STUDY ON THE CONTENT OF TRACE BENEFICIAL ELEMENTS IN DRINKING WATER BY NEW NEEDLE STONE CERAMIC MATERIALS UNDER DIFFERENT HEATING CONDITIONS

by

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In this paper, the rich in calcium and magnesium zinc chrome strontium selenium and other 40 kinds of trace elements beneficial to human body and mineral material analysis, developed a new kind of new needle stone ceramic materials that can change the drinking water quality. Existing ceramic materials, although some contain trace elements. Some existing ceramic materials in the human body needs trace elements, but its chemical properties of stability, very difficult to apply to water. Which are rich in stone needle component of ceramic material, it not only can improve water quality in the drinking water is rich in many kinds of trace elements, and on the form has the very good plasticity, can be processed to produce forms of household appliances and other functional products, also can make particles added to the water purification device in long time used in this paper, first of all, the main factors of affecting the content of trace elements in drinking water done in-depth research, and then according to the material, the factors which influence study materials can be widely used in drinking water purification and treatment.

Key words: *trace elements, drinking water, needle stone ceramic materials, water quality,*

Introduction

With the people's standard of living rises gradually, at the same time more and more people begin to pay close attention health problems, and the natural environmental degradation, water pollution, drinking water safety problems need to solve, the water quality of drinking water problem has become the focus of attention of people more and more people begin to choose to use water purifier water quality change [1].

Researchers constantly research and development which has the function of water purification products, including the invention of the water purifiers meet the demand of the masses, gradually entered the ordinary people, when people have got used to the health harmless water purification at the same time, in fact, the trace elements in the water was purified, the purifying water while health is harmless, but lack of trace elements for human, long-term consumption of body will be getting sick due to the lack of beneficial trace elements, although

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few human daily intake of trace elements, but it is necessary, the use of new needle stone ceramic materials will increase the human body needs trace elements play a role of its new needle stone ceramic materials can be made into storage containers, water purification after deposited in the storage device may continue to soften water quality and increase the ownership of trace element, provides the high quality water source [2, 3].

Needs to pay attention that the precipitation of trace elements is need to keep a certain temperature and precipitation of special condition is the basic safeguard, play as a ceramic material, through the study of ceramic materials formula and production methods to produce suitable for requirements of porcelain and ceramics art, it not only ensures the edible value of original product also added the functionality of the product. This kind of new needle stone ceramic materials can also be used for water company, by purifying softened water, can directly provide weak alkaline high-quality household water containing trace elements.

Ceramic products is essential to human life and daily necessities, since the date of its birth is related to human life are inseparable, for ceramic containers have the function that change the water quality, will provide the required trace element for human body and will bring great changes to human body health [4, 5]. Stone needle is one of the first invented in ancient China and use the most primitive medical appliance, it is the product of the neolithic age, as early as the paleolithic human subconscious use stone needle therapy of disease, but the inspiration that comes from a medical function and optimizing water quality characteristics of the stone needle, [6-8].

Methodology

According to the methods provided by existing research [9-12], the configuration of the new ceramic material need to first calculate the all the proportion of raw materials, firstly. Through the data from tab. 1 and tab. 2 calculate the stone needle powder alternatives to the content of each mineral chemical composition, as shown in tab. 2 stone needle clay mixed white kaolin in the material red kaolin is according to the product needed color to choose, so we just choose ore containing calcium magnesium zinc iron and silica can determine the raw materials after they are balancing various chemical raw materials, the proportion in the overall calculation method to calculate the blank ingredients through the format. At last, through raw material crushing process into a new type of needle stone ceramic materials.

The specific composition of various components is:

Table 1. The composition of the stone clay

Scale Component name	Percentage [%]
Red kaolin	30
White kaolin	10
Bian-stone powder	10
Tuogou clay/Native clay	30
Feldspar	15
Quartz	5

The data is obtained by detecting the mineral chemical composition in the stone.

Table 2. The results of chemical composition analysis and its proportion in new ceramic materials

Chemical weight / Name	The proportion of each chemical composition in the bian-stone [%]	Specific gravity of chemical components of bian-stone replacement in new needle stone ceramic materials [%]
$CaCO_3$	96.17	9.617
MgO	0.60	0.06
SrO	0.33	0.033
Fe_2O_3	0.84	0.084
SiO_2	0.78	0.078
TiO_2	0.40	0.04
Na_2O	0.84	0.084
K_2O	0.04	0.004

Specific experiments

Check the utility function of new ceramic material.

The PH detection of new needle stone ceramic materials

Refer to the existing research [13-15] to determine the following experimental protocol. Materials: natural water, tap water.

Instrument: PH meter; measuring range 0-14 ph; model: MT-5000.

Temperature: 100 °C.

In the vessel made of new ceramic materials, 100 °C natural water and 100 °C tap water were respectively brewed. It was found that the pH values of the two waters increased, and the pH value was between 8.03 and 8.19, which was weakly alkaline, as shown in fig. 1. This shows that this new ceramic material has the function of softening water quality.

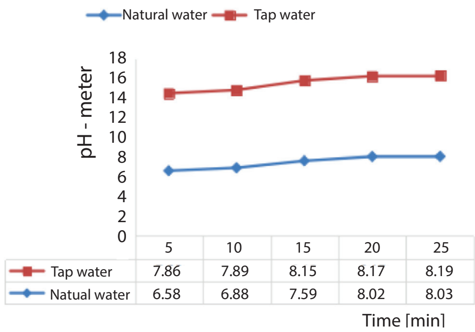

Figure 1. Comparison of PH value of natural water and tap water under new needle stone ceramic materials

The influence of the heating curve on the yield

Record the product yield of different temperature firing system, with 100 units per kiln.

Through the firing experiments, the manufacturing success rates of 1050 °C, 1100 °C, 1150 °C, 1200 °C, 1250°C, 1300 °C, 1350 °C were recorded and studied, and the best firing temperature of this new ceramic was found in 1190-1210 °C. Around 1190-1210 °C, the manufacturing success rate in this interval can reach about 98%, as shown in fig. 2.

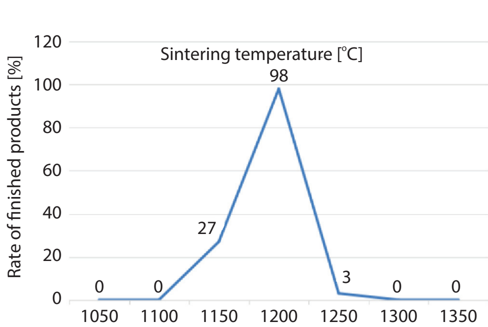

Figure 2. Relationship between temperature and product yield

The influence of the heating curve on the yield

Refer to the existing research [16-18] to determine the following experimental protocol.

Experimental materials: 20 g sample, volume 200 mL.

Experimental method: inductively coupled plasma atomic emission spectrometry (D. L. Indicates that the detection limit is below the detection limit).

Table 3. Drinking the health of the volunteers who were rich in trace elements group I

Time / Element	40 °C	60 °C	80 °C	100 °C
Ca	3.1610	4.4609	5.2871	5.5818
Fe	0.0054	0.0071	0.0095	0.0187
K	0.0610	0.0720	0.1037	0.1190
Mg	0.0531	0.0780	0.0890	0.1271
Na	0.0760	0.1340	0.1913	0.3067
Si	0.0137	0.1315	0.1370	0.1621
Sr	0.0098	0.0287	0.0328	0.0346
Ti	D. L.	–	–	–

Table 4. Drinking the health of the volunteers who were rich in trace elements group II

Time / Element	40 °C	60 °C	80 °C	100 °C
Ca	3.2877	4.4556	5.4590	5.3928
Fe	0.0053	0.0060	0.0090	0.0288
K	0.0601	0.0790	0.1042	0.1178
Mg	0.0526	0.0767	0.0898	0.1277
Na	0.0745	0.1355	0.1917	0.3287
Si	0.0130	0.1350	0.1305	0.1598
Sr	0.0091	0.0270	0.0376	0.0378
Ti	D. L.	–	–	–

Table 5. Drinking the health of the volunteers who were rich in trace elements group III

Time / Element	40 °C	60 °C	80 °C	100 °C
Ca	3.2357	4.4553	5.4501	5.3944
Fe	0.0046	0.0058	0.0088	0.0256
K	0.0635	0.0777	0.1050	0.1188
Mg	0.0526	0.0777	0.0887	0.1297
Na	0.0728	0.1348	0.1906	0.3223
Si	0.0129	0.1386	0.1302	0.1599
Sr	0.0088	0.0290	0.0388	0.0350
Ti	D. L.	–	–	–

Table 6. Drinking the health of the volunteers who were rich in trace elements group IV

Time / Element	40 °C	60 °C	80 °C	100 °C
Ca	3.2645	4.4542	5.4503	5.3944
Fe	0.0040	0.0077	0.0089	0.0256
K	0.0630	0.0771	0.1002	0.1179
Mg	0.0544	0.0782	0.0885	0.1202
Na	0.0728	0.1320	0.1930	0.3288
Si	0.0145	0.1388	0.1367	0.1512
Sr	0.0085	0.0201	0.0345	0.0353
Ti	D. L.	–	–	–

Table 7. Drinking the health of the volunteers who were rich in trace elements group V

Time / Element	40 °C	60 °C	80 °C	100 °C
Ca	3.2833	4.4583	5.4570	5.3990
Fe	0.0045	0.0038	0.0077	0.0291
K	0.0689	0.0756	0.1081	0.1182
Mg	0.0592	0.0728	0.0892	0.1290
Na	0.0793	0.1337	0.1919	0.3203
Si	0.0140	0.1336	0.1330	0.1591
Sr	0.0055	0.0266	0.0323	0.0389
Ti	D. L.	–	–	–

Table 8. Drinking the health of the volunteers who were rich in trace elements group VI

Time / Element	40 °C	60 °C	80 °C	100 °C
Ca	3.2863	4.4590	5.4583	5.3946
Fe	0.0088	0.0077	0.0020	0.0202
K	0.0692	0.0783	0.1040	0.1129
Mg	0.0503	0.0767	0.0892	0.1230
Na	0.0702	0.1382	0.1930	0.3240
Si	0.0190	0.1319	0.1348	0.1572
Sr	0.0073	0.0203	0.0355	0.0329
Ti	D. L.	–	–	–

In this experiment, six different water samples were selected, immersed in a new ceramic container, and the temperature was adjusted, and finally the content of trace elements in water was measured. The results are shown in tabs. 3-8. It can be seen from the data that the amount of trace elements precipitated is proportional to the water temperature. Therefore, when using this ceramic material, the water temperature should reach 80 °C or higher.

The long-term consumption of water rich in trace elements can reduce the incidence of human diseases

Refer to the existing research [19, 20] to determine the following experimental protocol.

The six groups of volunteers with different physical fitness were selected as the study subjects, and a group of five participants.

I < II < III < IV < V < VI (six groups of volunteers' health status).

A < B < C < D < E (incidence of strong and weak contrast).

Table 9. Health status of volunteers drinking water rich in trace elements

Month / Volunteers	1	4	8	12	16	20
I	E	E	E	C	C	B
II	E	D	D	C	B	B
III	D	C	C	B	B	B
IV	D	C	B	B	B	A
V	C	B	B	A	A	A
VI	C	B	A	A	A	A

As can be seen from tab. 9, by investigating five groups of volunteers who applied new ceramic products with different physiques, it was found that even the worst physiology of group I and group II was greatly improved, from the original E to B. The group V with the best physical performance achieved a comprehensive evaluation in the 12^{th} month.

Results and discussion

Using the ultra-pure boiled water and standard solution, soaking new with the needle stone ceramic materials, get the results:

Ultrapure water brew fluid does not contain harmful to human body of Cd, Cr, Cu, Pb and zinc and other heavy metal elements, but contain very tiny amounts of Ca, Mg, Sr, Na, K and Si the common elements, such as the extension of its content as the brewing time presents the rising trend, but much lower than national indicators of water quality standards, and brewing liquid pH stability between 8.1-8.2, weak alkaline and taste good.

In the infusion solution of standard solution, the content of the main common elements is increasing with the increase of the time of infusion and the increase of pH value. But harmful heavy metals, and the vast majority of the content of metal ions have a trend of decline for the dissolution of $CaCO_3$, metal ions, carbonate precipitation and adsorption between metal ions and the surface of $CaCO_3$, is brewing in the vast majority of metal ion concentration showed a trend of decline for the three main factors.

New needle stone ceramic materials brewing water non-poisonous and harmless, and has a lower concentration of harmful heavy metal elements in the brewing water and appropriate to the human body complement the function of the Ca and K, have certain help to improve water quality, and appling to use in food, safely.

Conclusions

Using the natural water and tap water 100 °C soaked with new needle stone ceramic materials, by detecting the PH value found in the water all have rise, and PH between 8.03-8.19, as the weak alkaline, illustrates the new ceramic material has the function of softening water quality.

By firing practice, respectively on the yield of 1050, 1100, 1150, 1200, 1100, 1300, 1150 compare records and research, found that the new type ceramic best sintering temperature is controlled in 1190-1210, in the range of successed yield can reach 98%.

Using new ceramic bubble water in Experiment 3, and detect the content of trace elements in water, the data shows that trace element is directly proportional to the amount of precipitation and temperature, therefore, in the use of this ceramic material when the water temperature should be above 80 °C.

For the application of new products based on 6 groups of different constitution volunteers to investigation and study, can be found even the weakest prealence of I and II also has great improvement from level E to level B, level V with best body physique even reached level A in December.

New composite stone needle component ceramic material will make a great contribution the change of water quality, provide people with healthy alkalescent water to solve drinking water problem reduce the prevalence of this ceramic material can be as a family as the unit using a small scale, also can be used in improving urban water purification equipment, provides the high quality material for tap water company, widely used in municipal water.

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