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ABSTRACT

Provided herein are nicotine-containing products that also contain anatabine. Also provided are methods of making such products.
Omithine Arginine Quillinolic acid ODS ADC Putrescine Nicotinic acid N-methylputrescine N-methylα-pyrolinium Anatabine

FIG. 1
NICOTINE-CONTAINING PRODUCTS AND METHODS OF MAKING

CROSS REFERENCE TO RELATED APPLICATIONS


TECHNICAL FIELD

[0002] This disclosure generally relates to nicotine-containing products.

BACKGROUND

[0003] Tobacco is a complex mixture of compounds with many different sensorial attributes. Many compounds in tobacco and tobacco smoke play a role in the sensorial aspects of tobacco products.

SUMMARY

[0004] The present disclosure describes nicotine-containing products that also contain anatabine and methods of making such products.

[0005] In one aspect, a nicotine-containing product comprising anatabine is provided. In such a product, the ratio of anatabine to nicotine is greater than 5:95. In some embodiments, the ratio of anatabine to nicotine is greater than 10:90. In some embodiments, the ratio of anatabine to nicotine is greater than 15:85.

[0006] In some embodiments, the nicotine is synthetic nicotine. In some embodiments, the nicotine is tobacco-derived nicotine. In some embodiments, the anatabine is synthetic anatabine. In some embodiments, the anatabine is tobacco-derived anatabine.

[0007] Representative nicotine-containing products include, without limitation, a smokable product and a smokeless product. Representative smokable products include, without limitation, an e-cigarette, an electronic smoking article, and aerosolized vapor products, and a heated tobacco product. Representative smokeless products include snus, a pouch, a tab, a film, a stick, a woven product, a meltblown product, or a sintered piece. In some embodiments, such a product further includes an additive, a sweetener, a flavorant, a polymer, a fiber, filler, or a plasticizer, or combinations thereof.

[0008] In another aspect, a method of making a nicotine-containing product is provided. Such a method typically includes providing a nicotine-containing product and introducing anatabine into a nicotine-containing product in an amount such that the anatabine to nicotine ratio is greater than 5:95. In some embodiments, the ratio of anatabine to nicotine is greater than 10:90. In some embodiments, the ratio of anatabine to nicotine is greater than 15:85.

[0009] In some embodiments, the nicotine is synthetic nicotine. In some embodiments, the nicotine is tobacco-derived nicotine. In some embodiments, the anatabine is synthetic anatabine. In some embodiments, the anatabine is tobacco-derived anatabine.

[0010] 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 the methods and compositions of matter belong. Although methods and materials similar or equivalent to those described herein can be used in the practice or testing of the methods and compositions of matter, suitable methods and materials are described below. In addition, the materials, methods, and examples are illustrative only and not intended to be limiting. All publications, patent applications, patents, and other references mentioned herein are incorporated by reference in their entirety.

DESCRIPTION OF DRAWINGS

[0011] FIG. 1 shows the pathway by which nicotine and anatabine are produced.

DETAILED DESCRIPTION

[0012] This disclosure describes nicotine-containing products that, in addition to nicotine, include anatabine. Anatabine ([2R, (+)]-1,2,3,6-Tetrahydro-2,3-bipyridine) is a minor alkaloid found in tobacco. Anatabine has been shown to have affinity for nicotine acetylcholine receptors (Maciuk et al., 2008, J. Pharm. Biomed. Anal., 48:238-46) and has been shown to inhibit monoamine oxidase (U.S. Pat. No. 6,569,470) and the enzyme responsible for nicotine metabolism (Denton et al., 2004, Biochem. Pharmacol., 67:751-6). Although not bound by any particular theory, anatabine may accentuate the nicotine response by binding to the nicotine receptor; anatabine may prolong the increased levels of neurotransmitters in the brain by inhibiting monoamine oxidase; and/or anatabine may extend the time between product use by inhibiting the enzyme responsible for nicotine metabolism.

[0013] The level of anatabine in dark tobacco is typically less than about 5% of the level of nicotine, but can be as high as 7% in burley tobacco. Ratios of anatabine to nicotine can be greater than that found in cured tobacco leaf; for example, the ratio of anatabine to nicotine can be greater than about 5:95 (e.g., greater than about 6:94, 7:93, 8:92, 9:91, 10:90, 15:85, 20:80, 25:75, 30:70, 35:65, 40:60, 45:55, or 50:50 anatabine-to-nicotine).

[0014] Nicotine-containing products that include anatabine can take any number of forms, and can include, for example, smokable products (e.g., combustible smoking products, non-combustible vapor-generating products (e.g., electronic cigarettes), smokeless products, and liquid aerosol formulations for use in, e.g., an electronic smoking article. Smokeless products also can take many forms including, without limitation, disseolvable or disintegratable products (e.g., tabs, films, sticks), loose and pre-formed moist snuff (e.g., woven products, pouches, snus), and mouth-stable polymer products (e.g., meltblown products and sintered pieces). See, for example, US 2005/0244521; US 2006/0191548; US 2010/0163062; US 2010/0275936; US 2012/0024301; and US 2012/0031416; and U.S. Pat. Nos. 7,819,124; 7,918,231; 7,913,699; 7,980,251; and 7,901,512.

[0015] The nicotine in a nicotine-containing product that also includes anatabine can be tobacco-derived nicotine, synthetic nicotine, or a combination thereof. Similarly, the anatabine in such a product can be tobacco-derived anatabine, synthetic anatabine, or a combination thereof. Tobacco-derived nicotine and/or tobacco-derived anatabine generally include one or more tobacco organoleptic components in
addition to the nicotine and/or anatabine. Tobacco-derived nicotine and/or tobacco-derived anatabine can be extracted from raw tobacco (e.g., green leaf) or processed tobacco. Processed tobacco can include cured tobacco (e.g., dark air-cured, dark fire-cured, flue cured), fermented tobacco, conditioned tobacco and/or pasteurized tobacco (see, for example, U.S. Pat. Nos. 4,528,993; 4,660,577; 4,848,373; and 5,372,149, and U.S. Publication Nos. 2004/0118422 and 2005/0178398).

[Tobacco-derived nicotine and/or tobacco-derived anatabine can be obtained by mixing tobacco (i.e., raw or processed) with water or another solvent (e.g., ethanol) and removing the insoluble tobacco material. Nicotine and/or anatabine can be concentrated or purified from a tobacco extract using routine methods. Representative methods for obtaining nicotine and other alkaloids from tobacco are described, for example, in U.S. Pat. Nos. 2,162,738; 3,139,436; 3,396,735; 4,153,063; 4,448,208; 5,487,792; and 5,684,155. In addition, nicotine, anatabine, or a salt thereof, can be produced synthetically. See, for example, U.S. Pat. Nos. 4,442,292; 4,452,984; 6,995,265; 7,112,678; and 8,207,346.]

To some extent, the nicotine-containing product that includes anatabine can be substantially free of tobacco plant tissue. As used herein, the term “tobacco plant tissure” refers to processed or non-processed cellulose parts (e.g., leaves, stems) of a member of the genus *Nicotiana*, but does not include extracts of tobacco (e.g., tobacco-derived nicotine or tobacco-derived anatabine). For example, a nicotine-containing product that includes anatabine can also include one or more organoleptic components extracted from raw or processed tobacco, yet be substantially free of tobacco plant tissue.

[It would be understood by those skilled in the art that, in addition to nicotine and anatabine, a nicotine-containing product that includes anatabine as described herein also can include one or more additives, sweeteners, and/or flavorants, as well as one or more polymers, fibers, fillers, plasticizers, and/or other processing aids to provide a flavorful flavor profile and tactile experience. The following should be considered representative only and is not intended to be a comprehensive or exhaustive discussion of the components that can be found such a product.]

[One variety of flavorants can be used in a nicotine-containing product that contains anatabine. The flavorants can be natural or artificial. For example, suitable flavorants include wintergreen, cherry and berry type flavorants, various liqueurs and liquors (such as Drambuie, bourbon, scotch, and whiskey) spearmint, peppermint, lavender, cinnamon, cardamon, apium graveolens, clove, cassia, nutmeg, sandalwood, bergamot, geranium, honey essence, rose oil, vanilla, lemon oil, orange oil, Japanese mint, cassia, caraway, cognac, jasmine, chamomile, menthol, ylangylang, sage, fennel, ginger, anise, coriander, coffee, and liquorish. In some embodiments, flavorants can be encapsulated.

[A nicotine-containing product that includes anatabine as described herein can include a polymer. A polymer can be any of a number of different biocompatible and bioadhesive polymers. In some embodiments, the polymer is a thermoplastic or thermoplastic elastomer. Representative polymers include, without limitation, polyurethanes, silicon polymers, polyesters, polyacrylates, polyethylene, polypolyethylene, polystyrenes, polyetheramides, polystyrenes (e.g., acrylonitrile butadiene styrene), high impact polystyrenes (HIPS) polyvinyl alcohols, polyvinyl acetates, polyvinyl chloride, polybutyl acetates, butyl rubbers (e.g., polyisobutylacrylates), SBS, SEBS, and mixtures and copolymers thereof. In certain embodiments, the polymer can be a food-grade or medical-grade polymer (e.g., medical-grade polyurethane).]

[A nicotine-containing product containing anatabine also can include fillers such as starch, dicalcium phosphate, lactose, sorbitol, mannitol, and microcrystalline cellulose, calcium carbonate, dicalcium phosphate, calcium sulfate, clays, silica, glass particles, sodium lauryl sulfate (SLS), glycerol, palmitate, sodium benzoate, sodium stearyl fumarate, talc, and stearates (e.g., Mg or K), and waxes (e.g., glycerol monostearate, propylene glycol monostearate, and acetylated monoglycerides), stabilizers (e.g., ascorbic acid and monoster citrate, BHT, or BHA), disintegrating agents (e.g., starch, sodium starch glycolate, cross carmellose, cross linked PVP), pH stabilizers, or preservatives.]

[A nicotine-containing product that includes anatabine also can include one or more plasticizers. Plasticizers can soften the product and thus increase its flexibility. Suitable plasticizers include propylene glycol, glycerin, vegetable oil, and medium chain triglycerides. In some embodiments, the plasticizer can include phthalates. Esters of polycarboxylic acids with linear or branched aliphatic alcohols of moderate chain length can also be used as plasticizers.]

[Methods of making the nicotine-containing products described herein (e.g., combustible and smokeless nicotine-containing products) are known in the art. Methods of making such products often utilize automated or semi-automated processes, which can include cutting, pressing, shaping, tableting, rolling, dipping, coating, heating, melting, drying, sintering, melt blowing, needling, pouching, and combinations thereof. The particular product and the method by which it is made will determine when and in what form (e.g., tobacco-derived or synthetic) the anatabine is introduced. In some products and/or processes, the anatabine can be introduced prior to any processing; in other products and/or processes, the anatabine can be introduced during processing; while yet in other products and/or processes, the anatabine can be introduced after processing is complete but prior to packaging. Depending upon the source of the nicotine and at what point the nicotine is introduced, the anatabine can be introduced together with the nicotine or separately.]

[The nicotine-containing products described herein that include anatabine can be packaged in any type of conventional or non-conventional manner. For example, a plurality of nicotine-containing products that include anatabine can be packaged in a container having a lid. In other embodiments, a plurality of nicotine-containing products that include anatabine can be stacked and packaged in a paper, plastic, and/or aluminum foil tube. The packaging can have a child-resistant lid.

[In accordance with the present invention, there may be employed conventional molecular biology, microbiology, biochemical, and recombinant DNA techniques within the skill of the art. Such techniques are explained fully in the literature.

[It is to be understood that, while the methods and compositions of matter have been described herein in conjunction with a number of different aspects, the foregoing description of the various aspects is intended to illustrate and not limit the scope of the methods and compositions of matter. Other aspects, advantages, and modifications are within the scope of the following claims.]
Disclosed are methods and compositions that can be used for, can be used in conjunction with, can be used in preparation for, or are products of the disclosed methods and compositions. These and other materials are disclosed herein, and it is understood that combinations, subsets, interactions, groups, etc., of these methods and compositions are disclosed. That is, while specific reference to each various individual and collective combinations and permutations of these compositions and methods may not be explicitly disclosed, each is specifically contemplated and described herein. For example, if a particular composition of matter or a particular method is disclosed and discussed and a number of compositions or methods are discussed, each and every combination and permutation of the compositions and the methods are specifically contemplated unless specifically indicated to the contrary. Likewise, any subset or combination of these is also specifically contemplated and disclosed.

What is claimed is:

1. A nicotine-containing product comprising anatabine, wherein the ratio of anatabine to nicotine is greater than 5:95.

2. The nicotine-containing product of claim 1, wherein the ratio of anatabine to nicotine is greater than 10:90.

3. The nicotine-containing product of claim 1, wherein the ratio of anatabine to nicotine is greater than 15:85.

4. The nicotine-containing product of claim 1, wherein the nicotine is synthetic nicotine.

5. The nicotine-containing product of claim 1, wherein the nicotine is tobacco-derived nicotine.

6. The nicotine-containing product of claim 1, wherein the anatabine is synthetic anatabine.

7. The nicotine-containing product of claim 1, wherein the anatabine is tobacco-derived anatabine.

8. The nicotine-containing product of claim 1, wherein the nicotine-containing product is selected from the group consisting of a smokable product and a smokeless product.

9. The nicotine-containing product of claim 8, wherein the smokable product is selected from the group consisting of a combustible product and a non-combustible product.

10. The nicotine-containing product of claim 9, wherein the combustible product is selected from the group consisting of a cigarette and a cigar.

11. The nicotine-containing product of claim 9, wherein the non-combustible product is selected from the group consisting of a cigarette, a heated tobacco product, an aerosolized vapor product, and an electronic smoking article.

12. The nicotine-containing product of claim 8, wherein the smokeless product is selected from the group consisting of snus, a pouch, a tabs, a film, a stick, a woven product, a meltable melted product, and a sintered piece.

13. The nicotine-containing product of claim 1, further comprising an additive, a sweetener, a flavorant, a polymer, a fiber, filler, a plasticizer, or combinations thereof.

14. A method of making a nicotine-containing product, comprising:

- providing a nicotine-containing product; and
- introducing anatabine into a nicotine-containing product in an amount such that the anatabine to nicotine ratio is greater than 5:95.

15. The method of claim 14, wherein the ratio of anatabine to nicotine is greater than 10:90.

16. The method of claim 14, wherein the ratio of anatabine to nicotine is greater than 15:85.

17. The method of claim 14, wherein the nicotine is synthetic nicotine.

18. The method of claim 14, wherein the nicotine is tobacco-derived nicotine.

19. The method of claim 14, wherein the anatabine is synthetic anatabine.

20. The method of claim 14, wherein the anatabine is tobacco-derived anatabine.

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