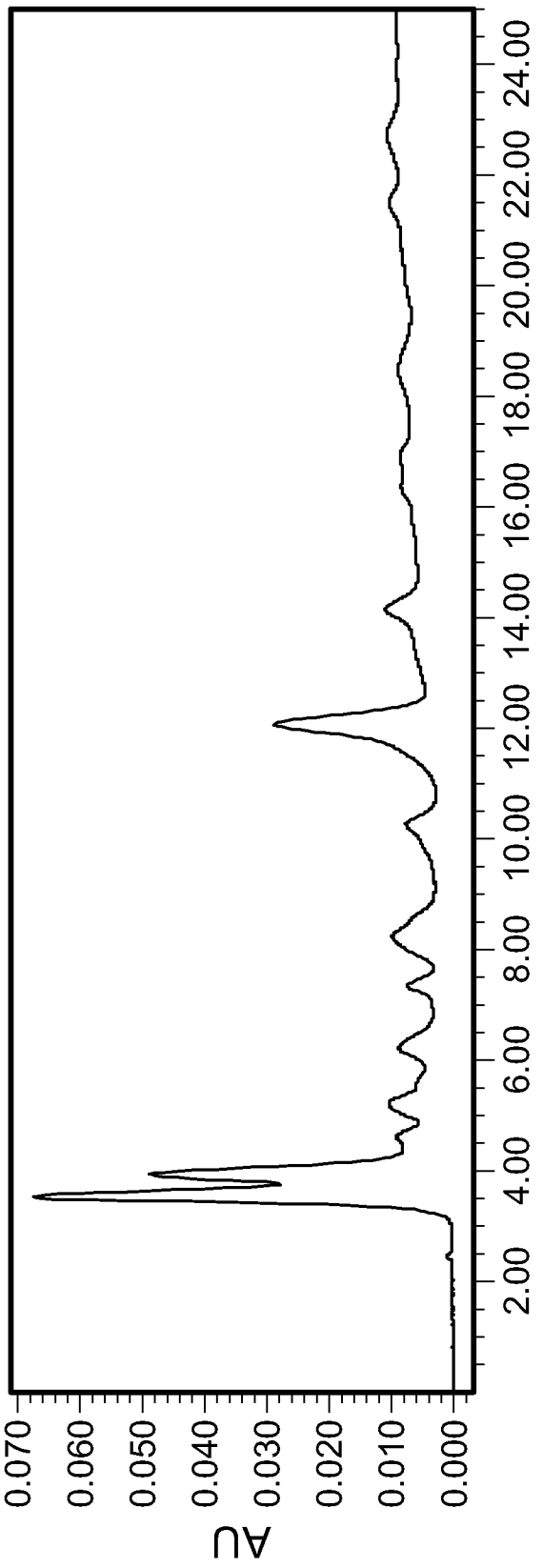


FIG. 29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0.050
0.040
0.030
0.020
0.010
0.000
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
22.00
24.00
Minutes

FIG. 30

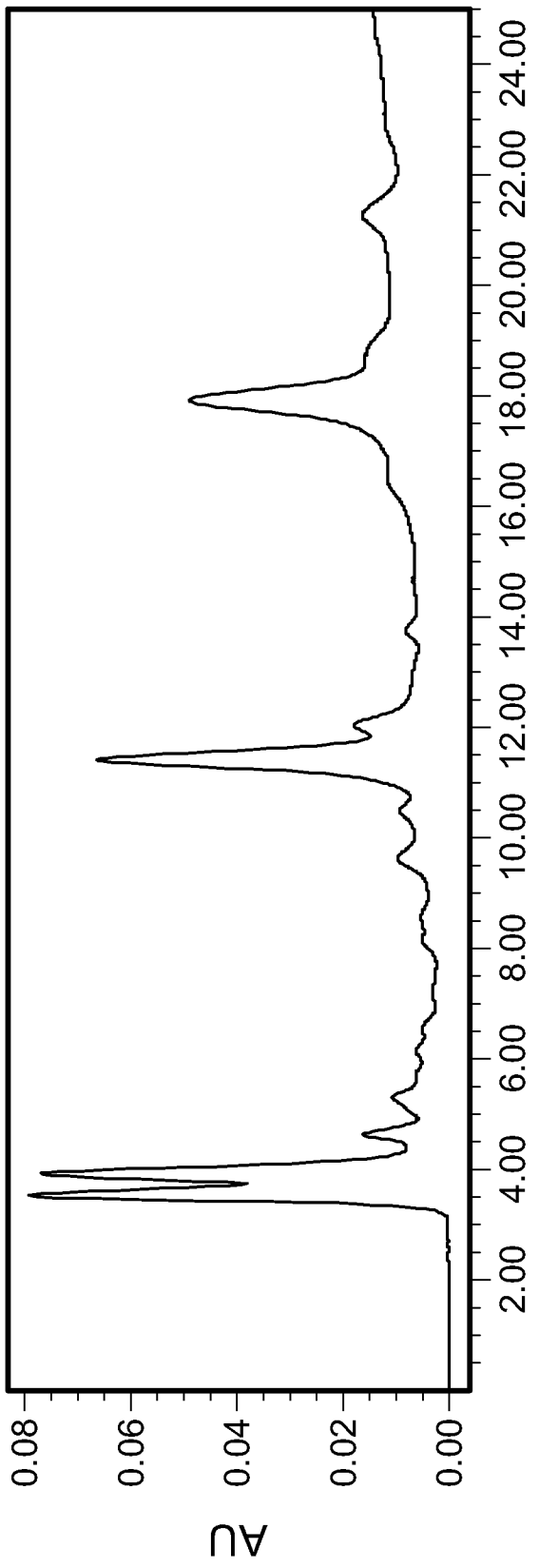
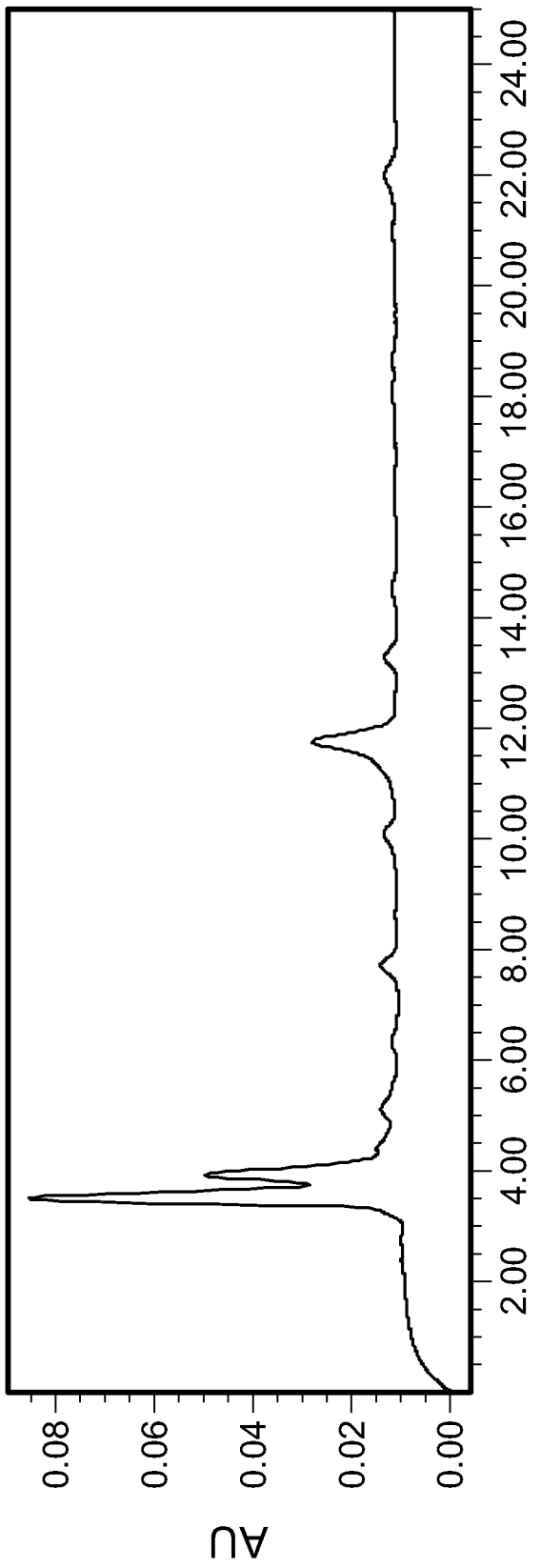

AU
0.08
0.06
0.04
0.02
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
22.00
24.00
Minutes

FIG. 31


AU
0.00
0.02
0.04
0.06
0.08
Minutes
2.00
4.00
6.00
8.00
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12.00
14.00
16.00
18.00
20.00
22.00
24.00

FIG. 32

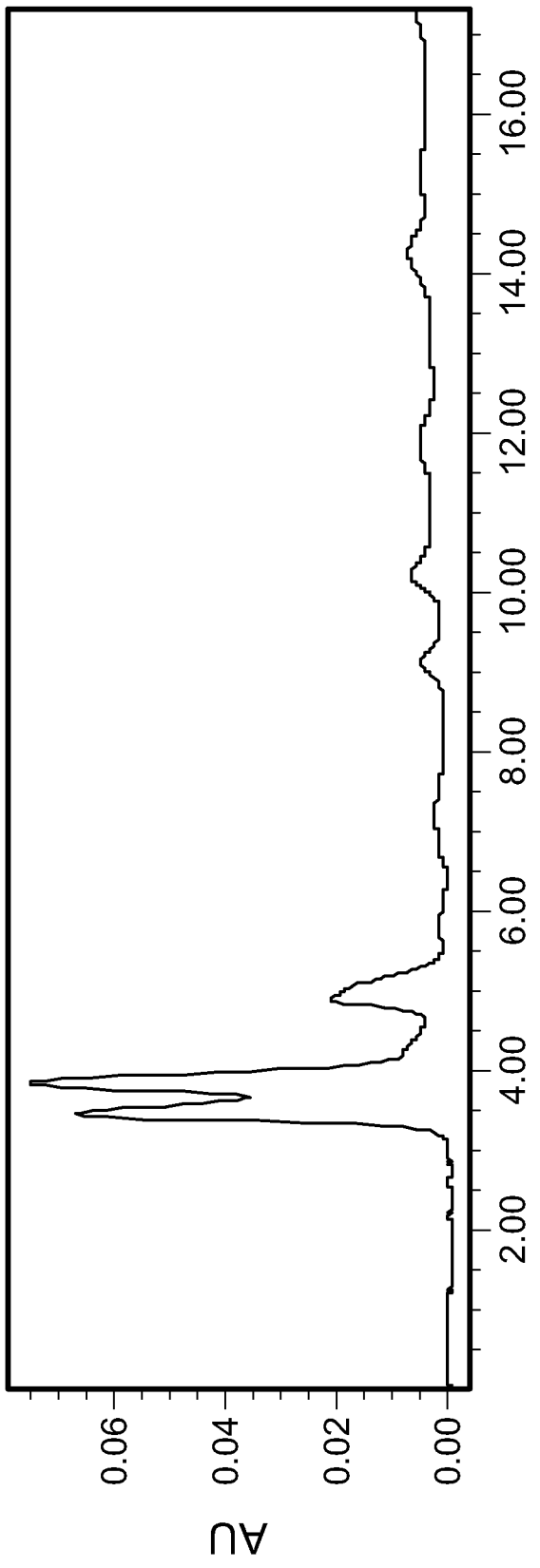


FIG. 33

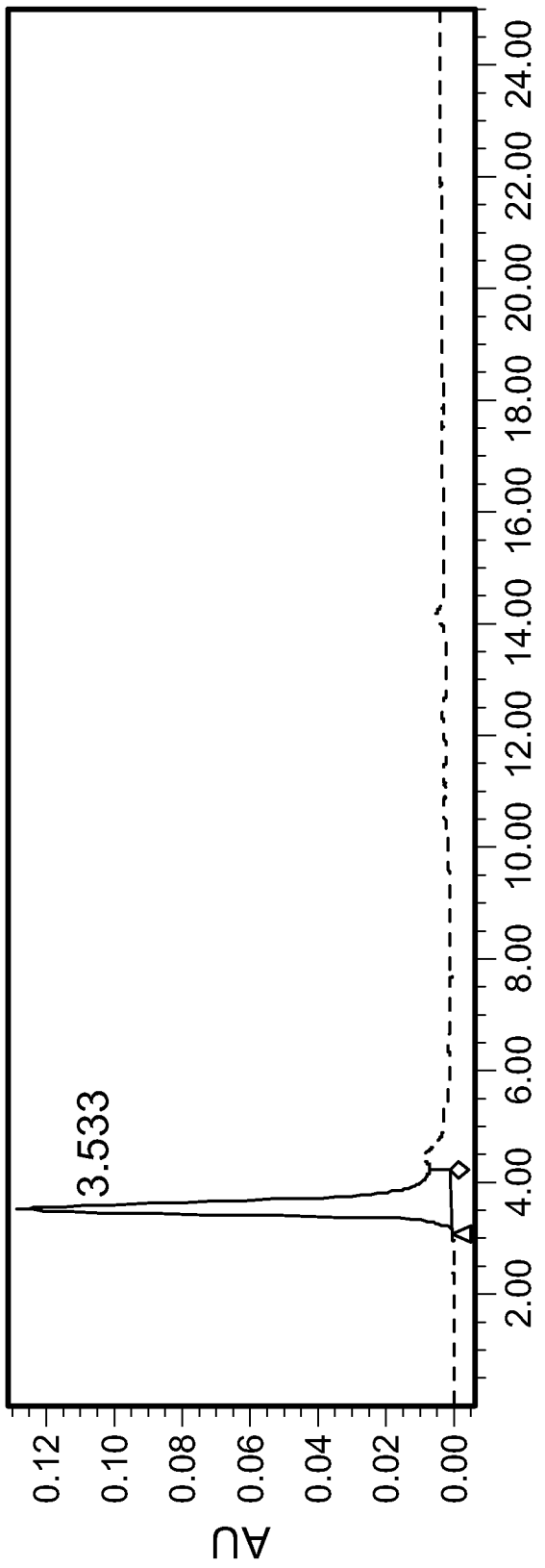
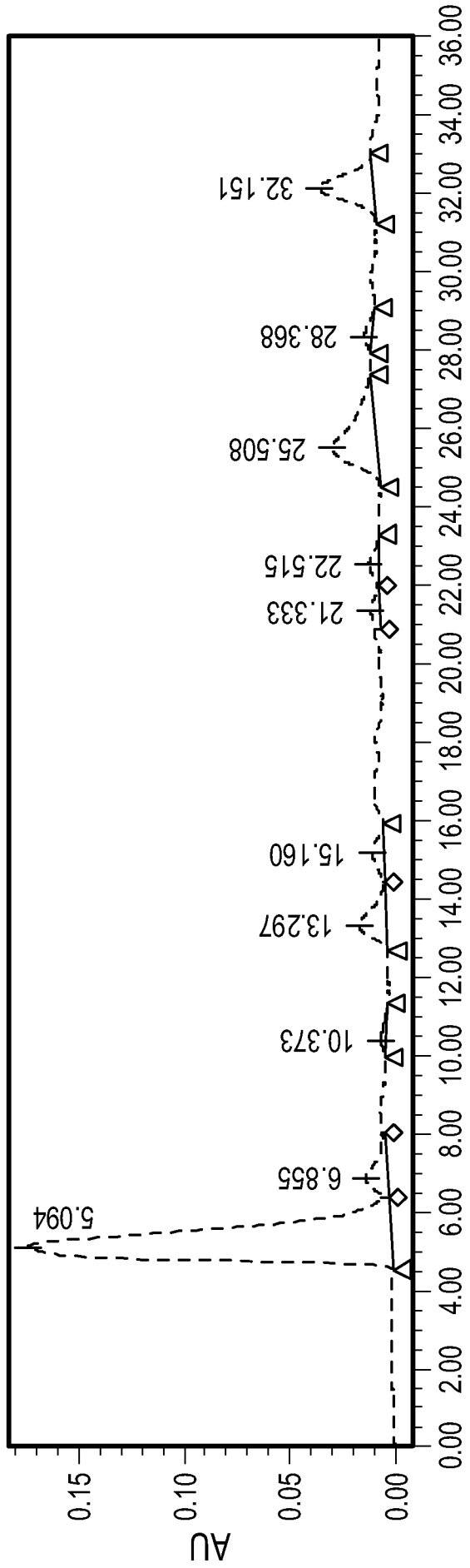

3.533
0.12
0.10
0.08
0.06
0.04
0.02
0.00
AU
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
22.00
24.00
Minutes

FIG. 34


AU
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0.00
Minutes
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
22.00
24.00
26.00
28.00
30.00
32.00
34.00
36.00
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6.855
10.373
13.297
15.160
21.333
22.515
25.508
28.368
32.151

FIG. 35

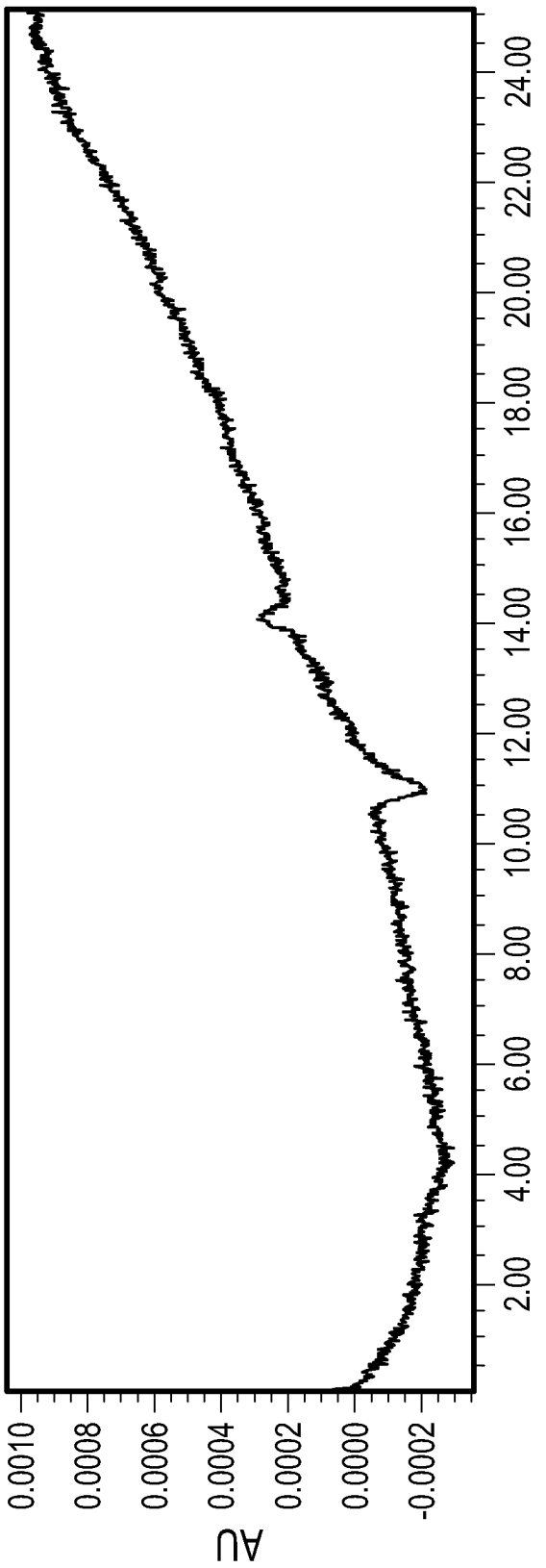
0.0010
0.0008
0.0006
0.0004
0.0002
0.0000
-0.0002
AU
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
22.00
24.00
Minutes

FIG. 36

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 13/31700

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - C07H 1/00; A61K 31/70 (2013.01)
USPC - 536/1.1; 514/23
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)
IPC(8): C07H 1/00; A61K 31/70 (2013.01)
USPC: 536/1.1; 514/23

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)
PatBase; Google Patents; Google Scholar, search terms used: potato polysaccharide composition mg/kg, raw potato carbohydrate 1.0 - 100 mg, raw potato polysaccharide therapeutic, potato polysaccharide treat obesity diabetes, raw potato FOXO IA expression, potato polysaccharide cell treatment NF KB 1 expression, potato polysaccharide alpha tocophero

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X — Y — A	WO 2011/069781 A1 (ALBERS et al.) 16 June 2011 (16.06.2011) pg 1, ln 1, pg 3, ln 16-18, pg 15, ln 29-33, pg 16, ln 11-13, ln 23- 30, pg 18, ln 4-9, pg 33, ln 4-7, pg 34, ln 7-9, ln 20-24	1-6, 10-14 ---------- 7-9, 15-28 ---------- 29, 30
X --- A Y	US 2011/0081475 A1 (HUBER et al.) 7 April 2011 (07.04.2011), para [0002], [0003], [0007], [0046], [0050], [0051], [0089], [0148] US 2008/0279984 A1 (KALUM et al.) 13 November 2008 (13.11.2013), para [0004], [0005],[0009] [0036], [0047]	31 ------ 29, 30 9, 15-28
Y	US 2008/0213400 A1 (FINE et al.) 4 September 2008 (04.09.2008), para [0037], [0045], [0046], [0156], [0159]	7, 8, 21, 22
A	US 2004/0038933 A1 (KANEKO et al.) 26 February 2004 (26.02.2004), para [0050]	1-6, 9-14, 23, 24
A	TAN et al. Regulation of mammalian pyruvate dehydrogenase alpha subunit gene expression by glucose in HepG2 cells. Biochem. J.; 15 November 1998; Vol. 336; Pt 1; pg. 49-56. Entire document, especially abstract.	29, 30

☒ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 April 2013 (26.04.2013)	23 MAY 2013
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. 571-273-3201	Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 13/31700

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 7,590,493 B2 (MENDRICK et al.) 15 September 2009 (15.09.2009), Abstract, Table 1	29, 30