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(54) **POLYMERIC YARN, COMPOSITION AND METHOD**

POLYMERGARN, ZUSAMMENSETZUNG UND VERFAHREN

FIL POLYMÈRE, COMPOSITION ET PROCÉDÉ

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(56) References cited:
**EP-A1- 3 342 902 CN-A- 109 183 176
US-A1- 2013 034 620**

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Description**FIELD OF THE DISCLOSURE**

5 **[0001]** The present disclosure relates especially to textile industries, and, more particularly, to a polymeric yarn and composition having antimicrobial and/or antibacterial properties.

BACKGROUND OF THE DISCLOSURE

10 **[0002]** Textile industry has conventionally been using both natural and synthetic fibers for manufacture of various products. Each having their own advantages and shortcomings related to strength, comfort, softness, longevity and the like. With ever-increasing demand to provide enhanced quality fibers manufacturers apart from enhancing traditional properties, have started incorporating more functional elements to fibers to provide better comfort, freshness, and hygiene to users. In pursuit of meeting demands of modern hygienic lifestyle, there have been several attempts to add a variety

15 of chemical agents to fabrics providing them with antimicrobial and antibacterial properties. These agents are normally applied on the surface to impart antimicrobial and antibacterial properties to the fabrics during finishing stage..

20 **[0003]** However, items made with such fabrics are unable to retain antimicrobial and antibacterial properties for long and as the compounds are washed-off during washings or ultra-violet exposure. A significant reason that these fibers are not able to provide long-term antimicrobial and antibacterial effects lies in the fact that these components are added to the fiber during the fabric finishing stage through the use of various finishing chemicals. Moreover, there is always a concern regarding use of such chemical agents and their potential after-effects on the human body. EP3342902A1 discloses a non-natural fiber or filament composition comprising an herbal masterbatch as an antimicrobial agent, a base polymer powder or a polymer, and one or more additives such as coupling agent, UV stabilizer, antioxidant, antistatic agent, colorants, pigments, and the like. CN109183176B discloses an antimicrobial fiber, which preparation involves

25 using jade powder, an anti-microbial wetting agent, and plant extract toner.

[0004] Therefore, there exists a need for innovation in relation to this technology to overcome the shortcomings prevalent in the market.

SUMMARY OF THE DISCLOSURE

30 **[0005]** In view of the foregoing disadvantages inherent in the prior art, a purpose of the present disclosure is to provide a polymeric yarn and composition having antimicrobial and/or antibacterial properties, to include all advantages of the prior art, and to overcome the drawbacks inherent in the prior art.

35 **[0006]** Therefore, an object of the present disclosure is to provide a polymeric composition or polymeric yarn made from such composition, and method of making such polymeric composition or polymeric yarn that incorporates antimicrobial and/or antibacterial properties. Preferably, the polymeric composition or polymeric yarn shows improved color fastness than previously exhibited.

[0007] Another object of the present disclosure is to provide a polymeric composition or polymeric yarn having an herbal masterbatch with herbal component therein that incorporates antimicrobial and/or antibacterial properties.

40 **[0008]** Another object of the present disclosure is to provide a method for preparing a polymeric yarn having an herbal masterbatch with herbal component therein that incorporates antimicrobial and/or antibacterial properties.

[0009] In light of the above objects, in one aspect, a polymeric composition having antimicrobial and/or antibacterial properties e.g. for textile materials is provided having the features of claim 1. The carrier polymer may be the same as the base polymer and may include at least one of: polybutylene terephthalate (PBT), polyethylene terephthalate (PET), or polyamides, polypropylene. In order to make a polymeric yarn, the herbal masterbatch and the base polymer are melted and extruded together at a temperature in a range of 175°C to 300°C to obtain the polymeric yarn having the herbal component in a range of 0.01% to 10% in weight of the polymeric yarn. Alternatively, the herbal component may be present in the final product in an amount of 0.01% to 0.9 % or from 0.02% to 0.8% in weight of the polymeric material. The herbal component is tetrahydrocurcumin (THC) or equivalent hydrogenated extract of turmeric. Such extracts have

45 been found to be more efficacious, allowing lower quantities to be used, while having better color fastness. Other items of manufacture requiring antimicrobial and/or antibacterial properties may also be produced using the polymeric composition by extrusion, molding, 3-D printing, spinning or the like.

50 **[0010]** In light of the above objects, in another aspect, a method for preparing a polymeric yarn having antimicrobial and/or antibacterial properties for textile materials is provided according to claim 11. Alternatively, the herbal component may be present in the final product in an amount of from 0.01% to 0.9 % or from 0.02% to 0.8% in weight of the polymeric material. The herbal component is tetrahydrocurcumin (THC) or equivalent hydrogenated extract of turmeric. Other items of manufacture requiring antimicrobial and/or antibacterial properties may also be produced using the polymeric composition by extrusion, molding, 3-D printing, spinning or the like.

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[0011] In one embodiment of the present disclosure, preparing the herbal masterbatch may include: (i) melting a mixture of the herbal component and the carrier polymer at a temperature in a range of 175°C to 300°C to obtain a melted homogeneous mixture of the herbal component and the carrier polymer, wherein the mixture of the herbal component and the carrier polymer comprises: Turmeric extract in the range of 1% w/w to 75% w/w, and the carrier polymer having at least one of the polybutylene terephthalate (PBT), or the poly(ethylene terephthalate) (PET), or the polyamides, or polypropylene, wherein the carrier polymer is preferably in the range of 25% w/w to 99% w/w; and (ii) solidifying the melted homogeneous mixture herbal component and the carrier polymer underwater at a temperature in a range of 4°C to 30°C to obtain the herbal masterbatch.

[0012] In light of the above objects, in another aspect, an herbal masterbatch composition is provided according to claim 14. The herbal masterbatch may be used for making a polymeric yarn, fiber or filament for textile materials as described above and hereinafter.

[0013] In the above, the yarn, polymeric composition, herbal masterbatch or item of manufacture may be colored in any suitable manner. In one preferred embodiment, a yarn, filament, fiber or other item of manufacture is colored by solution dyeing using a colored masterbatch. The colored masterbatch may be provided in an overall amount of between 0.1% and 20% by weight of the final product, preferably between 1% and 10% or between 2% and 4%. The colored masterbatch may be added separately or combined with the herbal masterbatch. The skilled person will be aware that other procedures for providing color to such components may also be performed. In particular, yarns or textiles may be dyed by any other conventional process such as vat dyeing, using any suitably dye, including but not limited to acid dyes and dispersed dyes.

[0014] This together with the other aspects of the present disclosure, along with the various features of novelty that characterize the present disclosure, is pointed out with particularity in the claims annexed hereto and forms a part of the present disclosure. For a better understanding of the present disclosure, its operating advantages, and the specified object attained by its uses, reference should be made to the accompanying drawings and descriptive matter in which there are illustrated exemplary embodiments of the present disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The advantages and features of the present disclosure will become better understood with reference to the following detailed description taken in conjunction with the accompanying drawings, in which:

FIGS. 1A to 1C illustrate various kind of yarns having herbal content therein that exhibits antimicrobial and/or antibacterial properties for textile materials, in accordance with an exemplary embodiment of the present disclosure; and

FIGS. 2A and 2B illustrate methods of making yarns of FIGS. 1A to 1C, in accordance with an exemplary embodiment of the present disclosure.

[0016] Like reference numerals refer to like parts throughout the description of several views of the drawing.

DETAILED DESCRIPTION OF THE DISCLOSURE

[0017] The exemplary embodiments described herein detail for illustrative purposes are subject to many variations in implementation. The present disclosure provides a polymeric yarn and composition having antimicrobial and/or antibacterial properties. It is understood that the teachings may equally be applied to other polymeric items of manufacture, including but not limited to filaments, fibers and molded or 3-D printed items and that various omissions and substitutions of equivalents are contemplated as circumstances may suggest or render expedient, but these are intended to cover the application or implementation without departing from the scope of the present disclosure.

[0018] The terms "a" and "an" herein do not denote a limitation of quantity, but rather denote the presence of at least one of the referenced items.

[0019] The terms "having", "comprising", "including", and variations thereof signify the presence of a component.

[0020] The term "% w / w" or wt % used herein means grams of solute dissolved in 100 grams of solution or grams per 100 grams of the whole.

[0021] The present disclosure provides a polymeric composition having antimicrobial and/or antibacterial properties that may be used in yarns, filaments and fibers for textile materials. The polymeric composition includes an herbal masterbatch and a base polymer. In one example of the present disclosure, the polymeric composition includes the herbal masterbatch in a range of 0.01% w/w to 10% w/w, and the base polymer in a range of 90% w/w to 99.99% w/w, which means that if 0.01% w/w of herbal masterbatch is used then 99.99 w/w of the base polymer may be used, and if 10% w/w of herbal masterbatch is used then 90% w/w of the base polymer may be used. In further example embodiment of the present disclosure, the polymeric composition may include the herbal masterbatch in a preferable range of 0.1%

w/w to 8% w/w, and the base polymer may be in a preferable range of 99.9 w/w % to 92% w/w, which means that if 0.1%w/w of herbal masterbatch is used then 98% w/w of the base polymer may be used, and if 8% w/w of herbal masterbatch is used then 92% w/w of the base polymer may be used. In yet another example embodiment of the present disclosure, the polymeric composition may include the herbal masterbatch in a more preferable range of 2% w/w to 5% w/w, and the base polymer may be in a most preferable range of 98% w/w to 95% w/w, which means that if 2% w/w of herbal masterbatch is used then 98% w/w of the base polymer may be used, and if 5% w/w of herbal masterbatch is used then 95% w/w of the base polymer may be used. The skilled person will be aware that the choice of the ratio of herbal masterbatch to base polymer will generally depend on the manufacturing process and the ability to accurately dose and mix the masterbatch. A more concentrated masterbatch, will require more accurate dosage and may be more susceptible to variations but will have the advantage of requiring smaller stocks of masterbatch.

[0022] The herbal masterbatch includes the herbal component that has Turmeric extract in a range of 1% to 75% w/w, preferably in a range of 10% w/w to 40% w/w; more preferably in a range of 20% w/w to 30% w/w, for example about 25% w/w or 30% w/w. Further, the herbal masterbatch, in such embodiment of the polymeric composition, may include a carrier polymer in a range of 25% w/w to 99% w/w; preferably in a range of 90% w/w to 60% w/w; more preferably in a range of 80% w/w to 70% w/w, for example about 75% w/w or 70% w/w. In one embodiment of the present disclosure, the Turmeric extract may be used in a powder form having a size of the powder in a range of 0.001 microns to 25 microns to make the herbal masterbatch. In another embodiment, the Turmeric extract may be used in a liquid form to make the herbal masterbatch. The skilled person will be aware that for herbal extracts of greater purity, a lower amount of the herbal component may be required. In particular, for THC, amounts below 1 wt % in the masterbatch may be sufficient. The herbal component may thus also be present in an amount from 0.2 wt % to 1.0 wt% or from 0.3 wt % to 1.0 wt% or around 0.5 wt %. Again, of importance is the amount of herbal component in the finished product and the concentration and amount of masterbatch may be more dependent on processing convenience and accuracy. Furthermore, the carrier polymer, in such herbal masterbatch, may be one of polybutylene terephthalate (PBT), polyethylene terephthalate (PET), polyamides or polypropylene. In one embodiment, a chemical extract of Turmeric may be used to make the herbal masterbatch. Such chemical extract that may be extracted from the Turmeric may include, but is not limited to, Curcuminoids or Curcumin in particular, tetrahydrocurcumin. One or other chemical extract of Turmeric may be used in combination or alone to obtain the effective result.

[0023] The base polymer includes one of polybutylene terephthalate (PBT) or polyethylene terephthalate (PET), or polyamides, or polypropylene. In one embodiment of the present disclosure, the polyamides may generally include Polyamide 6 (PA6) or Polyamide 66 (PA66). In one preferred embodiment of the present disclosure, the base polymer and the carrier polymer may generally be of the same polymer group in such polymeric composition.

[0024] The polymeric composition as described above may be utilized to manufacture a polymeric yarn 100 or a twisted continuous polymeric yarn 200 or a bulk continuous filament (BCF) polymeric yarn 300 as shown in FIGS. 1A, 1B and 1C. Such yarns made from the polymeric composition as described above exhibit antimicrobial and/or antibacterial properties. Those manufactured using THC also exhibit very favorable color and light fastness.

[0025] In one embodiment of the present disclosure, a block diagram of a method 400 for preparing such polymeric yarn 100 or the twisted continuous polymeric yarn 200 or the BCF yarn 300 having antimicrobial and/or antibacterial properties is illustrated in FIG. 2A. The method 400 may include, at 410, preparation of an herbal masterbatch, such as the herbal masterbatch as described above.

[0026] In one embodiment of the present disclosure, preparation of the herbal masterbatch may include certain steps, such as steps 412, 414 and 416, as shown in FIG. 2B. Preparation of the herbal masterbatch may, at 412, include mixing the herbal component having chemical extract of Turmeric, and the carrier polymer, for example, PBT, PET, polyamides, or polypropylene, in desired proportion as mentioned above. Further, at 414, the mixture of the herbal component and the carrier polymer are melted at a temperature in a range of 175°C to 300°C; preferably in a range of 200°C to 275°C; more preferably in a range of 220°C to 275°C, to obtain a melted homogeneous mixture of the herbal component and the carrier polymer. Furthermore, at 416, the melted homogeneous mixture of the herbal component and the carrier polymer, may be solidified at a temperature in a range of 4°C to 30°C to obtain the herbal masterbatch. Subsequently, as per the requirement, the herbal masterbatch may go under granulation, which involves cutting the masterbatch into granules of the size in the range of 40 chips per gram to 200 chips per gram; preferably in the range of 60 chips per gram to 100 chips per gram; more preferably in the range of 70 chips per gram to 90 chips per gram.

[0027] Referring back to FIG. 2A, at 420, the base polymer, which includes one of PBT, PET, polyamides, polypropylene is prepared in the form of granules. Furthermore, at 430 the herbal masterbatch and the base polymer are mixed together in desired ranges such as described above. Moreover, at 440, the mixture of the herbal masterbatch and the base polymer are melted and extruded at a temperature in a range of 175°C to 300°C; preferably in a range of 200°C to 290°C; more preferably in a range of 220°C to 280°C, to obtain the polymeric yarn having the herbal component in a range of 0.01% to 10%; preferably in the range of 0.01% to 1%; more preferably, in the range of 0.01% to 0.9%, by weight of the polymeric yarn.

[0028] In one embodiment of the present disclosure, the polymeric yarn 100 may be formed by a single-step continuous

process, on a single machine line, including the steps of: extruding, spinning, quenching, spin finish application, drawing, and/or texturing, cooling, intermingling and winding at the predetermined parameters. In such embodiment of the present disclosure, the mixture of the herbal masterbatch and the base polymer are melted and extruded at the gradual temperature having a range of 175°C to 300°C through a plurality of temperature zones, and at a pressure range of 60bars to 130bars. Further, the step of spinning is performed, followed by a gradual quenching, at the predetermined parameters, via, an air flow, having a quenching air flow temperature in a range of 10°C to 25°C, quenching air flow rate in a range of 0.1 m/sec to 0.4 m/sec, and quenching air flow pressure in a range of 1bars to 4bars. After quenching, spin finish application is performed. Furthermore, after the spin finish application, the spin finish application yarn is sequentially drawn at predetermined parameters, such as drawing speed and drawing temperature. In one embodiment of the present disclosure, the drawing speed may be in a range of 760mpm to 3500mpm, and the drawing temperature range may be in a range of 80°C to 190°C. Thereafter, the drawn yarn may be optionally textured at a texturing temperature range of 120°C to 190°C and a texturing vacuum pressure range of 50mbars to 150mbars. The drawn yarn may be cooled intermingled and wounded to obtain the polymeric yarn 100 having the herbal component in a range of 0.01% to 10%; preferably in a range of 1% to 8%; more preferably greater than 1% to up to 6%, on weight of the polymeric yarn.

[0029] Referring back to FIG. 2A, in one embodiment of the present disclosure, the method 400, at 430, may further include cabling or twisting the polymeric yarn in a range of 40 TPM (Twist Per Meter) to 350TPM; preferably in a range of 120TPM to 230TPM; more preferably in a range of 180TPM to 220TPM to obtain the polymeric yarn with twists 200 (hereafter may also be referred to as "twisted polymeric yarn 200"), as shown in FIG. 1B. Such twisted polymeric yarn 200 may also include the herbal component in the range of 0.01% to 10%; preferably in the range of 1% to 8%; more preferably, greater than 1% to up to 6%, on weight of the polymeric yarn.

[0030] Furthermore, in one embodiment of the present disclosure, the method 400, at 440, may further include heat setting the twists of the polymeric yarn, such as the BCF yarn 300. Heat treating may be carried out by a fluid, such as air, steam, or any other compressible liquid or vapor capable of transferring heat to the twisted yarn as it continuously travels through a heat setting device. The temperature of such fluid must be such that the yarn does not melt. If the temperature of the yarn is above the melting point of the yarn it is necessary to shorten the time in which the yarn dwells in the heat setting device. This step of heat setting utilizes such stream capable of transferring heat to the twisted yarn as it continuously travels through the heat setting device, at a temperature 100°C to 200°C; preferably 120°C to 190°C; more preferably 125°C to 190°C. This process is affected by the length of time during which the twisted yarn is exposed to the heating medium (time/temperature effect). Generally, useful exposure times are from 30 seconds to 90 seconds; preferably from 40 seconds to 60seconds.

[0031] In another aspect of the present disclosure, a polymeric yarn, such as the yarns 100, 200 and 300 may be made with an herbal component (not necessarily the herbal masterbatch) having the chemical extract of Turmeric; and the base polymer having one of PBT, PET, polyamides, polypropylene, wherein the herbal component in the polymeric yarn is in a range of 0.01% to 10%; preferably in the range of 0.01% to 1%; more preferably, in the range of 0.01% to 0.9%, by weight of the polymeric yarn. The production of pre-mixed polymeric compositions for use in manufacturing of components, including yarns, filaments, fibers and other items of manufacture, is sometimes referred to compounding. The polymeric composition is thus pre-mixed in the required proportions as disclosed above and hereinafter, including herbal component and any required color component for producing the end product.

[0032] In one embodiment of the present disclosure, the polymeric yarns, such as the yarns 100, 200 and 300 may exhibit a denier per filament (DPF) ratio measuring in a range of 0.5 DPF to 50 DPF; preferably in a range of 1 DPF to 40 DPF; more preferably in a range of 3 DPF to 20 DPF.

[0033] In one embodiment of the present disclosure, the one or more of the polymeric yarns, fibers or filaments as described above, may be used to make or be included in, various kind of textile materials, including but not limited to: floor coverings such as carpets, mats and rugs; seat coverings and upholstery; woven fabrics; knitted fabrics; tufted fabrics; fleeces; non-wovens; felts; and so forth. The present disclosure further relates to textile materials comprising fibers, filaments or yarns formed from a polymer composition comprising from 0.01 wt % to 10 wt% of a herbal component of Turmeric, in particular THC. In an embodiment, the herbal component is by weight of the textile material, which may include, but is not limited to, either one of knitted, tufted, non-woven or woven textile materials.

[0034] As tested in the lab, the textile material made from such yarns shows tremendous improvement in killing or controlling the growth of bacteria or microorganism that may flourish on textile materials. More specifically, use of the herbal composition shows tremendous improvement in killing or controlling the growth of bacteria, particularly gram positive and gram negative bacteria, or microorganism, on the textile materials by about 90% to 99.99%, as shown by various lab test presented in Table 1 below:

Table 1

Polymeric Yarn	Test done on	Herbal Masterbatch % in Yarn	Herbal component in Masterbatch (%)	Herbal Component in yarn (%)	Base Polymer in Yarn (%)	Denier	No of Filament	% Reduction in gram positive and gram negative bacteria and microorganisms
Herbal Masterbatch (Neem)+ Base polymer (PA6)	Yarn	1.00%	20.00%	0.20%	99.80%	1288	66	fabric doesn't show any antibacterial activity
Herbal Masterbatch (Neem)+ Base polymer (PA6)	Yarn	2.00%	20.00%	0.40%	99.60%	1288	66	98%
Herbal Masterbatch (Neem)+ Base polymer (PA6)	Yarn	3.00%	20.00%	0.60%	99.40%	1288	66	97%
Herbal Masterbatch (Neem)+ Base polymer (PA6)	Yarn	4.00%	20.00%	0.80%	99.20%	1288	66	97%
Herbal Masterbatch (Neem)+ Base polymer (PA6)	Yarn	4.00%	20.00%	0.80%	99.20%	1288	66	98%
Herbal Masterbatch (Neem)+ Base polymer (PBT)	Yarn	4.00%	20.00%	0.80%	99.20%	1200	120	97%
Herbal Masterbatch (Neem)+ Base polymer (PBT)	Yarn	4.00%	20.00%	0.80%	99.20%	1200	120	96%
Herbal Masterbatch (Neem)+ Base polymer (PBT)	Yarn	5.50%	20.00%	1.10%	98.90%	1200	120	97%
Herbal Masterbatch (Neem)+ Base polymer (PA6)	BCF Tuft	2.00%	20.00%	0.40%	99.60%	1288	68	94%
Herbal Masterbatch (Neem)+ Base polymer (PA6)	BCF Tuft	3.00%	20.00%	0.60%	99.40%	1288	68	96%

(continued)

Polymeric Yarn	Test done on	Herbal Masterbatch % in Yarn	Herbal component in Masterbatch (%)	Herbal Component in yarn (%)	Base Polymer in Yarn (%)	Denier	No of Filament	% Reduction in gram positive and gram negative bacteria and microorganisms
Herbal Masterbatch (Neem)+ Base polymer (PA6)	BCF Tuft	4.00%	20.00%	0.80%	99.20%	1288	68	96%
Herbal Masterbatch (Turmeric)+ Base polymer (PA6)	BCF Tuft	2.00%	6.00%	0.12%	99.88%	1200	68	90%
Herbal Masterbatch (Turmeric)+ Base polymer (PA6)	BCF Tuft	3.00%	6.00%	0.18%	99.82%	1200	68	88%
Herbal Masterbatch (Turmeric)+ Base polymer (PA6)	BCF Tuft	4.00%	6.00%	0.24%	99.76%	1200	68	93%
Herbal Masterbatch (Neem + Turmeric)+ Base polymer (PA6)	BCF Tuft	2.00%	14.00%	0.28%	99.72%	1200	68	95%
Herbal Masterbatch (Neem + Turmeric)+ Base polymer (PA6)	BCF Tuft	3.00%	14.00%	0.42%	99.58%	1200	68	94%
Herbal Masterbatch (Neem + Turmeric)+ Base polymer (PA6)	BCF Tuft	4.00%	14.00%	0.56%	99.44%	1200	68	94%
Herbal Masterbatch (Neem)+ Base polymer (PBT)	BCF Tuft	2.00%	20.00%	0.40%	99.60%	1200	120	90%
Herbal Masterbatch (Neem)+ Base polymer (PBT)	BCF Tuft	3.00%	20.00%	0.60%	99.40%	1200	120	95%
Herbal Masterbatch (Neem)+ Base polymer (PBT)	BCF Tuft	4.00%	20.00%	0.80%	99.20%	1200	120	96%

(continued)

Polymeric Yarn	Test done on	Herbal Masterbatch % in Yarn	Herbal component in Masterbatch (%)	Herbal Component in yarn (%)	Base Polymer in Yarn (%)	Denier	No of Filament	% Reduction in gram positive and gram negative bacteria and microorganisms
Herbal Masterbatch (Neem)+ Base polymer (PBT)	Heat set tuft	2.00%	20.00%	0.40%	99.60%	1200	120	97%
Herbal Masterbatch (Neem)+ Base polymer (PBT)	Heat set tuft	3.00%	20.00%	0.60%	99.40%	1200	120	91%
Herbal Masterbatch (Neem)+ Base polymer (PBT)	Heat set tuft	4.00%	20.00%	0.80%	99.20%	1200	120	93%

[0035] An exemplary test protocol according to AATCC TM100-2012 is shown for reference below. Each test was performed on 4 swatches in the form of 48 mm disks of fabric using *Staphylococcus aureus* and *Klebsiella pneumoniae*:

TEST REPORT				
			NUMBER : BOMT20016997	
			DATE : 27-Jun-2020	
TEST CONDUCTED (AS REQUESTED BY THE APPLICANT)				
1. Antimicrobial Activity [Quantitative] (AATCC 100-2012)				
Name of the test: Evaluation of Antimicrobial activity by AATCC 100-2012				
Organisms used:				
1. <i>Staphylococcus aureus</i> Strain No. ATCC 6538 (Gram Positive Bacteria) 1.7×10^5 cfu/ml				
2. <i>Klebsiella pneumoniae</i> Strain No. ATCC 4352 (Gram Negative Bacteria) 1.8×10^5 cfu/ml				
Additional Information:				
1. Sample size: 48mm discs cut from larger submitted samples				
2. No. of swatches used: 4(1 swatches per 100ml inoculation jar)				
3. Method of sterilization: Free steaming using Autoclave				
4. Inoculum Carrier: Phosphate Buffered water				
5. Neutraliser: DE Broth				
6. Contact time: 24 hrs				
7. Control sample: Sample at '0' contact time				
8. cfu: colony forming unit				
9. Percentage reduction of Microorganisms (R): $100 \times (B-A/B)$				
ANTIMICROBIAL ACTIVITY RESULTS				
Sample Identification	Test Culture	No. of colonies recovered at '0' hr [B]	No. of colonies recovered at '24' hrs [A]	Reduction of Microorganisms [R]
Hose Sample	<i>S.aureus</i>	1.62×10^5	2.8×10^3	98.27%
	<i>K. pneumoniae</i>	1.85×10^5	3.3×10^3	98.21%
INFERENCE: The Hose Sample received for antibacterial property analysis when tested as per AATCC 100 method showed 98% antibacterial activity for both bacteria.				

[0036] As presented, the present disclosure is advantageous in providing such composition, yarn or textile material that may control the growth or kills bacteria or microorganism that may flourish on textile materials. More specifically, the present disclosure is advantageous in providing such textile material that may control the growth or kills bacteria or microorganism via the herbal means that may flourish on textile materials. Furthermore, the present disclosure is advantageous in providing a method of preparing such textile material that may control the growth or kills bacteria or microorganism via the herbal means that may flourish on textile materials.

[0037] Further tests performed according to AATCC TM100-2019 have shown that the antibacterial activity is retained without significant reduction even after 50 washes. As the herbal component is provided in the form of a masterbatch, it is not subject to being washed off as may be the case with finishes and coatings.

[0038] Additionally, yarns are tested for color fastness to light according to ISO 105-B02:2014. Accordingly, polyester yarns of 1250 denier/240 filaments were extruded to include 3% of a masterbatch incorporating 2% active curcumin. The curcumin masterbatch exhibits a natural dark yellow color, which gives the yarn a light yellow tone. The resulting yarns had a total curcumin content of 0.06 % by weight. Three shades of solution or dope dyed yarn were tested, together with an undyed version (colored only by the curcumin).

[0039] The results of testing are shown in Table 2 below, illustrating consistent test results of 1-2, meaning a very poor color fastness to light.

Table 2

Polymer Type	DEN/FIL	SHADE	Herbal component	Test Method	Test Results
PET	1250 den / 240 Fil	Raw White	2% Curcumin in masterbatch, and 3% loading in spinning, effective content of curcumin in final yarn 0.06%	Colour Fastness to light (Up to grade 6) ISO 105 B02	1-2
	1250 den / 240 Fil	Light Shade (Pigmentdope dyed)			1-2
	1250 den / 240 Fil	Medium Shade (Pigmentdope dyed)			1-2
	1250 den / 240 Fil	Dark Shade (Pigmentdope dyed)			1-2

[0040] In a comparative test, polyester yarns of 1325 denier/144 filaments were extruded to include 2% of a masterbatch incorporating 3% tetrahydrocurcumin. The resulting yarns had a total THC content of 0.3 % by weight. The THC structure is without unsaturated C=C bonds compared to curcumin, thus lacking the conjugate double bonds that exhibit the yellow color. In terms of color, THC is white and the products made with THC, exhibit a natural white or light creamish color allowing colored yarns to be produced without any significant tonal deviation. Three shades of solution or dope dyed yarn were tested, together with an undyed version.

[0041] The results of testing are shown in Table 3 below, illustrating consistent test results of 6, which is a standard acceptance level in the industry for color fastness to light.

Table 3

Polymer Type	DEN/FIL	SHADE	Herbal Component	Test Method	Test Results
PET	1325 den 144 fil	Raw white	2% THC in masterbatch, and 3% loading in spinning, effective content of THC in final yarn 0.06%	Colour Fastness to light (Up to grade 6) ISO 105 B02	6
	1325 den 144 fil	Light Shade (Pigment dope dyed)			6
	1325 den 144 fil	Medium Shade (Pigment dope dyed)			6
	1325 den 144 fil	Dark Shade (Pigment dope dyed)			6

Claims

1. A polymeric yarn composition having antimicrobial and/or antibacterial properties for textile materials, the polymeric yarn composition comprising:

(i) an herbal masterbatch, preferably in a range of 0.01% w/w to 10% w/w, the herbal masterbatch comprising:

(a) an herbal component having hydrogenated extract of Turmeric, preferably in a range of 1% w/w to 75% w/w, and

(b) a carrier polymer having at least one of: polybutylene terephthalate (PBT), polyethylene terephthalate (PET), or polyamides, polypropylene, wherein the carrier polymer is preferably in a range of 25% w/w to 99% w/w; and

(ii) a base polymer having one of polybutylene terephthalate (PBT) or polyethylene terephthalate (PET), or polyamides, or polypropylene, preferably in a range of 90% w/w to 99.99% w/w,

wherein the herbal masterbatch and the base polymer are melted and extruded together at a temperature in a range of 175°C to 300°C to obtain a polymeric yarn having the herbal component in a range of 0.01% to 10% in weight of the polymeric yarn.

2. The polymeric yarn composition of claim 1, wherein the polymeric yarn is configured to reduce gram positive and gram negative bacteria and microorganisms by about 85% to 99.99%.

3. The polymeric yarn composition of claim 1, wherein the textile materials made from the polymeric yarn includes floor covering materials.

4. The polymeric yarn composition of claim 1, wherein the textile materials made from the polymeric yarn comprise either one of knitted, tufted, or woven textile materials.

5. The polymeric yarn composition of claim 1, wherein the hydrogenated extract of Turmeric is used in a powder form, and wherein a size of the powder is in a range of 0.001 microns to 25 microns.

6. The polymeric yarn composition of claim 1, wherein the hydrogenated extract of Turmeric is used in a liquid form.

7. The polymeric yarn composition of claim 1, wherein the polyamides comprise PA6 or PA66.

8. The polymeric yarn composition of claim 1, wherein the polymeric yarn exhibits a denier per filament (DPF) ratio measuring in a range of 0.5 DPF to 50 DPF.

9. The polymeric yarn composition of claim 1, wherein the polymeric yarn is cabled with at least 1 ply between 40 TPM (Twist Per Meter) to 350TPM to obtain a polymeric yarn with twists.

10. The polymeric yarn composition of claim 9, wherein the polymeric yarn with twists is heat set.

11. A method for preparing a polymeric yarn having antimicrobial and/or antibacterial properties for textile materials, the method comprising:

preparing an herbal masterbatch, wherein the herbal masterbatch comprises: an herbal component having hydrogenated extract of Turmeric, preferably in a range of 1% w/w to 75% w/w, and a carrier polymer having at least one of polybutylene terephthalate (PBT), or poly(ethylene terephthalate) (PET), polyamides, or polypropylene, wherein the carrier polymer is preferably in a range of 25% w/w to 99% w/w; mixing the herbal masterbatch in a preferred range of 0.01% w/w to 10% w/w, and a base polymer in a preferred range of 90% w/w to 99.99% w/w, wherein the base polymer comprises one of polybutylene terephthalate (PBT) or polyethylene terephthalate (PET), or polyamides, or polypropylene; and melting and extruding the mixture of the herbal masterbatch and the base polymer at a temperature in a range of 175°C to 300°C to obtain the polymeric yarn having the herbal component in a range of 0.01% to 10% on weight of the polymeric yarn.

12. The method of claim 11, wherein preparing the herbal masterbatch comprises:

melting a mixture of the herbal component and the carrier polymer at a temperature in a range of 175°C to 300°C to obtain a melted homogeneous mixture of the herbal component and the carrier polymer, wherein the mixture of the herbal component and the carrier polymer comprises: hydrogenated extract of Turmeric in the range of 1% w/w to 75% w/w, and the carrier polymer having at least one of the polybutylene terephthalate (PBT), or the poly(ethylene terephthalate) (PET), or the polyamides, or polypropylene, wherein the carrier polymer is in the range of 25% w/w to 99% w/w; and solidifying the melted homogeneous mixture herbal component and the carrier polymer underwater at a temperature in a range of 4°C to 30°C to obtain the herbal masterbatch.

13. The method of claim 12 further comprising:

cabling the polymeric yarn in a range of 40 TPM (Twist Per Meter) to 350TPM to obtain the polymeric yarn with twists, and
heat setting the twists of the polymeric yarn.

- 5 14. An herbal masterbatch composition for making a polymeric yarn for textile materials, the herbal masterbatch composition comprising:

an herbal component having hydrogenated extract of Turmeric in a range of 1% w/w to 75% w/w; and
a carrier polymer having at least one of:

10 polybutylene terephthalate (PBT),
polyethylene terephthalate (PET), or
polyamides, or
polypropylene,

15 wherein the carrier polymer is in a range of 25% w/w to 99% w/w.

- 20 15. The herbal masterbatch composition of claim 14, wherein the herbal composition having the hydrogenated extract of Turmeric is in powder form, and the size of the powder is in a range of 0.001 microns to 25 microns.

Patentansprüche

- 25 1. Polymere Garnzusammensetzung mit antimikrobiellen und/oder antibakteriellen Eigenschaften für Textilmaterialien, wobei die polymere Garnzusammensetzung umfasst:

(i) ein pflanzliches Masterbatch, bevorzugt in einem Bereich von 0,01% w/w bis 10% w/w, wobei das pflanzliche Masterbatch umfasst:

30 (a) eine pflanzliche Komponente mit hydriertem Extrakt von Kurkuma, bevorzugt in einem Bereich von 1% w/w bis 75% w/w, und
(b) ein Trägerpolymer mit mindestens einem von: Polybutylenterephthalat (PBT), Polyethylenterephthalat (PET) oder Polyamiden, Polypropylen, wobei das Trägerpolymer bevorzugt in einem Bereich von 25% w/w bis 99% w/w liegt; und

35 (ii) ein Basispolymer mit einem von Polybutylenterephthalat (PBT) oder Polyethylenterephthalat (PET) oder Polyamiden oder Polypropylen, bevorzugt in einem Bereich von 90% w/w bis 99,99% w/w,

40 wobei das pflanzliche Masterbatch und das Basispolymer geschmolzen und zusammen bei einer Temperatur im Bereich von 175°C bis 300°C extrudiert werden, um ein polymeres Garn zu erhalten, das die pflanzliche Komponente in einem Bereich von 0,01 Gew.-% bis 10 Gew.-% des polymeren Garns aufweist.

- 45 2. Polymere Garnzusammensetzung nach Anspruch 1, wobei das polymere Garn so konfiguriert ist, dass grampositive und gramnegative Bakterien und Mikroorganismen um etwa 85 % bis 99,99 % reduziert werden.

3. Polymere Garnzusammensetzung nach Anspruch 1, wobei die aus dem polymeren Garn hergestellten Textilmaterialien Bodenbelagsmaterialien umfassen.

- 50 4. Polymere Garnzusammensetzung nach Anspruch 1, wobei die aus dem Polymergarn hergestellten Textilmaterialien entweder gestrickte, getuftete oder gewebte Textilmaterialien umfassen.

5. Polymere Garnzusammensetzung nach Anspruch 1, wobei der hydrierte Extrakt von Kurkuma in Pulverform verwendet wird und wobei die Größe des Pulvers im Bereich von 0,001 Mikrometer bis 25 Mikrometer liegt.

- 55 6. Polymere Garnzusammensetzung nach Anspruch 1, wobei der hydrierte Extrakt von Kurkuma in flüssiger Form verwendet wird.

7. Polymere Garnzusammensetzung nach Anspruch 1, wobei die Polyamide PA6 oder PA66 umfassen.

8. Polymere Garnzusammensetzung nach Anspruch 1, wobei das polymere Garn ein Verhältnis von Denier pro Filament (DPF) aufweist, das im Bereich von 0,5 DPF bis 50 DPF liegt.

9. Polymere Garnzusammensetzung nach Anspruch 1, wobei das polymere Garn mit mindestens einem Zwirn zwischen 40 TPM (Twist Per Meter) und 350TPM verdreht ist, um ein polymeres Garn mit Zwirnen zu erhalten.

10. Polymere Garnzusammensetzung nach Anspruch 9, wobei das polymere Garn mit Zwirnen thermofixiert ist.

11. Verfahren zur Herstellung eines polymeren Garns mit antimikrobiellen und/oder antibakteriellen Eigenschaften für Textilmaterialien, wobei das Verfahren umfasst:

Herstellen eines pflanzlichen Masterbatches, wobei das pflanzliche Masterbatch umfasst: eine pflanzliche Komponente mit hydriertem Extrakt von Kurkuma, bevorzugt in einem Bereich von 1% w/w bis 75% w/w, und ein Trägerpolymer mit mindestens einem von Polybutylenterephthalat (PBT) oder Polyethylenterephthalat (PET), Polyamiden oder Polypropylen, wobei das Trägerpolymer bevorzugt in einem Bereich von 25% w/w bis 99% w/w liegt;

Mischen des pflanzlichen Masterbatches in einem bevorzugten Bereich von 0,01% w/w bis 10% w/w und eines Basispolymers in einem bevorzugten Bereich von 90% w/w bis 99,99% w/w, wobei das Basispolymer eines von Polybutylenterephthalat (PBT) oder Polyethylenterephthalat (PET) oder Polyamide oder Polypropylen umfasst; und

Schmelzen und Extrudieren der Mischung aus dem pflanzlichen Masterbatch und dem Basispolymer bei einer Temperatur in einem Bereich von 175°C bis 300°C, um das polymere Garn zu erhalten, das die pflanzliche Komponente in einem Bereich von 0,01 Gew.-% bis 10 Gew.-% des polymeren Garns aufweist.

12. Verfahren nach Anspruch 11, wobei die Herstellung des pflanzlichen Masterbatches umfasst:

Schmelzen einer Mischung aus der pflanzlichen Komponente und dem Trägerpolymer bei einer Temperatur im Bereich von 175°C bis 300°C, um eine geschmolzene homogene Mischung aus der pflanzlichen Komponente und dem Trägerpolymer zu erhalten, wobei die Mischung aus der pflanzlichen Komponente und dem Trägerpolymer umfasst: hydrierten Extrakt von Kurkuma im Bereich von 1% w/w bis 75% w/w und das Trägerpolymer mit mindestens einem von Polybutylenterephthalat (PBT) oder Poly(ethylenterephthalat) (PET) oder Polyamiden oder Polypropylen, wobei das Trägerpolymer im Bereich von 25% w/w bis 99% w/w liegt; und Verfestigen des geschmolzenen homogenen Gemischs aus pflanzlicher Komponente und Trägerpolymer unter Wasser bei einer Temperatur im Bereich von 4°C bis 30°C, um das pflanzliche Masterbatch zu erhalten.

13. Verfahren nach Anspruch 12, ferner umfassend:

Verdrillen des polymeren Garns in einem Bereich von 40 TPM (Twist Per Meter) bis 350 TPM, um das polymere Garn mit Zwirnen zu erhalten, und Thermofixieren der Zwirne des polymeren Garns.

14. Pflanzliche Masterbatch-Zusammensetzung zur Herstellung eines polymeren Garns für Textilmaterialien, wobei die pflanzliche Masterbatch-Zusammensetzung umfasst:

eine pflanzliche Komponente mit hydriertem Extrakt von Kurkuma in einem Bereich von 1% w/w bis 75% w/w; und ein Trägerpolymer mit mindestens einem von:

Polybutylenterephthalat (PBT),
Polyethylenterephthalat (PET) oder
Polyamiden oder
Polypropylen,

wobei das Trägerpolymer in einem Bereich von 25% w/w bis 99% w/w liegt.

15. Pflanzliche Masterbatch-Zusammensetzung nach Anspruch 14, wobei die pflanzliche Zusammensetzung mit dem hydrierten Extrakt von Kurkuma entweder in Pulverform vorliegt und die Größe des Pulvers im Bereich von 0,001 Mikron bis 25 Mikron liegt.

Revendications

1. Composition de fil polymère ayant des propriétés antimicrobiennes et/ou antibactériennes pour des matériaux textiles, la composition de fil polymère comprenant :

(i) un mélange maître à base de plantes, de préférence dans une plage de 0,01 % p/p à 10 % p/p, le mélange maître à base de plantes comprenant :

(a) un composant à base de plantes ayant un extrait hydrogéné de curcuma, de préférence dans une plage de 1 % p/p à 75 % p/p, et

(b) un polymère porteur ayant au moins un parmi : du polybutylène téréphtalate (PBT), du polyéthylène téréphtalate (PET) ou des polyamides, ou du polypropylène, dans lequel le polymère porteur est de préférence dans une plage de 25 % p/p à 99 % p/p ; et

(ii) un polymère de base ayant un parmi du polybutylène téréphtalate (PBT) ou du polyéthylène téréphtalate (PET), ou des polyamides, ou du polypropylène, de préférence dans une plage de 90 % p/p à 99,99 % p/p,

dans laquelle le mélange maître à base de plantes et le polymère de base sont fondus et extrudés ensemble à une température dans une plage de 175°C à 300°C pour obtenir un fil polymère ayant le composant à base de plantes dans une plage de 0,01% à 10% en poids du fil polymère.

2. Composition de fil polymère selon la revendication 1, dans laquelle le fil polymère est configuré pour réduire les bactéries à Gram positif et Gram négatif et les micro-organismes d'environ 85 % à 99,99 %.

3. Composition de fil polymère selon la revendication 1, dans laquelle les matériaux textiles fabriqués à partir du fil polymère comprennent des matériaux de revêtement de sol.

4. Composition de fil polymère selon la revendication 1, dans laquelle les matériaux textiles fabriqués à partir du fil polymère comprennent l'un de matériaux textiles tricotés, touffetés ou tissés.

5. Composition de fil polymère selon la revendication 1, dans laquelle l'extrait hydrogéné de curcuma est utilisé sous forme de poudre, et dans laquelle une taille de la poudre est dans une plage de 0,001 micron à 25 microns.

6. Composition de fil polymère selon la revendication 1, dans laquelle l'extrait hydrogéné de curcuma est utilisé sous une forme liquide.

7. Composition de fil polymère selon la revendication 1, dans laquelle les polyamides comprennent du PA6 ou du PA66.

8. Composition de fil polymère selon la revendication 1, dans laquelle le fil polymère présente un rapport denier par filament (DPF) mesuré dans une plage de 0,5 DPF à 50 DPF.

9. Composition de fil polymère selon la revendication 1, dans laquelle le fil polymère est câblé avec au moins 1 brin entre 40 TPM (torsion par mètre) et 350 TPM pour obtenir un fil polymère avec des torsions.

10. Composition de fil polymère selon la revendication 9, dans laquelle le fil polymère avec des torsions est thermofixé.

11. Procédé de préparation d'un fil polymère ayant des propriétés antimicrobiennes et/ou antibactériennes pour des matériaux textiles, le procédé comprenant les étapes consistant à :

préparer un mélange maître à base de plantes, dans lequel le mélange maître à base de plantes comprend : un composant à base de plantes ayant un extrait hydrogéné de curcuma, de préférence dans une plage de 1 % p/p à 75 % p/p, et un polymère porteur ayant au moins un parmi du polybutylène téréphtalate (PBT), ou du polyéthylène téréphtalate (PET), des polyamides ou du polypropylène, dans lequel le polymère porteur est de préférence dans une plage de 25 % p/p à 99 % p/p ;

mélanger le mélange maître à base de plantes dans une plage préférée de 0,01 % p/p à 10 % p/p, et un polymère de base dans une plage préférée de 90 % p/p à 99,99 % p/p, dans lequel le polymère de base comprend un parmi du polybutylène téréphtalate (PBT) ou du polyéthylène téréphtalate (PET), ou des polyamides, ou du polypropylène ; et

faire fondre et extruder le mélange du mélange maître à base de plantes et du polymère de base à une température dans une plage de 175°C à 300°C pour obtenir le fil polymère ayant le composant à base de plantes dans une plage de 0,01% à 10% en poids du fil polymère.

5 12. Procédé selon la revendication 11, dans lequel la préparation du mélange maître comprend les étapes consistant à :

10 faire fondre un mélange du composant à base de plantes et du polymère porteur à une température dans la plage de 175°C à 300°C pour obtenir un mélange homogène fondu du composant à base de plantes et du polymère porteur, dans lequel le mélange du composant à base de plantes et du polymère porteur comprend :
un extrait hydrogéné de curcuma dans la plage de 1 % p/p à 75 % p/p, et le polymère porteur ayant au moins un parmi du polybutylène téréphtalate (PBT), ou du polyéthylène téréphtalate (PET), ou des polyamides, ou du polypropylène, dans lequel le polymère porteur est dans la plage de 25 % p/p à 99 % p/p ; et
solidifier le composant à base de plantes de mélange homogène fondu et le polymère porteur sous l'eau à une température dans une plage de 4°C à 30°C pour obtenir le mélange maître à base de plantes.

15 13. Procédé selon la revendication 12, comprenant en outre les étapes consistant à :

20 câbler le fil polymère dans une plage de 40 TPM (torsion par mètre) à 350 TPM pour obtenir le fil polymère avec des torsions, et
thermofixer les torsions du fil polymère.

14. Composition de mélange maître à base de plantes pour la fabrication d'un fil polymère pour des matériaux textiles, la composition de mélange maître à base de plantes comprenant :

25 un composant à base de plantes ayant un extrait hydrogéné de curcuma dans une plage de 1 % p/p à 75 % p/p ; et un polymère porteur ayant au moins un parmi :

30 du polybutylène téréphtalate (PBT),
du polyéthylène téréphtalate (PET), ou
des polyamides, ou
du polypropylène,

dans lequel le polymère porteur est dans une plage de 25 % en poids à 99 % en poids.

35 15. Composition de mélange maître à base de plantes selon la revendication 14, dans laquelle la composition à base de plantes ayant l'extrait hydrogéné de curcuma est sous forme de poudre, et la taille de la poudre est dans une plage de 0,001 micron à 25 microns.

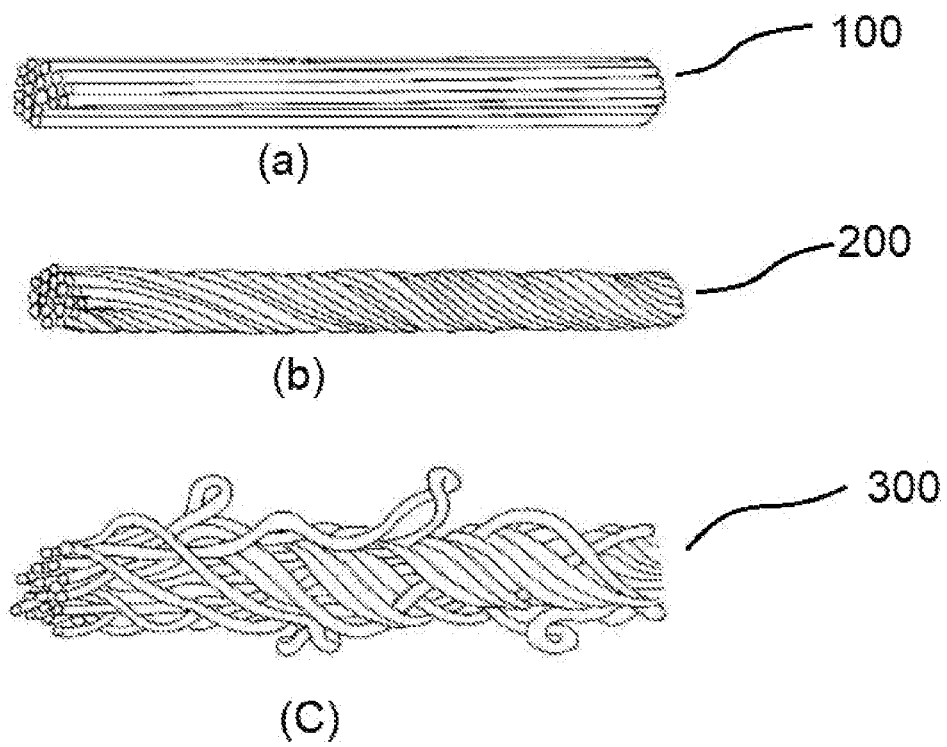


FIG. 1

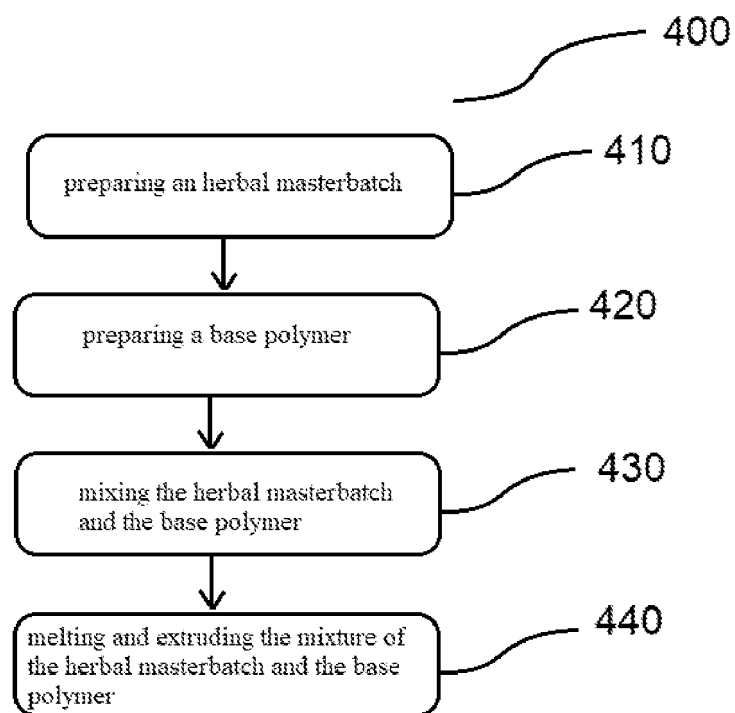


FIG. 2A

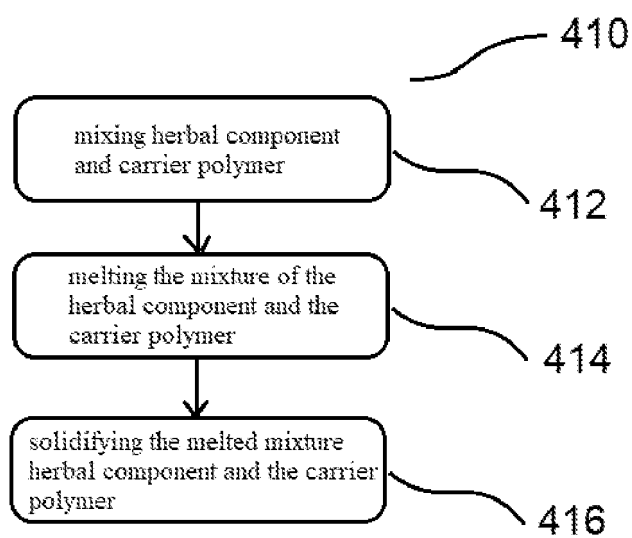


FIG. 2B

REFERENCES CITED IN THE DESCRIPTION

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