

The Function and Health Care of Negative Ion Fibers and Textiles

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Abstract Negative ion fibers and textiles play an important role in health care of people. This article introduced the forming mechanisms, function, and source of raw materials of the negative ion. And then the production process, test methods, evaluation and application of the negative ion fibers and textiles were described.

Keywords: Negative ion fibers; negative ion textiles; health care; application

Introduction

With the improvement in standard of living and the increases of the awareness of health care, the clothes are not just for shelter, warmth and decoration, but also are required medical care function by people. It is a good news that the coming out of the negative ion fibers and textiles to the consumers. When they are used, they can release a certain quantity of air negative ion, which can adjust the air quality around people, what's more, have an direct effect on the health of mankind. the air negative ion plays a very important role in human health, longevity and ecology. This has already been proved by the medical practice. So many people called it "longevity plain" or "air of vitamins"^[1,2]. As people know the negative ion products more and more, negative ion fibers, the new multifunctional health care materials in 21st century, will have a broad range of perspectives.

1 the mechanism of negative ion

The negative ion fibers and textiles owe releasing anion to the negative plains which are contained in the anion additive. The negative plains are a kind of environment protection materials. They will produce the anion continuously depending on the characteristics of the natural mineral; so long as the anion plains contact with the air, vapor and so on. As soon as the water molecules or other molecules in the air, or the water of the skin surface enter the anion electric field (the radius of 10 to 15 micron globular), they will be ionized by permanent pole to generate H^+ and OH^- . H^+ moves quite rapidly (about 18 times more than OH^-) to the cathode of permanent pole, absorb an electron and then become H_2 to fly into the air, while OH^- meets with the other water molecules to form $H_3O_2^-$. These changes can't stop unless there is on moisture in the air, and won't produce the poisonous substances or cause other side effects.

2 the function and activity principle for negative ion

A research shows that wearing the nightdress of launching the anion during sleeping at night could reduce the rectum temperature, promote sleeping, and improve the immunity of human body^[3]. This is all because of predominant function of health care for the anion. As follows:

(1) adjust the excitement and suppress function of the central nerves. The process : the negative ion \rightarrow lung \rightarrow blood \rightarrow a barrier of blood brain \rightarrow the brain ridge liquid \rightarrow the central nerves system.

(2) improve the function of lung and control the breathing. The principle is that the anion goes though the mucous membrane of respiratory tract, promote the movement of cilia in the mucous membrane, make the secrete of glands, the excitement of smooth muscle and exchanging breathing of the lung rise.

(3) Lower blood pressure. The process: the negative ion \rightarrow single amine MAO \rightarrow oxidation deamination \rightarrow decrease the concentration of five Hydroxyl Tryptamine, Catecholamine and Norepinephrine \rightarrow decompression.

(4) Functions to improve the myocardium and stimulating the hematopoietic function of it. The process : the negative ion \rightarrow blood \rightarrow increase the deformability repulsion of the erythrocyte \rightarrow slower the sinking blood ; the negative ion \rightarrow improve the function of spleen \rightarrow increase erythrocyte and blood calcium of the blood.

(5) Boost immune function. The main performance : ① oxygen anion (super oxide anion radicals) which has a high bioactivity can kill the bacteria to a certain extant. ②The epithelial cells can prevent the virus attacking the cells, because they own the negative charge by the negative ion, which increases the repulsion of the same electric charge.

(6) After the hydration hydroxyl ions are breathed into people' s bodies, they can adjust the PH value of blood

and make the human body fluid change into weak alkalinity. This kind of body fluid has many merits such as activating the cells, increasing the penetrations for the cells, improving various functions of the cells; keep the ionic balance, increasing the ability to transform of oxygen gas, accelerating metabolism and so on. So it can make people relax and be of good heart. As the same time, it also has an effect on the physical therapy.

3 The functional materials to release the negative ion

3.1 The kind of tombar thite ores which can send faint radiation

The ores containing natural uranium and thorium may launch a little radiation which can change the particles floating in the air into ions. So the negative electrons come into being. However, considering the safety^[4], the researchers take more consideration into other better succedaneum.

3.2 The natural crystal ores which possess electromagnetic field of their own

Such ores include odd ice stones, electrical stones, the protein stones, and hot stuff stones, etc. they all have the properties of thermoelectricity and controlling electricity^[5]. With the changes of the temperature and pressure even a slight variation, these ores will generate electrostatic charges of one million electron volt because of the energetic conductivity and piezoelectric property. So the ionization by air will come into being and then the electron hit will integrate the water and oxygen molecules nearby into the air negative ion that is the negative ion. Because the minerals are used with safety and environmental friendly, they are enjoyed very much by the researchers.

3.3 Some minerals in the ancient floors^[6]

The minerals are inorganic porous material including coral fossil, the seabed sediment, seaweed carbon, p.chinensis and so on. They all have permanent electric pole, which can ionize the air even in the slight changes. So they are regarded as natural negative ion generators.

3.4 The photo catalysis materials^[7]

Photo catalysis, a kind of catalyst, which can accelerate the reaction of other things without anything changes for itself, are mainly made up of titanium dioxide. Because titanium dioxide is light-sensitive semiconductor material, it will give rise to electronegative electrons and positive-electric hole by the ultraviolet energy after it catches sunlight and lighting source. The hole reacts with water, electron and oxygen to produce the strong oxidized characteristic hydroxyl radical and negative oxygen ion, which not only make air clean but act for

sterilization and deodorization.

4 The production of negative ion fibers and textiles

4.1 The production process of anion fibers

There are 3 steps in the process of negative ion fibers by chemical and physical methods. Firstly, make the anion additive into nano-grade fines with fine property of compatible with polymer materials. Secondly, after the superficial treatment, nano-grade fines are mixed with polymer carrier in the certain proportion to get the dry anion master batch by melt extrusion and drying. Finally, the mixture of the anion master batch and polymer slices with a certain ratio to make into fibers by spinning. The specific technology is as follows^[8]:

Raw materials → chemical and physical methods → nano-grade fines → superficial treatment → batch feeder → extrusion → anion master batch → drying → batch feeder again → spinning → finished products.

4.2 The processing method of the negative ion fibers and textiles

The processing methods of the anion fibers and functional textiles can be divided into two main categories. One is that make the anion additive to spin into anion fibers, the other one is that have the textiles release the negative ion by after finish.

The main method of manufacturing of anion fibers are surface coating and modification, blended spinning, copolymerization and so on.

4.2.1 Surface coating and modification

In the post processing of fibers for this method, people try to set the inorganic particulate conditioning fluid containing tourmaline which can stimulate the air anion on the surface of fibers taking advantage of the technology of superficial treatment and resination. For example, in Japan, the researchers mixed the pieces of coral fossil, saccharides, acid solution with some fungoid fungus to make into mineral stoste in the higher temperature for a long time, and then put it on the fibers. With resinbinder in the stoste, the negative ion fibers with nice durability are come into being.

4.2.2 Blended spinning

Compared to surface coating and modification, this method is better. It is mainly used to produce the modified and multifunctional synthetic fibers. Before polymerization and spinning, put the mineral releasing the air anion into the polymer melt or the spinning solution. After spinning, we can get the negative ion fibers. In our country, this method is mostly used to produce the anion fibers by the researchers^[9-12].

4.2.3 Copolymerization

The method belongs to chemical reaction. The anion additive is put into the polymerization process, and then the functional slice which can release the anion is made through the spinning process. The slice and master batch which are generally obtained by polymerization method make the additive distribution evenly; also the spinning formability is great. Abroad, three kinds of methods are all adopted in the production of the negative ion textile products. Because of the excellent durability, copolymerization is used the most to the law. However, in our country, people often produce the anion fiber taking advantage of the way of surface coating and modification right now.

4.3 finishing techniques

Finishing techniques is that fix the treating fluid of inorganic fine grain on the surface of textile fabrics in order to have it release the anion. In Japan, researchers make use of different sorts of fabric after-finishing^[13] to develop negative ion products, which have come out first in the world, such as "IONAGE" for the Nisshinbo Group, negative ion fabric named "Verbano"^[14] from KomatsuSeiren, the new finishing technique "aqua-heal"^[15] from Toray Industries, Inc., "green shower fibers"^[16] from Kabopou and so on. Researchers in Beijing copper Niu limited liability Company and in Cheng Du, the spinning product Co., LTD, Hong Kong office in Cheng Du both use Wizards stone series of anion additives to try to produce anion products, and also obtain good effect. After-finishing is different from the conventional process, which adds the mineral into the yarn, will mix of yarn, and the advantage of it can be applied to all kinds of textile fabrics and the process is simple.

5 the testing method and evaluation for negative ion textiles

No open standards at home and abroad for such documents evaluation of anion textiles yet. One of the few public reported documents is that the industry standard launched by the building materials industry in 2006-JC/T1016-2006 " test method of the result of anion material ", the standard to the determination of anions material surface occurrence. At present, rub with hands method and the new test methods for FCL anion fabric^[17] have commonly been used in domestic textile laboratory.

5.1 The method of hand rubs

This is a kind of opening measurement. And it combines oxygen ion measuring instrument with the way of artificial hand rub to test the released anion concentrations.

5.1.1 Testing method

Place the sample in front of testing instrument with opening by 1~2 cm, and then use your hands to roll the

sample at 200 times per minute frequency. And one minute later, instrument will record the dynamic curve of the anion concentrations, get the average for each test results, repeat it about three times, and then get the average of them, which minus the blank sample test results to get the results for concentrations of the anion sample.

5.1.2 Evaluating

The biggest problem in anion fabrics testing for this method is to evaluate anion textiles qualitatively, but no quantitative evaluation. So the test result has accidental severer error and bad reproducibility to be improved.

5.1.3 The existing problems

There are several defects in the method of hand rub. Firstly, different testing environment will develop different results. Then, with the changes of rubbing strength, the results won't be accurate. Finally, not every experiment could compare with the sample.

5.2 The anion testing of FCL fabrics

According to the production and current standard of the anion textiles, FCL fabric test methods, a kind of closed-end measurement, is a new method studied and recommended by the test center of Chinese textile industry association, which has had a directional research for the test method and standard evaluation.

5.2.1 Test method

Take SMART ION MONITOR made in Japan as anion testing device for the experimental environment of which is a storehouse (length x width x high not less than 700 mm × 40 mm × 40 mm, and no bottom) under the atmosphere in the standard. Meanwhile, use existing instrument as automatic fastness friction tester to test the concentration of negative ion released by the fabric.

5.2.2 Evaluating

According to the anion testing of FCL fabrics, the test results should be the average of testing results more than three times, and sample should be set as the same time and storehouse with the blank sample. Test outcome is as follows:

The ion concentration of sample (I) = the average of sample's ion concentration (I₁) - the average of blank sample's ion concentration (I₀).

What the results reflect is multiples, that is, the number of ions for sample relative to blank sample. While general blank sample of the anion can release 200 ions.

The testing results are divided into three grades: calculation results for 3~5 evaluated with ion function, 5~10 assessed for the good releasing ion textiles, more than 10 thought as the excellent releasing ion textiles.

No essential difference between the anion testing of

FCL fabrics and hand rub, however, FCL is more accurate and has better reproducibility than hand ion fibers and textiles

6 The application of ion fibers and textiles

(1) Clothing and household textiles such as underclothes, bedclothes, towels etc.

(2) Interior decoration materials, including curtains, carpets, sofa covering, cushion and so on

(3) medical nonwoven cloth: surgery clothes, nursing dress, hospital bed supplies, etc.

(4) Filter materials, such as filtration of the air conditioning, water filtration.

(5) Other materials.

7 Conclusions

Step into 21 century, with the rapid improvement of the human health conscious, the concept of “a person who has health then has everything” is deeply embedded in human being. Therefore, the newly type of negative ion health textile product which has highly—value and high—technology should be developed positively, also the important realistic meanings and great development prosperous is embraced.

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