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(54) COOLING FILTER ROD, APPLICATION AND CIGARETTE

(57) A cooling filter rod, an application and a cigarette are provided. The cooling filter rod is mainly formed by cooling particles; the cooling particle includes a particle body and a shell coated on the particle body, and the shell/or the particle body contains a phase change material. The phase change material is coated on the surface of the particle material to form cooling particles, and the cooling particles are integrally formed into a cooling filter rod, which can be directly used for cigarette production after being compounded with conventional filter rods; the cooling effect can be controlled according to the amount of the phase change material and the cooling filter rod, and such a filter rod can realize industrial production and has low cost and good cooling effect; the smoking resistance is small, and the contact area between the smoke and the phase change material is large, so the cooling efficiency is high.

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Description

Field of the Invention

[0001] The present invention relates to a cooling filter rod, an application thereof and a cigarette, belonging to the technical field of cigarette production.

Background of the Invention

[0002] In the smoking process of traditional cigarette, the heat generated by a cigarette burning cone will be carried by mainstream smoke to a filter, and as the smoking progresses, the temperature of smoke passing through the filter gradually increases. Studies have shown that the temperature of the smoke at the filter can be as high as 70-80°C near the end of smoking. Too high temperature at the filter will affect the retention effect of the filter, and will also affect consumer's evaluation on the sensory quality of smoke. Therefore, it is necessary to appropriately reduce the temperature of smoke.

[0003] A heat-not-burn cigarette produces smoke by heating the tobacco product with an external heating element. Generally, the tobacco product reaches an atomization condition at 250-350°C. In order to ensure the amount of smoke, low or no adsorption is usually required at the filter. The temperature of high-temperature atomized smoke entering the mouth through the filter will be higher than that of traditional cigarette burning. Therefore, appropriate reduction of the temperature of smoke is also a key technology for the development of low-temperature cigarettes.

[0004] Chinese patent CN201510045745.4 provides a filter and a cigarette. The temperature of smoke is reduced by adding a phase change material to the filter, the phase change material used is a mixture of a hydrated inorganic salt and urea, and the mixture is sprayed onto a cellulose acetate rod or its crystal is placed between two filters. As known in the industry, the use and effect of this hydrated salt are not ideal.

[0005] Chinese patent CN101396173 provides a vortex cooling and flavor keeping method for a cigarette and a cigarette structure. Vortex channels are formed in front of a cigarette filter to achieve the same cooling effect as air, but the structure is complicated and not suitable for heat-non-burning cigarette.

[0006] The perfuming treatment through the filter is generally in the form of perfuming particles, perfuming threads or capsules. For example, Chinese patent CN101390657 discloses a cigarette filter rod with a function of mint sustained release and a production process thereof. The perfuming means is to use cotton threads impregnated with perfume, but it is difficult to achieve continuous perfuming.

Summary of the Invention

[0007] The technical problem to be solved by the present invention is, when cigarettes (including traditional cigarettes and heat-not-burn cigarettes) are smoked, the temperature of smoke generated by combustion is relatively high, causing a burning sensation in the mouth of consumers to affect the smoking experience.

[0008] In order to solve the above technical problem, the technical solution of the present invention is as follows:
A cooling filter rod is mainly formed by cooling particles; the cooling particle includes a particle body and a shell coated on the particle body, and the shell/or the particle body contains a phase change material.

[0009] In this way, the cooling particles used have a core-shell structure, and the surface shells are distributed with the phase change material, which has a cooling function. The cooling filter rod can be obtained by molding of the cooling particles according to the required shape; after the cooling particles are stacked in a certain shape, the entire cooling filter rod formed has a loose and porous structure; when the cooling filter rod is applied to a cigarette product and high-temperature smoke passes through the cooling filter rod, the smoke can pass smoothly; and on the other hand, the high-temperature smoke has a large contact area with the shells, so the cooling efficiency is high, a good cooling effect can be achieved, and the experience of a smoker is improved. Optionally, only the shell contains the phase change material; optionally, only the particle body contains the phase change material; optionally, both the shell and the particle body contain the phase change material.

[0010] In some embodiments of the present invention, the shell is composed of a phase change material.

[0011] Further, the phase change material includes at least one of PLA, polyethylene glycol, stearic acid, palmitic acid, paraffin, microcrystalline wax, EVA, pentaerythritol, stearate-isopropanol ester, and stearate-glycerol ester. The suitable phase change material can ensure a good cooling effect while ensuring the coating effect, thereby improving the overall cooling performance of the cooling filter rod. Preferably, the phase change material includes a mixture of PLA, polyethylene glycol, stearates (including series stearates) and EVA.

[0012] In some embodiments of the present invention, the shell further contains a flavor enhancer. In this way, the shell of the cooling particle contains a phase change material and a flavor enhancer, and after the cooling particles are stacked in a certain shape, the entire cooling filter rod formed has a loose and porous structure, and the smoke can

pass smoothly; in addition, when the cooling filter rod is applied to a cigarette product and high-temperature smoke passes through the cooling filter rod, the high-temperature smoke has a large contact area with the shells, and the phase change material has a high absorption efficiency on the heat of smoke, so the cooling efficiency is high, a good cooling effect can be achieved, and the experience of a smoker is improved; meanwhile, the flavor enhancer in the shells is heated to slowly emit flavor, and the flavor enters the mouth of the smoker together with the smoke to give the smoke a unique taste, which can meet individual smoking needs; and when the phase change material undergoes a phase change by absorbing heat, the flavor ingredients inside the shell can be slowly released to add the flavor continually. Generally, the volatilization of the flavor enhancer to produce flavor is also a heat absorption process, and is also beneficial to the reduction of smoke temperature.

[0013] Further, the flavor enhancer includes a flavor and/or a tobacco extract; preferably, the mass ratio of the phase change material to the flavor enhancer is 100: (0.5-10). Optionally, the flavor includes at least one of menthone and coffee flavor, which can be specifically selected as required, and other types of flavors can also be selected as required.

[0014] Further, the mass of the shell accounts for 0.5-30% of the total mass of the cooling particle, preferably 1-20%. The proper amount of the phase change material can ensure that the cooling effect meets the requirements, and channels of the filter rod will not be blocked when the phase change is repeated in the smoking process.

[0015] In some embodiments of the present invention, the particle body contains plant fiber powder and/or inorganic material powder, and further, the plant fiber powder and/or inorganic material powder have a particle size of 80-200 meshes, preferably 100-180 meshes.

[0016] Further, the plant fiber powder includes at least one of tobacco powder, corncob powder, rice husk powder, walnut shell powder, coconut shell powder, tangerine peel powder, and grapefruit peel powder. The plant powder is natural, pollution-free and cheap, can be prepared into dense particles to reduce the adsorption efficiency, is more suitable for low-temperature cigarettes, and can reduce the loss of cutters during the preparation of the cooling filter rod and cigarettes. Further, the inorganic material powder includes at least one of calcium carbonate, carbon powder, ceramics, silica gel, and molecular sieves. The use of inorganic materials does not introduce peculiar smell, and at the same time, the porous property is partially utilized, so that the cooling filter rod has better adsorption performance and is more suitable for ordinary cigarettes. Further, the particle body further includes an auxiliary molding material, and the auxiliary molding material includes at least one of a binder, a wetting agent, and an excipient.

[0017] Further, the binder includes at least one of PVP, HPC, HPMC, SCMC, and modified starch; the wetting agent includes water or alcohol; and the excipient includes microcrystalline cellulose and lactose. The suitable binder and wetting agent can ensure that the prepared particles have good shape and strength.

[0018] By reasonably adjusting the ratio of the plant fiber powder and the inorganic material powder, the adsorption performance of the cooling filter rod can be adjusted to an appropriate range, and the needs of different cigarettes can also be met.

[0019] In some embodiments of the present invention, the particle body is obtained by thoroughly mixing base powder, hot melt adhesive powder, excipients, and water, granulating, drying, and sieving; wherein the base powder includes at least one of plant materials, inorganic materials, and metal powder; further, the plant materials include at least one of tobacco raw materials, straw, peanut shells, bagasse, corncobs, pericarp, and aromatic plants; the inorganic materials include at least one of carbon powder, clay, calcium carbonate, and silicon oxide; and the metal powder includes at least one of iron powder, aluminum oxide, and copper powder. Generally, the ratio of base powder, hot melt adhesive powder, excipients, and water can be selected according to needs, as long as they can be used for normal and smooth granulation and formation. The use of plant materials can reduce costs as much as possible, and the aromatic plants also have a flavoring effect in the filter rod. The inorganic materials and the metal powder will not introduce peculiar smell, and the metal powder is more helpful for the cooling effect. Further, the aromatic plants include at least one of sandalwood, agarwood, cloves, coffee, and anise.

[0020] Further, the hot melt adhesive powder includes at least one of EVA, TPU, PE, PA, and PES. The hot melt adhesive powder can ensure the formation of particles and the formation of particle rods. Meanwhile, the hot melt adhesive powder has certain phase change capability, so they can achieve a phase change cooling effect to a certain extent. The mass ratio of the hot melt adhesive powder in the cooling particles is 5%-50%, preferably 10%-40%, and the content of other ingredients can be adjusted as required. The proper amount of hot melt adhesive can ensure sufficient adhesion, and excessive amount may block the channels during melting to affect the cooling effect. Optionally, the excipients include microcrystalline cellulose and pre-gelatinized starch. Further, the cooling particles have a diameter of 10-50 meshes, preferably 20-35 meshes.

[0021] Further, when used to cool the heat-not-burn cigarettes, the cooling particles are granulated by extrusion rounding, are spherical or approximately spherical particles, and have a bulk density of 0.8 to 2.5 g/ml. The spherical or approximately spherical shape can ensure complex enough and continuous smoke channels inside the cooling filter rod, and the high enough particle density can ensure that its adsorption performance is minimized without affecting the amount of smoke produced by the cigarette.

[0022] Further, when used for cooling conventional cigarettes, the cooling particles are spherical or amorphous, and

have a bulk density of 0.4 to 1.6 g/ml. It can ensure complex enough and continuous smoke channels inside the cooling filter rod, and the low particle density can ensure that the internal pores of the particles are not completely blocked, so that the particles still have certain adsorption performance. Preferably, the moisture content of the cooling particles is 5-15wt%, and further is 7-12wt%. Keeping the moisture content in a proper moisture content range can keep the cigarette in a good mouthfeel during smoking, and can prevent mildew for the cooling filter rod containing plant fiber powder.

[0023] The particles of proper diameters can ensure sufficient air permeability inside the filter rod, and the proper moisture facilitates storage and forming control.

[0024] Further, the effective porosity inside the cooling filter rod is 65-95%. In this way, the entire cooling filter rod has a porous structure with complex and continuous channels formed inside; after the high-temperature smoke enters the cooling filter rod from one end of the cooling filter rod, the high-temperature smoke is quickly dispersed in the pores in the cooling filter rod and fully contacts the cooling particles to exchange heat, thus realizing cooling; in addition, the high-temperature smoke has a long distance of travel in the cooling filter rod, so the cooling effect achieved is good. The sufficient effective porosity can meet the needs of air permeability inside the filter rod.

[0025] Further, the effective porosity inside the cooling filter rod is 80-95%.

[0026] Further, the porous structure is honeycomb-like.

[0027] Optionally, the cooling filter rod is a loose and air-permeable cylinder.

[0028] Further, the cooling filter rod is formed by the bonding of the cooling particles through a binder.

[0029] Further, the cooling filter rod is mainly formed by the cooling particles through the way of microwave heating or heat solidification.

[0030] Further, the cooling filter rod is connected to a cut tobacco section or a smoking section for smoking, wherein the cooling filter rod is close to the cut tobacco/ smoking section. Optionally, a preparation method of the cooling filter rod includes the following steps:

(1) mixing plant fiber powder and/or inorganic material powder with relevant auxiliary molding materials, granulating, drying, and screening to obtain particle bodies; then coating the particle bodies with a phase change material to obtain cooling particles; and

(2) molding the cooling particles obtained in step (1) to obtain the cooling filter rod; or,

1) thoroughly mixing at least one of plant materials/ inorganic materials/ metal powder, hot melt adhesive powder, microcrystalline cellulose, pre-gelatinized starch, water, etc., granulating, drying, and screening to obtain particle bodies; then coating the particle bodies with a phase change material to obtain cooling particles of proper diameters; and

2) molding the obtained cooling particles into a cylinder with definite size, that is, the required cooling filter rod.

or,

1) mixing plant fiber powder and/or inorganic material powder with relevant auxiliary molding materials, granulating, drying, and screening to obtain base particles;

2) heating a phase change material for melting, weighing a proper amount of flavor enhancer and adding it to the molten phase change material, stirring and shearing at a high speed for thorough and uniform mixing to obtain a mixed liquid for later use;

3) coating the base particles prepared in step 1) with the mixed liquid prepared in step 2) as a coating material to obtain cooling particles; and

4) molding the cooling particles prepared in step 3) into a cylinder with definite size to obtain a flavor enhanced cooling filter rod.

[0031] Based on the same inventive concept, the present invention further provides an application of the aforementioned cooling filter rod in the production of a cigarette. Based on the same inventive concept, the present invention further provides a cigarette, including the aforementioned cooling filter rod.

[0032] Further, a cigarette includes a smoking portion and a filter connected in sequence, wherein the aforementioned cooling filter rod is arranged inside the filter.

[0033] Optionally, the cooling filter rod is compounded with conventional filter rods in a certain ratio as a filter for conventional cigarettes or heat-not-burn cigarettes, for example, the cooling filter rod is arranged between two conventional filter rods to constitute a cigarette filter portion (filter), and all high-temperature smoke needs to pass through the cooling filter rod before entering the mouth to ensure the cooling effect. Different conventional filter rods are selected according to different usage requirements.

[0034] Further, the conventional filter rods are acetate filter rods, polypropylene fiber filter rods, paper filter rods, empty tube rods, etc.

[0035] Compared with the prior art, the technical effects brought by the technical solution of the present invention are:

(1) The phase change material is coated on the surface of the particle material to form cooling particles, and the

cooling particles are integrally formed into a cooling filter rod, which can be directly used for cigarette production after being compounded with conventional filter rods.

(2) The cooling effect can be controlled according to the amount of the phase change material and the cooling filter rod. The form of the cooling filter rodis simple and novel, and the bran-new filter rod facilitates industrial production and has low cost and good cooling effect.

(3) The smoking resistance is small, and the contact area between the smoke and the phase change material is large, so the cooling efficiency is high, the temperature of smoke entering the smoker's mouth can be greatly reduced, and the experience is improved.

(4) The flavor enhancer is compounded with the phase change material, so that the cooling filter rod realizes a flavoring function for the first time, and its the application value greatly increases.

(5) The temperature of smoke entering the mouth is greatly reduced by controlling the effective porosity of the cooling filter rod and using the means of no ventilation or dilution based on the principle of physical cooling, and the cooling amplitude can reach more than 50%.

Detailed Description of the Embodiments

[0036] The following examples are intended to illustrate the content of the present invention, rather than to further limit the protection scope of the present invention.

Example 1

[0037] In this embodiment, the test process included the following steps:
1)100 parts of 100-150 mesh tobacco raw material powder, 20 parts of modified starch and 30 parts of microcrystalline cellulose by mass were taken, mixed uniformly and then sprayed with 30 parts of water, followed by uniform mixing to prepare a mixed soft material; 2) the soft material was granulated by extrusion rounding, dried and sieved, and 20-50 mesh tobacco particles were taken for later use; 3) the obtained tobacco particles were coated with molten PEG1500 in an amount of 10% of the mass of the tobacco particles, followed by sieving, and 20-40 mesh tobacco particles were taken as cooling tobacco particles; 4) the obtained cooling tobacco particles were continuously moldedwith microwave into a loose and porous cylinder with a circumference of 23.5 mm, and the cylinder was cut into 120 mm long cooling filter rods; and 5) the cooling filter rods were compounded with acetate fiber sections in a length ratio of 10: 15 for preparing cigarettes, wherein the cooling sections were close to cut tobacco, and acetate fiber rods were also prepared into cigarettes of the same specification as a control. The two kinds of filter rod cigarettes were smoked, the temperatures at the outlet ends of the filter rods were tested at the fifth time of smoking, and the results were shown in Table 1.

Example 2

[0038] In this embodiment, the test process included the following steps:
1) 80 parts of 100-150 mesh corncob flour, 20 parts of calcium carbonate, 10 parts of HPMC and 40 parts of microcrystalline cellulose by mass were taken, mixed uniformly and then sprayed with 25 parts of water, followed by uniform mixing to prepare a mixed soft material; 2) the soft material was granulated by extrusion rounding, dried and sieved, and 20-50 mesh corncob particles were taken for later use; 3) stearic acid and pentaerythritol in a mass ratio of 1: 1 were melted to coat the obtained corncob particles in an amount of 5% of the mass of the corncob particles, followed by sieving, and 10-50 mesh corncob particles were taken as cooling corncob particles; 4) the obtained cooling corncob particles were continuously molded into a loose and porous cylinder with a circumference of 23.5 mm by heat curing, and the cylinder was cut into 84 mm long cooling filter rods; and 5) the cooling filter rods were compounded with acetate fiber sections in a length ratio of 7: 18 for preparing cigarettes, wherein the cooling sections were close to cut tobacco, and acetate fiber rods were also prepared into cigarettes of the same specification as a control. The two kinds of filter rod cigarettes were smoked, the temperatures at the outlet ends of the filter rods were tested at the fifth time of smoking, and the results were shown in Table 1.

Example 3

[0039] In this embodiment, the test process included the following steps:
1) 60 parts of 100-150 mesh grapefruit peel powder, 40 parts of carbon powder, 20 parts of modified starch, 20 parts of microcrystalline cellulose and 10 parts of lactose by mass were taken, mixed uniformly and then sprayed with 25 parts of water, followed by uniform mixing to prepare a mixed soft material; 2) the soft material was granulated by extrusion rounding, dried and sieved, and 20-50 mesh particles were taken for later use; 3) PEG3000, palmitic acid and stearate-isopropanol ester in a mass ratio of 1: 1: 1 were melted to coat the obtained particles in an amount of 15% of the mass

of the particles, followed by sieving, and 20-40 mesh particles were taken as cooling particles; 4) the obtained cooling particles were continuously molded with microwave into a loose and porous cylinder with a circumference of 23.5 mm, and the cylinder was cut into 120 mm long cooling filter rods; and 5) the cooling filter rods were compounded with paper empty tube sections in a length ratio of 10: 15 for preparing low-temperature cigarettes, wherein the cooling sections were close to cut tobacco, and acetate fiber rods were also prepared into low-temperature cigarettes of the same specification as a control. The two kinds of filter rod cigarettes were smoked, the temperatures at the outlet ends of the filter rods were tested at the fifth time of smoking, and the results were shown in Table 1.

Table 1Temperature test results

	Outlet temperature of samples of control rods	Outlet temperature of samples of cooling filter rods
Example 1	65°C	31°C
Example 2	67°C	37°C
Example 3	55°C	26°C

[0040] The tests showed that the cooling filter rod provided by the present invention had a very obvious cooling effect, and compared with traditional filter rod cigarettes, the outlet temperature was reduced by more than 50%.

Example 4

[0041] In this embodiment, the test process included the following steps:
1) 100 parts of 100-150 mesh tobacco raw material powder, 20 parts of modified starch and 30 parts of microcrystalline cellulose by mass were taken, mixed uniformly and then sprayed with 30 parts of water, followed by uniform mixing to prepare a mixed soft material; 2) the mixed soft material was granulated by extrusion rounding, dried and sieved, and 20-50 mesh cooling particle cores were taken for later use; 3) PEG2000 was melted by heating and thoroughly mixed with menthone in a mass ratio of 100: 0.5 to obtain a mixed liquid; 4) the obtained cooling particle cores were coated with the mixed liquid in an amount of 10% of the mass of cooling particles, followed by sieving, and 30-50 mesh cooling particles containing menthone were taken; 5) the obtained cooling particles were continuously molded with microwave into a loose and porous cylinder with a circumference of 23.5 mm, and the cylinder was cut into 120 mm long cooling filter rod sections; and 6) the cooling filter rod sections were compounded with acetate fiber sections in a length ratio of 10: 15 for preparing cigarettes, wherein the cooling sections were close to cut tobacco, and acetate fiber rods were also prepared into cigarettes of the same specification as a control. The two kinds of filter rod cigarettes were smoked, the temperatures at the outlet ends of the filter rods were tested at the fifth time of smoking, and the temperature test results were shown in Table 2. At the same time, the two kinds of cigarettes smoked were evaluated, and the results were shown in Table 3.

Example 5

[0042] In this embodiment, the test process included the following steps:
1) 80 parts of 100-150 mesh corncob flour, 20 parts of calcium carbonate, 10 parts of HPMC and 40 parts of microcrystalline cellulose by mass were taken, mixed uniformly and then sprayed with 25 parts of water, followed by uniform mixing to prepare a mixed soft material; 2) the mixed soft material was granulated by extrusion rounding, dried and sieved, and 20-50 mesh cooling particle cores were taken for later use; 3) stearic acid and pentaerythritol in a mass ratio of 1: 1 were melted by heating, and mixed thoroughly and uniformly with a tobacco extract in a mass ratio of 100: 5 to obtain a mixed liquid; 4) the obtained cooling particles were coated with the mixed liquid in an amount of 5% of the mass of the cooling particles, followed by sieving, and 20-40 mesh flavor enhanced cooling particles containing the tobacco extract were taken; 5) the obtained cooling particles were continuously molded into a loose and porous cylinder with a circumference of 23.5 mm by heat curing, and the cylinder was cut into 84 mm long cooling filter rod sections; and 6) the cooling filter rod sections were compounded with acetate fiber sections in a length ratio of 7: 18 for preparing cigarettes, wherein the cooling sections were close to cut tobacco, and acetate fiber rods were also prepared into cigarettes of the same specification as a control. The two kinds of filter rod cigarettes were smoked, the temperatures at the outlet ends of the filter rods were tested at the fifth time of smoking, and the results were shown in Table 2. At the same time, the two kinds of cigarettes smoked were evaluated, and the results were shown in Table 3.

Example 6

[0043] In this embodiment, the test process included the following steps:
1) 60 parts of 100-150 mesh grapefruit peel powder, 40 parts of carbon powder, 20 parts of modified starch, 20 parts of microcrystalline cellulose and 10 parts of lactose by mass were taken, mixed uniformly and then sprayed with 25 parts of water, followed by uniform mixing to prepare a mixed soft material; 2) the mixed soft material was granulated by extrusion rounding, dried and sieved, and 20-50 mesh cooling particle cores were taken for later use; 3) PEG3000, palmitic acid and stearate-isopropanol ester in a mass ratio of 1: 1: 1 were melted by heating, and mixed thoroughly and uniformly with coffee flavor in a mass ratio of 100: 2 to obtain a mixed liquid; 4) the obtained cooling particle cores were coated with the mixed liquid in an amount of 15% of the mass of cooling particles, followed by sieving, and 20-40 mesh cooling particles were taken; 5) the obtained cooling particles were continuously molded with microwave into a loose and porous cylinder with a circumference of 23.5 mm, and the cylinder was cut into 120 mm long cooling filter rod sections; and 6) the cooling filter rod sections were compounded with paper empty tube sections in a length ratio of 10: 15 for preparing low-temperature cigarettes, wherein the cooling sections were close to cut tobacco, and acetate fiber rods were also prepared into low-temperature cigarettes of the same specification as a control. The two kinds of filter rod cigarettes were smoked, the temperatures at the outlet ends of the filter rods were tested at the fifth time of smoking, and the results were shown in Table 2. At the same time, the two kinds of cigarettes smoked were evaluated, and the results were shown in Table 3.

Table 2Temperature test results

	Outlet temperature of samples of control rods	Outlet temperature of samples of flavor enhanced cooling filter rods
Example 4	65°C	31°C
Example 5	67°C	37°C
Example 6	55°C	26°C

[0044] The tests showed that the cooling filter rod provided by the present invention had a very obvious cooling effect.

Table 3Results of cigarette smoking evaluation

	Samples of control rod samples	Samples of flavor enhanced cooling filter rods
Example 4	Relatively full and harmonious flavor, slightly mixed with impure smoke, and burning sensation at the last two streams of smoke	Full and relatively harmonious flavor, slightly mixed with impure smoke, moderate cooling sensation, and good uniformity throughout smoking
Example 5	Relatively full and harmonious flavor, slightly mixed with impure smoke, and burning sensation at the last two streams of smoke	Full and relatively harmonious flavor, slightly mixed with impure smoke, thicker tobacco aroma, and good uniformity throughout smoking
Example 6	Relatively full flavor, enough smoke, and burning sensation at the first two streams of smoke	Full flavor, enough smoke, no burning sensation, light coffee aftertaste, and release uniformity throughout smoking

[0045] The contents illustrated by the above embodiments should be understood as these embodiments are merely used for illustrating the present invention more clearly, rather than limiting the scope of the present invention. Various equivalent modifications made to the present invention by those skilled in the art after reading the present invention all fall within the scope defined by the appended claims of the present application.

Claims

1. A cooling filter rod, mainly formed by cooling particles, wherein the cooling particle comprises a particle body and a shell coated on the particle body, and the shell/or the particle body contains a phase change material.

2. The cooling filter rod according to claim 1, wherein the phase change material comprises at least one of PLA, polyethylene glycol, stearic acid, palmitic acid, paraffin, microcrystalline wax, EVA, pentaerythritol, stearate-isopro-

panol ester, and stearate-glycerol ester.

3. The cooling filter rod according to claim 1, wherein the shell further comprises a flavor enhancer; further, the flavor enhancer comprises a flavor and/or a tobacco extract; and preferably, the mass ratio of the phase change material to the flavor enhancer is 100: (0.5-10).

4. The cooling filter rod according to claim 1, wherein the mass of the shell accounts for 0.5-30% of the total mass of the cooling particle.

5. The cooling filter rod according to claim 1, wherein the particle body contains plant fiber powder and/or inorganic material powder; further, the plant fiber powder comprises at least one of tobacco powder, corncob powder, rice husk powder, walnut shell powder, coconut shell powder, tangerine peel powder, and grapefruit peel powder; further, the inorganic material powder comprises at least one of calcium carbonate, carbon powder, ceramics, silica gel, and molecular sieves; and further, the particle body comprises an auxiliary molding material, and the auxiliary molding material comprises at least one of a binder, a wetting agent, and an excipient.

6. The cooling filter rod according to claim 1, wherein the particle body is obtained by thoroughly mixing base powder, hot melt adhesive powder, excipients, and water, granulating, drying, and sieving; wherein the base powder comprises at least one of plant materials, inorganic materials, and metal powder; further, the plant materials comprise at least one of tobacco raw materials, straw, peanut shells, bagasse, corncobs, pericarp, and aromatic plants; the inorganic materials comprise at least one of carbon powder, clay, calcium carbonate, and silicon oxide; and the metal powder comprises at least one of iron powder, aluminum oxide, and copper powder.

7. The cooling filter rod according to any of claims 1-6, wherein the cooling particles have a diameter of 10 to 50 meshes.

8. The cooling filter rod according to any of claims 1-6, wherein the effective porosity inside the cooling filter rod is 65-95%.

9. The cooling filter rod according to claim 7, wherein when the cooling particles are used for heat-not-burn cigarettes, the granulation is extrusion rounding granulation; and the cooling particles are spherical or approximately spherical, and have a bulk density of 0.8 to 2.5 g/ml.

10. The cooling filter rod according to claim 7, wherein when the cooling particles are used for conventional cigarettes, the cooling particles are spherical or amorphous, and have a bulk density of 0.4 to 1.6 g/ml.

11. An application of the cooling filter rod according to any of claims 1-10 in the production of cigarettes.

12. A cigarette, comprising the cooling filter rod according to any of claims 1-10.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2019/078660

A. CLASSIFICATION OF SUBJECT MATTER

A24D 3/04(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A24D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNABS; TWABS; WPI; EPODOC; CNKI; CNTXT; TWTXT, ISI WEB OF KNOWLEDGE: 降, 低, 温, 储热, 存热, 控, 相变, PLA, 聚乳酸, PEG, 聚乙二醇, 硬脂酸, 软脂酸, 石蜡, 微晶蜡, EVA, 季戊四醇, 异丙醇酯, 丙三醇三酯, phase, chang+, transit +, control+, reduc+, low+, temperature, cool+, heat, stor+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 105077576 A (CHINA TOBACCO YUNNAN INDUSTRIAL CO., LTD.) 25 November 2015 (2015-11-25) description, paragraphs 0009-0031, and figures 1-3	1-12
A	CN 104720101 A (CHINA TOBACCO HUNAN INDUSTRIAL CO., LTD.) 24 June 2015 (2015-06-24) entire document	1-12
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☑ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
28 May 2019	**06 June 2019**

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INTERNATIONAL SEARCH REPORT

International application No.
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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	US 2013306085 A1 (LOEC INC.) 21 November 2013 (2013-11-21) entire document	1-12

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
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