FORM 2

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COMPLETE SPECIFICATION
(See section 10 and rule 13)

ANTIMICROBIAL TOOTHBRUSH PROTECTOR

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The following specification describes the nature of invention:

Preamble:

An antimicrobial toothbrush protector which provides a sanitizing environment for toothbrush comprising of naturally-derived antimicrobial compound which provides complete protection of toothbrush bristles.

Field of invention:

This antimicrobial toothbrush protector contains potent antimicrobial solid dosage form which helps to disinfect the bristles of toothbrush. The naturally-derived antimicrobial compound embedded in solid dosage form is released through vaporization and saturation of vapors helps to sanitize the toothbrush bristles.

Background of the invention and Prior art:

Mouth is the opening wedge of our digestive and respiratory tracts and some of these bacteria which are present on toothbrush bristles and non-sterile environment may cause infections. Daily brushing, gargling, flossing are the natural defenses adopted for good oral healthcare. Without proper toothbrush cleaning, the toothbrush bristles can become a storehouse of bacteria. Upon re-use of the infected toothbrush, its bristles can become the source to develop bacteria and fungus into the oral cavity. Therefore, this protector was developed to protect conventional and electric toothbrushes from becoming prone to bacterial contamination.

The Innovation is an antimicrobial formula for toothbrush protection made with naturally-derived actives by using different manufacturing method at different concentration. A toothbrush protector has a potential to kill or minimize the bacterial and fungal load on bristles of toothbrush. Also it is very convenient and pocket friendly for daily use and can easily be fixed on regular & electric toothbrushes. The formulation consists of components amongst the pharmaceutically acceptable ingredients such as Eucalyptus oil, Mint, Thyme, Wintergreen oil, Tea Tree oil, Clove oil, Lavender oil, Cumin oil, Lemon grass oil, Cinnamon oil, Rosemary oil, Starch, Dibasic calcium phosphate, Microcrystalline cellulose, Pregelatinized starch, Sorbitol, Calcium carbonate, Mannitol, Calcium silicate, Lactose, Sodium starch glycolate, Colloidal silicon dioxide, Talc, Magnesium stearate,

Polyethylene glycol, Hydrogenated vegetable oil, Calcium stearate, Maltodextrin, Dextrose, Maltose and Magnesium alumino metasillicate.

The prior art search does not reveal any such composition prepared earlier in past.

The prior art search reveal some findings as discussed below:

US 8672128B2 patent titled Container for sanitizing an article illustrates a case with central voids, a granular, antimicrobial agent such as thyme oil or thymol, tea tree oil, oregano oil, terpinol, eucalyptus oil, eucalyptol, clove oil, cedar wood oil, wintergreen oil and methyl salicylate or a derivative thereof. Approximate, 20% to 50 % of thymol is present in thyme oil. The case is manufactured to accommodate a part of the objects which may be toothbrush, a comb etc. This invention also describes the manufacturing method of antimicrobial granules with fragrances.

US 7246400B2 patent titled as Hygienic toothbrush with cover, features a specially designed brush cover to keep the bristles free from airborne contaminants as well as bacterial and fungal agents. It is convenient, safe and easy to use.

US 2006/0165473 A1 titled as oral care toothbrush illustrates that an oral care toothbrush comprises of a head attached to one end of the handle containing antimicrobial agents. This toothbrush is light in weight and of small size so it is easily portable.

US 2006/0029530 A1 titled with perfect toothbrush sterilize represents sterilizing container for toothbrush which will keep the toothbrush microbes free. It is made up of clear transparent glass and is easy to hold to clean.

US 5340581 patent titled with sustain release matrices for dental application describes a toothbrush with sustain releasing matrixes. The matrixes include antimicrobial agents i.e. chlorhexidine gluconate, colorant i.e. dye and water leachable substance which can be polyethylene oxide. The matrix gives a control release of antimicrobial compounds to kill the bacteria into the mouth and bristles of the toothbrush.

US 5476333 patent subjected as Hygienic toothbrush represents that brush part is carried a sterilizing agents for sterilization of toothbrush. It can be protected safely, transported easily with minimum chances of spillage of sterilizing agents and less possible chances of contamination.

US 5061106 patent titled Toothbrush with slow release of disinfectant and antibacterial agents and method of manufacturing the same describes the invention that disinfectant includes 1,3-bis(2-ethylhexyl) hexahydra-5-methyl-5-pyrimidineamine, phenol, trichlorophenyl , quaternary ammonium chloride, pyridine derivative and hexachlorophene. These antibacterial agents were entrapped in capsule, tablet and microspheres form. Polymers like gelatin, polyvinyl pyrrolidone and hydroxyethyl methacrylate were used for slow releasing effect. They also worked on toothbrush design which have a head with self-contained structured tuft holes in which the toothbrush bristles are mounted for slow releasing disinfectant effect.

WO 98/51189 patent titled as antimicrobial brush features a brush with antimicrobial properties the inhibit the microbial growth. In this invention the antimicrobial agents are suspended in either the toothbrush or body or both of them. It is cost effective, non-toxic and durable. An antimicrobial agent is insoluble in water so, that any leaching during use can be avoided.

WO 2005/112690 A2 patent titled a cover for toothbrush is related to protective enclosures for toothbrushes for maintain oral hygiene. A toothbrush cover includes first chamber enclosed with dental hygiene product and a second chamber which is enclosed with toothbrush part.

US 5960801 patent titled Toothbrush accessory or enclosure shows that toothbrush enclosure has a body having a base and a lid and a sanitizing material i.e. sterilizing tablet is placed on the compartment of the enclosure. Sanitizing material includes thymol and excipients such as dibasic calcium phosphate. The quantity of thymol may be vary as per their antimicrobial activity. Its in-vitro and in-vivo antimicrobial activity proved the efficacy of the thymol tablet.

The patent no. US 2011/0150995 A1 titled with solid dosage forms of essential oils describes the preparation of solid dosage forms (tablets or capsules) of essential oils by adsorbing essential oil in excipients. This invention links to solid dosage form containing essential oils for inhibiting or killing growth of fungal, bacterial and viral infections in human subjects.

Prior art does not include the elaborated work on purity, efficacy as well as stability of the sanitizing agent which was used for sterilization of toothbrush bristles.
Hence, this comprehensive work helps to fill a major gap in prior art. Different manufacturing methods have been used to formulate antimicrobial toothbrush protector by using different concentration of naturally-derived sanitizing agents with excipients for giving a hygienic environment to toothbrush bristles. Analytical evaluation of active agents has confirmed the purity of the naturally-derived sanitizing agents, and its in-vivo and in-vitro studies have been done to justify product effectiveness. The time span of product efficacy has been further confirmed.

Objectives:

1. The main objective of the invention was to develop naturally-derived antimicrobial formula that can sanitize or disinfect the conventional and electric toothbrush.

2. Another objective of the invention was to demonstrate the antimicrobial potency through in-vitro and in-vivo activity.

3. Another objective was to confirm the controlled release of naturally-derived disinfectant/sanitizing agent which is embedded in the solid dosage form.

4. Yet another objective was to confirm the time span of product efficacy on the basis of analytical and antimicrobial activity.

Description of invention:

The present invention relates to an antimicrobial protector for a toothbrush, to provide a hygienic environment to its bristles. Toothbrush is generally rinsed with plain water, but this method is inadequate for proper cleaning and sanitization of its bristles, because after brushing, a toothbrush is placed and re-used for several months and it usually remains moist, which becomes a favorable ground for environmental and air-borne contaminants (in bathroom) to thrive on the bristles.

This antimicrobial toothbrush protector contains potent antimicrobial solid dosage form which helps to disinfect the bristles of toothbrush. The naturally-derived antimicrobial compound embedded in solid dosage form is released through vaporization and saturation of vapors helps to sanitize the toothbrush bristles.

The comprehensive study of antimicrobial efficacy of toothbrush protector was carried out in uncontrolled environment on mouth flora of healthy volunteers. Through this study the percentage inhibition of product against microbes can be calculated. This study was continued until a declining effect in product efficacy was observed.

Major naturally-derived active components like Eucalyptol (5.5 to 110 mg), Menthol (200 to 315 mg), Mint (55 to 550 mg), Thyme (55 to 550 mg), Wintergreen oil (11 to 275 mg), Clove oil (55.5 to 110 mg), Neem oil (2.2 to 55 mg), Tea tree oil (2.2 to 55 mg), Lavender oil (2.2 to 88 mg), Cinnamon oil (2.2 to 88 mg), Rosemary oil (2.2 to 55 mg), Orange oil (2 to 100 mg) and Lemon grass oil (2.2 to 55 mg) have been used individually for solid dosage form of a total weight ranging from 600 mg to 1600 mg and these naturally-derived components are found to be effective against different organisms at different active concentration. The purity of the naturally-derived active components has been quantified by Gas Chromatography. Work is done to select the most potent vaporizable naturally-derived active components to embed in solid dosage form to have a potential to disinfectant the toothbrush bristles through sublimation.

Along with naturally-derived actives, various diluents like Starch (55 to 495 mg), Dibasic calcium phosphate (22 to 550 mg), Microcrystalline cellulose (110 to 550 mg), Polyvinylpyrrolidone (15 to 100 mg), Pregelatinized starch (22 to 165 mg), Sorbitol (55 to 330 mg), Calcium carbonate (55 to 330 mg), Mannitol (55 to 330 mg), Lactose (55 to 220 mg), Maltodextrin (35 to 275 mg), Dextrose (55 to 220 mg), Magnesium carbonate (22 to 110 mg),

Sodium starch glycolate (22 to 88 mg), Hydrogenated vegetable oil (22 to 66 mg),Calcium stearate (5.5 to 22 mg) Sodium lauryl sulphate (5.5 to 22 mg) and lubricants like Colloidal silicon dioxide (2.2 to 60 mg), Talc (11 to 110 mg), Stearic acid (22 to 55 mg) Magnesium stearate (11 to 55 mg), Polyethylene glycol (22 to 55 mg) and Magnesium alumino metasilicate (5.5 to 88 mg) were used for development of stable solid dosage form of a total weight ranging from 600 mg to1600 mg.

The product was charged in accelerated condition and room temperature for determining the time span of product efficacy and percentage loss of active components.

Example 1

A direct compression of the following materials: Thymol 350 mg, Thyme oil 150 mg, Di basic calcium phosphate 430 mg, Colloidal silicon di oxide 50 mg, Magnesium stearate 20 mg. All the above materials were mixed and passed through 40 # Sieve. The composition failed due to poor flow of powder.

Example 2

A direct compression of the following materials: Thymol 425 mg, Di basic calcium phosphate 365.50 mg, Colloidal silicon di oxide 42.5 mg, Magnesium stearate 17 mg. All the above materials were mixed, passed through 40# Sieve and compressed into a tablet. The composition failed due to low hardness of tablet.

Example 3

A direct compression of the following materials: Thymol 400 mg, Di basic calcium phosphate 150 mg, Micro crystalline cellulose 238, Colloidal silicon di oxide 8 mg, Magnesium stearate 4 mg. All the above materials were mixed, passed through 40# Sieve and compressed into a tablet. The composition failed due to undesirable thickness of tablet.

Example 4

A direct compression of the following materials: Thymol 400 mg, Menthol 150 mg, Di basic calcium phosphate 150 mg, Micro crystalline cellulose 230, Colloidal silicon di oxide 16 mg, Magnesium stearate 4 mg. All the above materials were mixed and compressed into a tablet. The composition failed due to Eutectic Mixture formation.

Example 5

A direct compression of the following materials: Thymol 400 mg, Menthol 100 mg, Di basic calcium phosphate 150 mg, Micro crystalline cellulose 230 mg, Colloidal silicon di oxide 16 mg, Magnesium stearate 4 mg. All the above materials were mixed and compressed into a tablet. The composition failed due to Eutectic Mixture formation.

Example 6

A direct compression of the following materials: Peppermint oil 8 mg, Thymol 400 mg, Magnesium Aluminometasilicate 40 mg, Di basic calcium phosphate 150 mg, Micro crystalline cellulose 230 mg, Colloidal silicon di oxide 16 mg, Magnesium stearate 8 mg. All the above materials were mixed. The composition failed due to poor flow of powder.

Example 7

A direct compression of the following materials: Thymol 385 mg, Orange oil 12 mg, Peppermint oil 2.5 mg, Di basic calcium phosphate 160 mg, Micro crystalline cellulose 179.90 mg, Colloidal silicon di oxide 52 mg, Magnesium stearate 8 mg. All the above materials were mixed and compressed into a tablet. The composition had a slight orange node and potent Thyme smell.

Example 8

A direct compression of the following materials: Thymol 300 mg, Di basic calcium phosphate 330 mg, Micro crystalline cellulose 350 mg, Colloidal silicon di oxide 10 mg, Magnesium stearate 10 mg. All the above materials were mixed, Thymol was dissolved in Isopropyl Alcohol, the solution was adsorbed on MCC 102 and air-dried. All the ingredients were passed through 40 # sieve and compressed into a tablet with desirable characteristics, but loss of 3 % of Thymol in the process was observed during analysis.

Example 9

A direct compression of the following materials: Menthol 300 mg, Di basic calcium phosphate 330 mg, Micro crystalline cellulose 350 mg, Colloidal silicon di oxide 10 mg, Magnesium stearate 10 mg. All the above materials were mixed, passed through 40 # sieve and compressed into a tablet with desirable characteristics.

Example 10

A direct compression of the following materials: Menthol 300 mg, Calcium carbonate 315 mg, Micro crystalline cellulose 350 mg, Colloidal silicon di oxide 10 mg, Magnesium stearate 10 mg. All the above materials were mixed, passed through 40 # sieve and compressed into a tablet. Di calcium phosphate is replaced with calcium carbonate. The desirable flow is not obtained.

Example 11

A granulation and compression of the following materials: Menthol 315 mg, Calcium carbonate 300 mg, polyvinylpyrrolidone 15 mg, Micro crystalline cellulose 315 mg, Colloidal silicon di oxide 10 mg, Magnesium stearate 10 mg. Calcium carbonate granules were prepared with

Polyvinypyrrolidone and water as a binder, but not achieved desirable binding and flow property.

Example 12

A granulation and compression of the following materials: Menthol 315 mg, Calcium Carbonate 300 mg, Maltodextrin 35 mg, Polyvinylpyrrolidone 35 mg, Micro crystalline cellulose 315 mg, Colloidal silicon di oxide 10 mg, Magnesium stearate 10 mg. Calcium carbonate granules were prepared with the mixture of Maltodextrin and Polyvinylpyrrolidone using water as a binder. The granules were dried and passed through 16 # Sieve. All the remaining materials were mixed, passed through 20 # sieve while Magnesium stearate was passed through 40 # sieve. The blend was sifted and compressed into a tablet. The desirable flow ~~is~~ and bulk density was obtained.

Claims:

We claim:

1. An antimicrobial Toothbrush Protector, comprising of potent antimicrobial substances and pharmaceutically acceptable excipients embedded in solid dosage form, wherein the antimicrobial substances released from solid dosage form through vaporization and saturation of vapors disinfect the toothbrush bristles.

2. An antimicrobial Toothbrush Protector as claimed in claim 1, wherein the potent antimicrobial substances are selected from a group of comprising Thymol, Menthol, Orange Oil, Tea Tree Oil, Rosemary Oil, Lemongrass Oil, Eucalyptus Oil, Lemon Oil, Cinnamon Oil and Peppermint Oil.

3. An antimicrobial Toothbrush Protector as claimed in claim 1, wherein the pharmaceutically acceptable excipients are selected from the group comprising Di basic calcium phosphate, Calcium carbonate, Maltodextrin, Polyvinylpyrrolidone, Micro crystalline cellulose, Colloidal silicon di oxide, Magnesium Aluminometasilicate and Magnesium stearate.

4. An antimicrobial Toothbrush Protector as claimed in claim 1, wherein the potent antimicrobial substance used, is Menthol.

5. An antimicrobial Toothbrush Protector as claimed in claim 2, wherein Menthol is used in quantity of 200 to 315 mg in the solid dosage form of total weight of 600 mg to 1600 mg.

6. An antimicrobial Toothbrush Protector as claimed in claim 1, wherein the pharmaceutically acceptable excipients used are Calcium carbonate in quantity 300 mg to 500 mg, Maltodextrin in quantity 30 mg to 60 mg, Polyvinylpyrrolidone in quantity 15 mg to 35 mg, Micro crystalline cellulose in quantity 150 mg to 315 mg, Colloidal silicon di oxide in quantity 10 mg to 60 mg and Magnesium stearate in quantity 4 mg to 20 mg in the solid dosage form of total weight of 600 mg to 1600 mg.

7. An antimicrobial Toothbrush Protector as claimed in claim 1, wherein the solid dosage form was analyzed for in-vitro anti-microbial activity against oral flora & bacteria *Streptococcus mutant* in comparison with Menthol as a reference standard. The relative percentage inhibition was found to be 92.59 % on oral flora and 90.90 % on bacteria *Streptococcus mutant.*

8. An antimicrobial Toothbrush Protector as claimed in claim 1, wherein the in-vivo anti-microbial efficacy of the solid dosage form against oral flora was found > 99 % on day 1 and efficacy retained till 90^{th} day at the end of study.

9. An antimicrobial Toothbrush Protector as claimed in claim 1, wherein the solid dosage form was analyzed for its potent antimicrobial substance Menthol by Gas Chromatography as per pharmacopeial method, and Menthol was identified & quantified in the formulation against standard and was found to be 99.99 % of label claim on day 1 and 72.33 % of label claim on 90^{th} day in the solid dosage form, at the end of study.

Abstract

Antimicrobial toothbrush protector:

Oral hygiene is a window to overall health, and globally the oral healthcare sector has been changing substantially in the past years. To maintain optimum oral health, toothbrush is one of the most convenient object which has been used since many years for cleaning teeth. Usually, a toothbrush is placed in an open area in the bathroom where chances of bacterial, fungal and airborne infection are very high on bristles of toothbrush, which leads to illness. Hence, it was found worth to develop an antibacterial dosage form for protecting toothbrush bristles. This invention relates to the development of an antibacterial dosage form for toothbrush protection by using naturally-derived agents, through different experimental trials. The purity of the natural actives was quantified by analytical / instrumentation techniques. Furthermore, its in-vivo and in-vitro studies were designed and conducted to prove its antibacterial efficacy. This comprehensive research work correlate the minimum effective concentration of naturally-derived actives with duration of efficacy.

Dated 28th day of February, 2023

……Digitally signed…….

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