An apparatus is provided to make fabrics. The fabrics are environmentally friendly, water-repellent and colored. A pigment, a C4 fluorine-containing compound, a dispersant and a related polymer substrate carrier are bond to obtain water-repellent colored masterbatches. The C4 fluorine-containing compound is environmentally friendly while being free of perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS). The masterbatches are spun into yarns for making a fabric with the pigment and the C4 fluorine-containing compound uniformly mixed. Thus, the present invention significantly reduces waste water pollution from dyeing and processing without generating environmentally harmful PFOA and PFOS.
APPARATUS OF FABRICATING ENVIRONMENTALLY FRIENDLY WATER-REPELLENT COLORED FABRICS

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention relates to fabricating fabrics; more particularly, relates to uniformly mixing a pigment and a C4 water-repellent agent into environmentally friendly water-repellent colored fabrics for significantly reducing waste water pollution from dyeing and processing without generating environmentally harmful perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS).

DESCRIPTION OF THE RELATED ART

[0002] For making water-repellent colored yarns, a water-repellent fluorine-containing agent (C6 or C8) is used on winding after dyeing the yarns for adhering the water-repellent agent before drying. Yet, there are shortcomings. The water-repellent agent would not be adhered uniformly; wash fastness would be poor; the spinning device would be polluted; and, the water-repellent agent would generate environmental hormones of perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS). In addition, a lot of waste water would be produced to pollute the environment on dyeing the yarns. Traditional water-repellent C8 (8 carbons) fluorine-containing agent contains PFOA or PFOS, whose half-lives are long and would continue to exist in the natural environment while being low-dose accumulated in organisms to cause harm to human. Although the water-repellent C6 fluorine-containing agent is measured to have a far below concentration than the C8 fluorine-containing water-repellent agent and long-term residual harms are thus reduced, toxicity concern can not be completely ruled out. Hence, the prior art does not fulfill all users’ requests on actual use.

SUMMARY OF THE INVENTION

[0003] The primary purpose of the present invention is to provide an apparatus for binding a pigment, an environmentally friendly C4 fluorine-containing compound (water-repellent C4 fluorine-containing agent completely free of PFOA and PFOS), a dispersant and a related polymer substrate carrier to obtain water-repellent colored master-batches; and spinning the masterbatches into yarns for uniformly mixing the pigment and the C4 fluorine-containing compound into fabric to obtain environmentally friendly water-repellent colored fabrics, where waste water pollution from dyeing and processing is significantly reduced without generating environmentally harmful PFOA and PFOS.

[0004] To achieve the above purpose, the present invention is an apparatus for fabricating environmentally friendly water-repellent colored fabrics, comprising a masterbatch generator, a drying device, a yarn spinner, a first fabric generator and a second fabric generator, where the masterbatch generator melt-kneads a raw material; after being melt-kneaded, the raw material is extruded to form a plurality of water-repellent colored masterbatches through cooling and granulating; the drying device is connected to the masterbatch generator; the drying device hot-dries the masterbatches to obtain a plurality of dried masterbatches; the yarn spinner is connected to the drying device to obtain water-repellent colored yarns by spinning; the first fabric generator is connected to the yarn spinner to obtain a water-repellent colored fabric of a knitted fabric, a woven fabric or a plush fabric; and the second fabric generator is connected to the drying device to obtain a water-repellent colored non-woven fabric. Accordingly, a novel apparatus of fabricating environmentally friendly water-repellent colored fabrics is obtained.

BRIEF DESCRIPTION OF THE DRAWING

[0005] The present invention will be better understood from the following detailed description of the preferred embodiment according to the present invention, taken in conjunction with the accompanying drawing, in which

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0007] The following description of the preferred embodiment is provided to understand the features and the structures of the present invention.

[0008] Please refer to FIG. 1, which is a view showing a preferred embodiment according to the present invention. As shown in the FIGURE, the present invention is an apparatus of fabricating environmentally friendly water-repellent colored fabrics, comprising a masterbatch generator 1, a drying device 2, a yarn spinner 3, a first fabric generator 4 and a second fabric generator 5.

[0009] The masterbatch generator 1 comprises a mixing unit 11; a high-speed powder kneading device 12 communicated with the mixing unit 11; a driving unit 13 located at a side of and connected to the powder kneading device 12; a cooling tank 14 located at another side of and connected to the powder kneading device 12; a granulator 15 located at a side of and connected to the cooling tank 14; and a collecting trough 16 located at another side of and connected to the cooling tank 14. The masterbatch generator 1 processes kneading and melting of a raw material; and, after being melted and kneaded, the raw material is extruded to form a plurality of water-repellent colored masterbatches 6a through cooling and granulating.

[0010] The drying device 2 is connected to the collecting trough 16 of the masterbatch generator 1 to hot-dry the masterbatches 6a for obtaining a plurality of dried masterbatches 6.

[0011] The yarn spinner 3 is connected to the drying device 2 and comprises a yarn-making device 31; a winding device 32 corresponding to the yarn-making device 31 at an end; and a plurality of rollers 33 located between the yarn-making device 31 and the winding device 32. The yarn spinner 3 obtains water-repellent colored yarns through spinning.

[0012] The first fabric generator 4 is connected to the yarn spinner 3 to obtain a water-repellent colored fabric, such as a knitted fabric, a woven fabric, a plush fabric, etc.

[0013] The second fabric generator 5 is connected to the drying device 2 to obtain a water-repellent colored non-woven fabric.


[0015] The water-repellent colored masterbatch 6 comprises 40-69.5 weight percent (wt %) of a polymer substrate carrier 61; 0.01-6 wt % of a dispersant 62; 1-30 wt % of a C4 fluorine-containing compound 63; and 1-30 wt % of
a pigment 64. The polymer substrate carrier is made of poly(trimethylene terephthalate) (PTT), polybutylene terephthalate (PBT), polyethylene terephthalate (PET), polypropylene (PP), polyethylene (PE), Nylon 6, Nylon 612, Nylon 66, or a mixture thereof.

[0016] On fabricating the water-repellent colored master-batches 6, the polymer substrate carrier 61, the dispersant 62, the C4 fluorine-containing compound 63 and the pigment 64 are put in the mixing unit 11 of the masterbatch generator 1 to be mixed by a high-speed powder kneading device 12 at a rotational speed of 1000 rotations per minute (RPM) ~3000 RPM for a time of 10–90 minutes. Thus, the C4 fluorine-containing compound 63 is quickly and uniformly dispersed in a polymer-substrate-carrier mixture for forming a water-repellent polymer-substrate powder having the C4 fluorine-containing compound 63 and the pigment 64 uniformly dispersed. Therein, the water-repellent polymer-substrate powder is kneaded and granulated at a temperature of 220 Celsius degrees (°C) ~300°C by a twin-screw kneading device having a screwing speed of 300 RPM~400 RPM with coordination of the cooling tank 14 and the granulator 15 for forming water-repellent colored master-batches 6a having uniform and smooth surface. Then, the fabricated water-repellent colored masterbatches 6a are collected in the collecting trough 16 to be hot-dried at a temperature of 110°C~140°C for 6–30 hours for obtaining the dried masterbatches 6.

[0017] On fabricating the water-repellent colored yarns, 1–20 wt % of the dried masterbatches 6 are put into the yarn-making device 31 of the yarn spinner 3 to be spun with coordination of spinning nozzle 7 for obtaining the water-repellent colored yarns 8a having yarn finenesses of 1–100 deniers; and, then, the water-repellent colored yarns 8a are winded by the winding device 32 through the rollers 33. Furthermore, by using the water-repellent colored yarns 8a for fabricating a fabric (i.e., a cloth), a water-repellent colored fabric 8 like a knitted fabric, a woven fabric or a plush fabric is fabricated through the first fabric generator 4.

[0018] Or, the second fabric generator 5 can melt-knead the 1–20 wt % dried masterbatches 6 to obtain a water-repellent colored non-woven fabric 9.

[0019] Hence, the present invention binds a pigment, an environmentally friendly C4 fluorine-containing compound (C4 water-repellent agent completely free of perfluorooctanoic acid (PFOA) and Perfluorooctane sulfonate (PFOS)), a dispersant and a related polymer substrate carrier to obtain water-repellent colored masterbatches. Then, the masterbatches are spun into yarns for uniformly mixing the pigment and the C4 fluorine-containing compound into fabric to obtain an environmentally friendly water-repellent colored fabric, where waste water pollution from dyeing and processing is significantly reduced without generating environmentally harmful PFOA and PFOS.

[0020] To sum up, the present invention is an apparatus of fabricating environmentally friendly water-repellent colored fabrics, where a pigment, an environmentally friendly C4 fluorine-containing compound, a dispersant and a related polymer substrate carrier are bond to obtain water-repellent colored masterbatches; the masterbatches are spun into yarns for uniformly mixing the pigment and the C4 fluorine-containing compound into fabric; thus, an environmentally friendly water-repellent colored fabric is obtained for significantly reducing waste water pollution from dyeing and processing without generating environmentally harmful PFOA and PFOS.

[0021] The preferred embodiment herein disclosed is not intended to unnecessarily limit the scope of the invention. Therefore, simple modifications or variations belonging to the equivalent of the scope of the claims and the instructions disclosed herein for a patent are all within the scope of the present invention.

What is claimed is:

1. An apparatus of fabricating water-repellent colored fabrics, comprising:
   a masterbatch generator, said masterbatch generator melt-kneading a raw material,
   wherein, after being melt-kneaded, said raw material is extruded to obtain a plurality of water-repellent colored masterbatches through cooling and granulating;
   a drying device, said drying device being connected to said masterbatch generator,
   wherein said drying device hot-dries said masterbatches to obtain a plurality of dried masterbatches;
   a yarn spinner, said yarn spinner being connected to said drying device to obtain water-repellent colored yarns by spinning;
   a first fabric generator, said first fabric generator being connected to said yarn spinner to obtain a water-repellent colored fabric selected from a group consist of a knitted fabric, a woven fabric and a plush fabric; and
   a second fabric generator, said second fabric generator being connected to said drying device to obtain a water-repellent colored non-woven fabric.

2. The apparatus according to claim 1,
   wherein said masterbatch generator comprises
   a mixing unit;
   a high-speed powder kneading device communicated with said mixing unit;
   a driving unit located at a side of and connected to said powder kneading device;
   a cooling tank located at another side of and connected to said powder kneading device;
   a granulator located at a side of and connected to said cooling tank; and
   a collecting trough located at another side of and connected to said cooling tank,
   where said driving unit is connected to said collecting trough.

3. The apparatus according to claim 1,
   wherein said yarn spinner comprises
   a yarn-making device;
   a winding device corresponding to said yarn-making device at an end of said yarn-making device; and
   a plurality of rollers located between said yarn-making device and said winding device.

4. The apparatus according to claim 1,
   wherein said water-repellent colored masterbatch comprises 40–69.5 weight percents (wt %) of a polymer substrate carrier; 0.01–6 wt % of a dispersant; 1–30 wt % of a C4 fluorine-containing compound; and 1–30 wt % of a pigment.

5. The apparatus according to claim 4,
   wherein said polymer substrate carrier is made of a material selected from a group consist of poly(trimethylene terephthalate) (PTT), polybutylene terephthalate
(PBT), polyethylene terephthalate (PET), polypropylene (PP), polyethylene (PE), Nylon 6, Nylon 6.12 and Nylon 6,6.

6. The apparatus according to claim 4, wherein said polymer substrate carrier is made of a mixture of said material.

7. The apparatus according to claim 4, wherein said C4 fluorine-containing compound, said dispersant, said pigment and said polymer substrate carrier are mixed by a high-speed powder kneading device so that said C4 fluorine-containing compound is quickly and uniformly dispersed in a polymer substrate carrier mixture to obtain a water-repellent polymer-substrate powder having said C4 fluorine-containing compound and said pigment uniformly dispersed.

8. The apparatus according to claim 7, wherein said high-speed powder kneading device processes kneading at a rotational speed of 1000 rotations per minute (RPM) ~3000 RPM for a time of 10–90 minutes.

9. The apparatus according to claim 7, wherein said water-repellent polymer-substrate powder is kneaded and granulated by a twin-screw kneading device to obtain water-repellent colored masterbatches having uniform and smooth surface.

10. The apparatus according to claim 9, wherein said twin-screw kneading device is operated at a temperature of 220 Celsius degrees (~200° C. –300° C. with a screwing speed of 300 RPM–400 RPM.

11. The apparatus according to claim 1, wherein said drying device processes hot-drying to said water-repellent colored masterbatches at a temperature of 110° C.–140° for 6–30 hours to obtain said dried masterbatches.

12. The apparatus according to claim 1, wherein said yarn spinner obtains said water-repellent colored yarns having 1–20 wt % of said dried masterbatches added, and said water-repellent colored yarns have yarn finenesses of 1–100 deniers.

13. The apparatus according to claim 1, wherein said first fabric generator obtains said water-repellent colored fabric having 1–20 wt % of said dried masterbatches added.

14. The apparatus according to claim 1, wherein said second fabric generator obtains said water-repellent colored non-woven fabric having 1–20 wt % of said dried masterbatches added.

* * * * *