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Preclinical efficacy examination on healing practices and experiences of users for pillows and mattresses of loess ball bio-products

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Abstract

In Korea, loess has been known as a healthy material traditionally, and in everyday life it has been used in various fields. Korean loess ball has unique electrical and magnetic properties indispensable to survival of human being such as living-light of far-infrared radiation which has been applied to various bio-products. However, the medical investigation of its efficacy for such bio-products has remained insufficient. The purpose of this paper is to check not only chemico-physical data but also medical data on the medical efficacy for the various healing practices and effects shown in users of these products. The Korean loess ball was manufactured by several powder processes at low temperature such as aging, mild grinding, separation, granulation, and drying. The healing effects for the bio-products of the loess ball were confirmed based on the statistical analysis of user′s experience for healing practices evaluated by Somatoscope microscope observations of the movement of red blood cells in living blood, the infrared thermography diagnostic equipment, the comparison of Digital Infrared Thermal Imaging, DITI photos, the survey of literature review on the loess healing including the Donguibogam edited by Jun Heo. In conclusion, when slept on loess ball bio-products such as pillows or mattresses, the congestion of red cells in the blood of the human body is relieved and the blood circulation in blood vessel is smoothly improved. The wave resonance actions of far-infrared rays radiated from the loess ball bio-products enforce the receptor and intracellular enzymes to act the interaction of a variety of pain and stress and to bring a healthy condition. Further study for clarifying medical healing mechanisms of bio-products through the clinical test in both the oriental and western hospital is requested and the upgrade of present bio-products becomes obvious.

Selection and peer-review under responsibility of Chinese Society of Particuology, Institute of Process Engineering, Chinese Academy of Sciences (CAS)

Keywords: Loess, Far-infrared rays, Bio-products, Wave resonance, CAM

1. Introduction

The space development was started from 1950s by Russia and USA. This project studied the survivable conditions of human being and NASA's research on sunlight found that far-infrared rays (FIR) of wavelength 5.6 to 14 μm were indispensable to the survival of the creature. At the same age, German scientists studied bio-resonance wave and detected the mechanism to improve human health which had been called as a kind of nature cure. Based on the information, FIR attracted attention in Japan at the

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almost same time. Then, various ceramic materials have been captured a spotlight as the source of FIR[1-3].

The yellow loess which is produced in Korea and contains various minerals has been said to exhibit excellent radiation heating effect inherently. The reduction of heating expense, the uniform heating by radiation, the effect of heat storage, and the properties of de-odor, antifungal, and anti-bacteria are excellent, and the effect of mold habitation prevention, and the function of its humidity and temperature adjustment are also excellent. In addition, the yellow loess has various characteristics such as the improvement of the aesthetic effect. As an example, the various designs of colors increase the value of the life goods by the realization of a unique color and make a beautiful appearance of cloths and houses.

Utilization fields of the yellow loess and yellow loess ball are very widespread from old days to the present. The effect shows some prominent medicine characteristics for treatment of various diseases. It has been used in the place to build a house or an earthenware vessel from old days. The uses are effective to cool at night and warm in daytime and re-fleshing due to the warmth of yellow loess. The effect of the yellow loess on the immune reinforcement of human body was analyzed and proved scientifically and yellow ball becomes now gradually useful everyday life goods for citizen who desire to pursuit sound life[4].

Based on the characteristics of yellow loess powder, a manufacturing process was developed to produce yellow loess balls, Living-In Hwangto ball, from yellow loess raw materials at the condition to maintain the characteristics of unique far-infrared rays radiation. The Living In Hwangto Co. Ltd. has launched to produces such bio-products as the mattresses, bed, pillow, and cushions with yellow loess balls since about 10 years ago and they were nominated to be a Korea Brand by the National Authority of Korea.

The yellow loess culture institute of health promotion was attempted to discuss the efficacy of Hwangto bio-products based on the following 2 items: (1) the basis of physicochemical properties of loess and the scan data of DITI (Digital Infrared Thermal Imaging) commonly used in the medical diagnosis, and (2) the related literatures[4-10]. In the meantime, we have heard the testimonials within a short period of time from many users of loess bio-products who have experienced the fatigue recovery and stress-relieving efficacy including the traditional healing actions or functions such as detoxification, deodorization, air purification, antibacterial, antifungal, and temperature control.

The paper presents the relationship between the efficacy of the Hwangto bio-products and the far-infrared radiation characteristics of yellow loess ball to provide the useful information obtained from research results.

Nomenclature

H	healing effect
k	empirical constant
t	healing time

2. Korean yellows loess and its characteristics

2.1 The physical and chemical properties of yellow loess

Table 1. Summary of physico-chemical characteristics of loess powder, living-in Hwangto

No.	Item	Measurements or Instrument	Characteristic value	Remarks
1	Color	Visual observation	Yellow to red	Iron content
2	True density	Helium gas substitution	2.81 g/cm^3	
3	Bulk density (Static)	Flowability test	0.87 g/cm^3	
	(Dynamic)	Flowability test	1.23 g/cm^3	
4	Particle size distribution	Mastersizer 2000	D_{50}=20.3 μm	
5	Crystal structure	X-rays powder diffraction	Structure	
6	Morphology	SEM photography	Honeycomb of Halloysite	
7	Thermal analysis (TGA)	SDT Q600	Weight change	
	(DSC)	SDT Q600	Phase change	
8	Chemical composition	EDS or XRF	Main & minor composition	
9	Specific surface area	BET method	23.0 m^2/g	
10	Micro pore distribution	Mercury intrusion method	D_{pore}=10.3 nm	

(a) Analysis of X-ray diffraction pattern: Feldspar and quartz are the main constituent minerals. Clays are composed of a sericite and a kaolinite. The constituents and their ratios are as follows: SiO_2 72.3wt%, Al_2O_3 13.0wt%, Fe_2O_3 6.00wt%, K_2O 2.18wt%, and MgO 1.05wt%.

(b) SEM observation: The particles of silt or clay of 40 μm or less are the fine structure of yellow loess. The existence of a structural form such as Kaolinite of plate shape or needle shape ($2Si_2O_5(OH)_4$) and Halloysite of hexagonal shape ($2Si_2O_5(OH)_4nH_2O$) were observed.

(c) Analysis results of chemical composition: Contents of the oxides of about 20 chemical species including mainly SiO_2 were measured.

(d) Analysis of minor amount elements: It was checked that the minor amount elements dissolved in the water is contained with various abundant mineral ingredients of 18 chemical species.

The above physico-chemical characteristics and the other measured data at least requested for the further discussion are summarized in Table 1[11].

2.2 The far-infrared radiation property of yellow loe

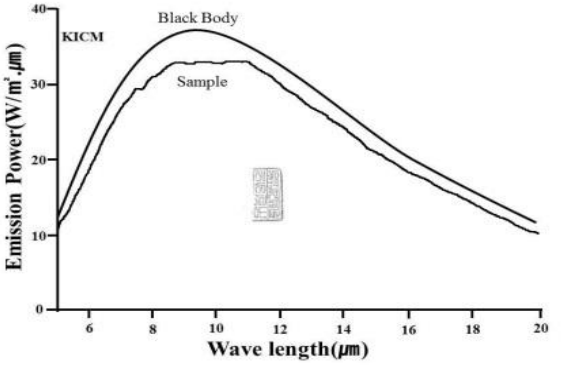
Table 2. Test results of far-infrared rays radiation of loess at 40℃

Test item	Test result	Remarks
Emissivity (5~20μm)	0.927	
Radiation power	374W / (m^2 • μm)	

1) Wave region: 2,200 / cm (4.5 μm) ~ 550/cm (18 μm).

2) Test date at 40℃ according to the demand.

3) Test results measured by FT-IR Spectrometer.



The emissivity and the radiation power of the far-infrared rays radiation characteristics at 40℃ were measured with FT-IR spectrometer at the Korean Construction Material Test Institute as sho wn in Table 2 and the right side figure. It is shown that almost radiant powers from Hwangto ba ll have covered the wavelength range of the growth rays of 5.6~14 μm wavelength essential for t he survival of the or-ganism.

2.3 Living blood test

Before and after far-infrared rays radiation (here for 20 minutes) on the mattresses, the glass blood sample was made from a drop of living blood taken from a finger. The photographs were taken by the Somatoscope (Olympus BX50, Tokyo, Japan) with CCD camera (Toshiba, Tokyo, Japan) for the observation of the action of red cells.

2.4 DITI inspection

DITI, IRIS-XP (Medicore, Seoul, Korea) was used as a digital infrared thermal diagnostic device. The surface temperature was measured for such three kinds of samples as yellow loess powder and its ball, Cheon-geum stone powder and its ball, and cement powder and its block.

All measurement conditions which affect the room temperature including aeration and lighting were controlled and the room temperature was maintained at 25℃. The distance between the camera of DITI and the surface of each test sample was fixed at 120 cm[15].

3. Manufacturing process of yellow loess ball for bio-products

3.1 The manufacturing process of yellow loess ball

One lot of natural raw powders is initially annealed for six months or more and processed to a series of unit operations such as screening to remove other heterogeneous matters such as pebble and fibrous material, crushing, kneading with a binder, extruding, spheronizing, drying and immersion process in plant extract liquid. The process as shown in Fig. 1 is a low temperature drying process with consideration for various characteristics of yellow loess as shown in Table 1[13].

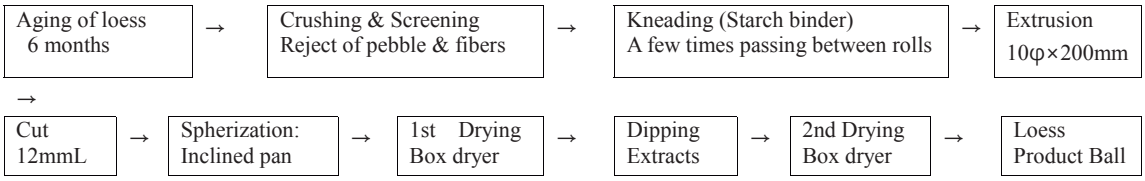


Fig. 1. The flow sheet of manufacturing process of yellow loess ball with-operating conditions.

3.2 Mattresses and pillow, bio-products of the yellow loess ball

- Mattresses for bed of head cold feet warm style (a type of Korean Ondol heating culture): The loess balls are charged line by line into mesh cloth as shown in Fig. 2. Fig. 3 shows the section profile of bed with spring mattresses. The temperature control system of mattresses was used with Korean Ondol heating system[12], in which a part near fire inlet is warm and other part away fire inlet is cool, and designed to set the mattresses temperature to be different such as head, body, and feet[12]. Even not necessary to input the electrical power in summer, it is recommend turning on electrical power and heating once per a month for revitalization of the yellow loess ball.

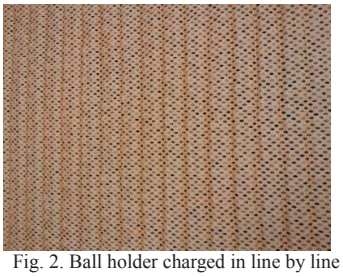


Fig. 2. Ball holder charged in line by line

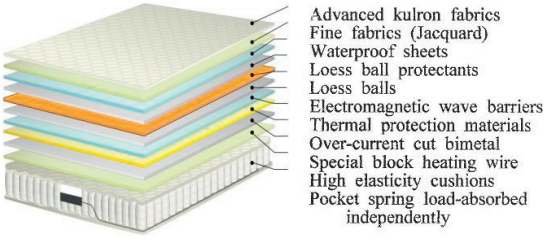


Fig. 3. Section profile of bed of spring mattresses

- Pillow: The electrical portion of heating is no needed. The others structure of pillow is similar to that of mattresses for beds. The yellow loess ball in pillow is also revitalized by taking the sun light once a month. The pillow can be revitalized and used more effectively [13,14].

4. Research results

4.1 Basic physical-properties data of yellow loess

Fig. 4 shows a typical graph of such physico-chemical properties as specific surface area and pore size distribution as shown in Table 1. The important data are noted in each figure. The data shows that the yellow loess is considered as a stable and safe material for healthy goods[11].

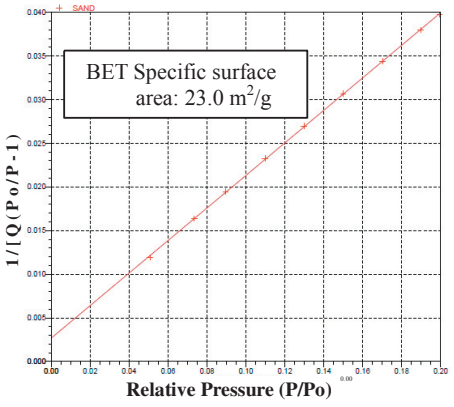


Fig. 4A. Bet surface area plot.

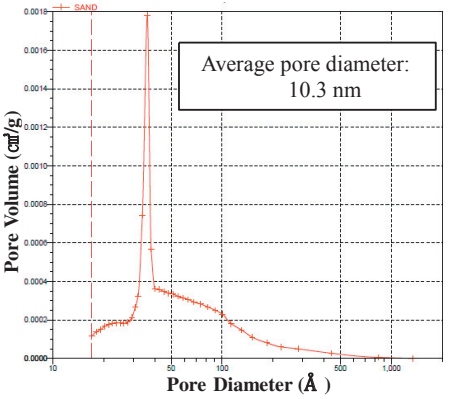
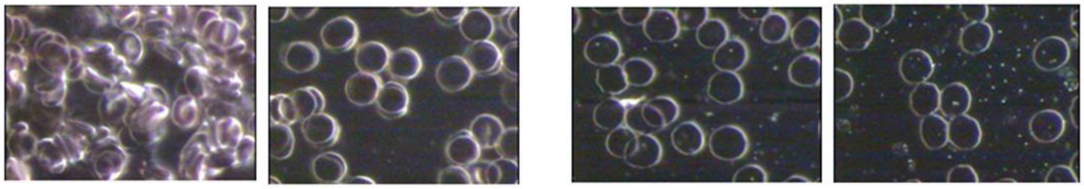


Fig. 4B. BJH Desorption dV/dD pore volume

4.2 Examination of living blood test data

Man of 50's generation Woman of 50's generation

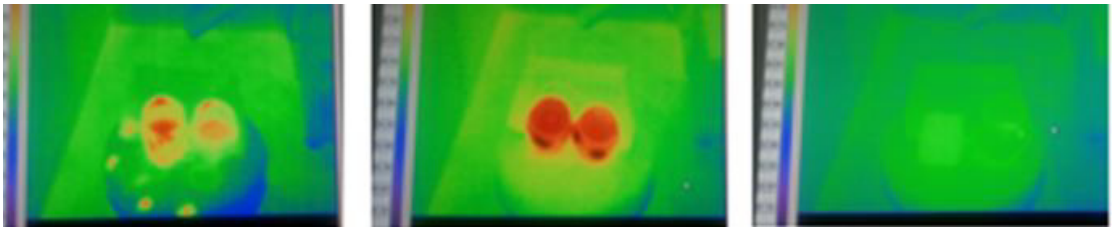


Left: before radiation, Right: after 20 minutes radiation on Mattresses

Fig. 5 Somatoscope photographs for living blood test of two persons.

Experimental conditions: Somatoscope: Olympus BX50, Tokyo, Japan, CCD camera: Toshiba, Tokyo, Japan.

The Somatoscope photographs of Fig. 5 show that the red cells in living blood after 20 minutes radiation from a mattresses are separated one by one and move more actively than those of before radiation. The blood circulation after 20 minutes radiation on the mattresses is observed to be improved not only in a large blood vessel but also in a peripheral small vessel. This movement of red cells in the case of the mattresses at room temperature is confirmed to be the same movement of red blood cells from those photographs[16,17].



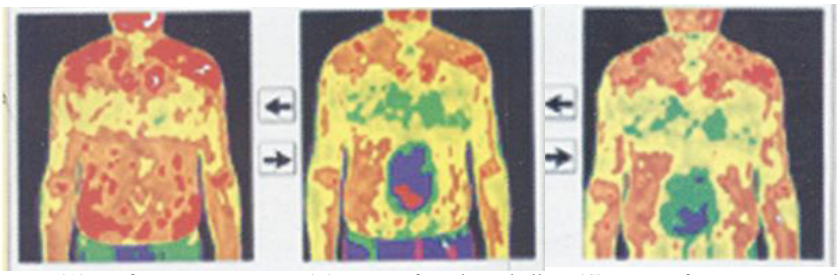
Sample: Loess powder and its ball Cheongeum stone and its ball Cement powder and its block

Fig. 6. Typical photographs of DITI for the surface of three samples by using DITI (25℃±1℃). Experimental conditions: Apparatus: DITI, IRIS-XP, Distance between IRIS-XP and the sample surface: 120 cm, Temperature: 25℃±1℃

DITI is a diagnostic technique that is non-invasive and no exposure from radiation. During an examination, these thermographic images are taken by trained thermographers who are capable to interpret the images and give medical advice to the patient. This technique is employed in common clinical uses such as early detection of breast cancer, monitoring changes in overall health, monitoring healing processes, disease and virus monitoring, and fever screening (i.e. H1N1, SARS) based on color changes before treatment and after treatment, which indicate the influence of increases or decreases in infrared radiation emitted from the body surface[18].

The measured surface temperature of each sample was appeared in order of Cheongeum stone, yellow loess, and cement from the colors as shown in Fig. 6.

4.3 Examination of a DITI photograph



(A) Before expose (B) Expose from loess ball (C) Expose from common soil

Fig. 7. Comparison of DITI photographs at various expose conditions.

Fig. 7A is the DITI photograph of a human body upper abdomen, and Fig. 7B is the DITI photograph after exposed from sample Cheongeum stone, and Fig. 7C is one after exposed from a common soil. Red color zones at an upper abdomen have suggested that the thermal radiation from yellow loess balls is larger

than other samples. It becomes clear that the far-infrared rays radiation property of the yellow loess is effective to rise the skin temperature rise. Thus, the DITI photograph is capable to apply to management of the patient who appeals against the pain of the backbone, the pain before and after operation, and the early checkup of the rheumatism disease accompanied with various pains, etc.

5. Consideration for human body healing characteristics owing to yellow loess bio-products

5.1 Users' testimonials to healing records of bio-products

Although there is still little medical proof, the healing effect of bio-products such as pillow, mattresses for bed, and cushions is told to be good from many users' experience cases such as headache, insomnia, stiffness of the shoulders, numbness of hand and foot, menstrual pain, chronic fatigue, and high blood pressure, etc. in Table 3. It is said that the considerable healing effect was early felt immediately from least one week to 4 months. In early stages of use, users' testimonials of No. 3, 9, and 10 for bed, No. 20 and 22 for mattresses, and No. 17 for pillow of table 3 showed a kind of negative reaction. It is thought in a kind of giddiness condition in which it gives the human body different feeling from the ordinary time, to give us the important information on an un-getting disease to be able to occur in human body by the healing effect of the far-infrared rays wave motion. A comprehensive healthy medical checkup at once is recommended for the confirmation of any disease[17,19].

Table 3. Statistical analysis list of healing records for experience cases collected from 2000 to 2013.

For Bed

No.	Time(Month)	Healing(%)	Gender	Age	Main symptoms
1	0	0	F	40	Static electricity
	3	80	F	40	
2	0.5	90	M	30	De-odor
3	0.25	-10	M	50	Pain after traffic
	0.5	70			acident
4	0.25	80	F	50	Pickles
5	0.25	80	F	40	Sleeplessness
6	0.25	50	F	40	Sleeplessness
	1	70			
7	1	90	M	40	Infarction
8	12	60	M	50	Parkin's disease
9	0.25	-10	F	70	Pain after traffic
	1	70			acident
10	0.25	-5	F	70	Sleeplessness
	1	80			
11	1	80	F	50	Skin & Sleeplessness
12	12	90	F	40	Syncope
13	0.5	70	M	50	Energetic recovery
14	2	70	M	50	Hyderhidrosis
15	3	80	M	60	Liver

For Mattresses

No.	Time(Month)	Healing(%)	Gender	Age	Main symptoms
1	0	0	M	50	Energetic recovery
	0.25	80	M	50	
2	0.25	70	F	30	Skin
3	6	80	F	50	Heels
4	0.25	80	F	30	Sleeplessness
5	0.25	80	M	50	Sleeplessness
6	0.25	80	F	40	Pickles
7	0.25	80	M	40	Pickles
8	0.25	80	F	30	Edema
9	0.25	80	F	40	Pain inshoulders
10	4	60	F	20	Pain menstrual
11	0.25	80	F	50	Sleeplessness
12	1	90	M	60	Pickles
13	0.25	80	M	70	Sleeplessness
14	4	60	F	20	Pain menstrual
15	0.25	80	M	50	Sleeplessness
16	1	70	M	60	Residual urine
17	3	70	F	70	Pain menstrual
18	0.25	80	M	30	Sleeplessness
19	2	50	F	50	Knee pain
20	0.25	-10	F	50	Coldness of hands&feet

For Mattresses (Contuniued)

No.	Time(Month)	Healing(%)	Gender	Age	Main symptoms
21	1	50	F	40	Pain menstrual
22	0.25	-10	M	80	Constipation
	0.5	70			
23	3	50	F	20	Pain menstrual
24	1	50	M	40	Pickles
	2	90			

For Pillow

No.	Time(Month)	Healing(%)	Gender	Age	Main symptoms
1	0	0	M	80	headaches
	0.25	90	M	80	
2	0.25	80	F	40	Pain inshoulders
3	0.25	80	M	50	Hypertension
4	0.25	80	M	40	Headaches
5	0.25	70	M	70	Pain inshoulders
6	1	80	M	30	Headaches&inshoulders
7	0.75	80	M	60	Neck disc
8	0.25	80	M	10	Sleeplessness
9	0.25	80	F	50	headaches
10	0.25	80	M	70	Sleeplessness
11	1	50	M	40	Headaches
	2	90			
12	0.25	-20	M	50	Headaches
	0.5	50			
	1	80			
13	0.25	80	M	40	Pain
14	0.25	30	F	30	Headaches
	1	50			
15	0.25	50	F	40	Headaches
	1	90			
16	0.25	50	M	50	headaches
	1	90			
17	0.25	-10	F	20	Neck disc
	2	80			
18	1	70	F	40	headaches

For cushions

No.	Time(Month)	Healing(%)	Gender	Age	Main symptoms
1	0	0	M	50	Hemorrhoids
	0.25	60	M	50	
2	0.5	70	F	30	Hyperhidrosis
3	0.75	70	M	30	Hyperhidrosis
4	1	70	M	40	Hyperhidrosis

*These records are healing cases from many users' various pains and expected to be a reference for pains.

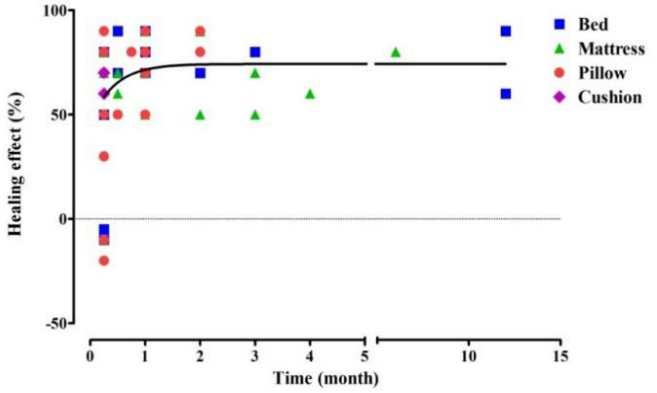


Fig. 8. Plot of relationship between healing time and healing effect for experience cases of loess ball bio-products

Fig. 8 shows the plot of relationship between the healing time and healing effect from the user's experience data of Table 3 for various bio-products such as beds, mattresses, pillows and cushions. The tendency of all the point data is shown in a solid line. The graph is made by GraphPad Prism for Window, version 5.01.

According to the time trend of healing, it is presumed that the decrease rate of the pain or stress is supposed to be decreased by 1st order reaction rate. As the initial and final conditions, when healing time is t=0 and t=∞, healing effect is H=0 and H=100, respectively. Then the relationship between both can be expressed as Eq. (1).

$$H = 100\,[1 - \{\exp(-kt)\}] \quad (1)$$

Where k(1/month) is an empirical constants depending on user and products of bio-products. The healing effect for all the bio-products is very fast within one or two weeks.

5.2 Consideration for typical experience cases of users

(a) The experience case of a professional engineer who is ever over-exposed to X-ray radiation

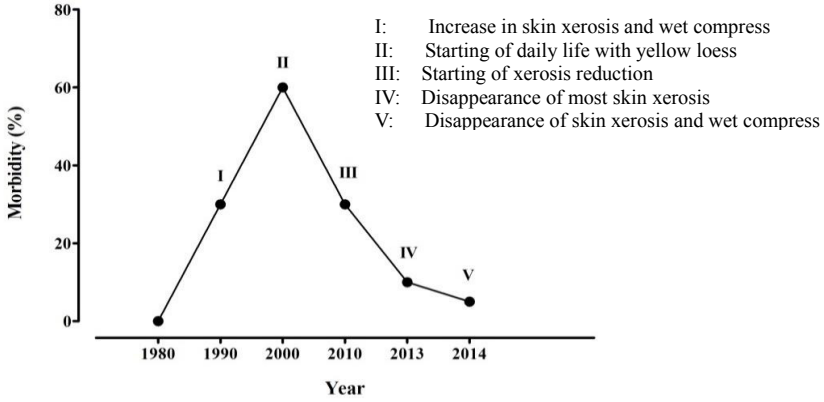


Fig. 9. Overall treatment processes of a radiological technologist over-exposed from beginning of sick to normal health. Age: 62, Gender: Man, Work of life: a professional radiological technologist in X-ray radiation , Working period: 30 years

He was engaged as a professional radiological technologist in the radiation domain for 30 years. Some day he was receive a diagnosis due to have been overexposed to radiation and accumulated over allowable limit without self-understanding during working period of 30 years. The xerosis on his skin had already occurred but troubled by a skin eruption and sleeplessness. Although the medical treatment of general hospitals such as a university hospital was examined, he felt that his state was getting worse and worse and the immune strength was decreased rapidly. On the way, he tried to recover his health by the natural

healing energy of Korean yellow loess. His daily life is as following: taking sleep on an yellow loess ball mattresses, drinking loess leachate water from yellow loess, and eating foods in pottery with yellow loess. After several years of the daily life with yellow loess, now he can overcome his skin xerosis by radiation exposure and recover his immune activation as shown in Fig. 9.

(b) The experience case of yellow loess ball mattresses

He is a man of 50's and President of Boruneo Co., Ltd. He has a severe hyperhidrosis and drags a kind of hormone medicine. After 2 months using the mattresses, the symptoms were improved and reduced the dose amount of hormones to half. Although he takes 3 to 4 hours of sleep per night, he feels the light condition and taking deep sleep. After then he introduces about 30 friends to result in the repurchase of the mattresses.[17]

(c) The experience case of yellow loess ball pillow

He is a man of 80 and retired. He says with pleasure that severe headaches disappear and takes a deep sleep since using loess ball pillows and his many friends used say also same words. [17]

5.3 Examination on Preliminary efficacy

(a) Healing effect of Korean Loess in the Donguibogam

Donguibogam or 'The Principles and Practices of Eastern Medicine' was written by the Royal physician Jun Heo (1546-1615) obeying the direction of King Seonjo. It is a refined medical encyclopedia which combined medical reference books from both Korea and China.

In the Donguibogam of Jun Heo, it is written as follows: the yellow loess has mild, sweet taste, non-toxic properties and can treat various pains such as diarrhea, dysentery, and stomach. Furthermore, the loess reduces various symptoms of poisoning from fruits, foods, and meats. Therefore the loess can called as medicine materials of pharmacological properties to lead a healthy state from abnormal state when contacting with yellow loess.

The ancient people captured the site of the house in the loess Plateau. We can find it in the ruins of the ancient who made cave in the yellow loess soil. It proves that the use of yellow loess is historically very long.[21] A series of researches has been carried out to find out the necessary conditions of space flights to survive in the spacecraft at the harsh conditions such as vacuum, zero gravity in cryogenic state in the NASA in 1981 and 1950-1970.[2] The project has revealed that far infrared rays of 3~25 μm wavelength can be absorbed by the human body. So far infrared rays of 4~14 μm wavelength is designated to a growing light. The function of far-infrared was defined to be essential for the physiological activation of the human body by deep reaching of skin. The heat in skin is attributed to collisions with water molecules and resonance effect of water molecules in the human body. In addition, the far infrared rays are a kind of electromagnetic wave transferred by radiation. The energy converted into heat is easily absorbed into the body liquids and organs in human body. If the energy is once absorbed, the bond between molecular is broken by the absorpted heat and the rapid motion of active molecular motion to lease out unnecessary materials from the body. Although the far-infrared energy is very weak [3,21], the prolong and repeat radiation energy is possible to solve the stagnation of blood in the body and to release out unnecessary harm materials, and thereby to circulate blood to the capillary blood vessels smoothly. As it was confirmed in the above experience cases, the energy flow is considered to reduce or eliminate a variety of pains.

(b) Wave effect of the far-infrared radiation on oncothermia

Heat shock proteins are instantaneously produced naturally when the body temperature rises locally. The heat shock protein is known to enhance the activity of natural killing cells for pathogens and cancer.[18] In addition, it increases the tree-like cells which let the cell of the immune system know the presence of the intruding substance called as an antigen, and then enhances the immune activity. [22]

Even if the far-infrared energy is weak, the radiation for a long time makes the red blood cells active to eliminate the stagnation and also to circulate smoothly to the blood capillaries. Thus, the active blood cell brings not only the reduction of a variety of pains and the relaxation of stresses as shown in the above experience cases, but also the release of unnecessary and harmful material quickly to the outside of the body.

(c) Estimation of healing action by considering above data

The goal of the manufacturing process of loess ball demonstrates the higher efficacy of the loess. In order to promote the characteristics of the specific component of yellow loess, the raw materials of loess are carefully granulated with starch binder and without fine grinding process. Then, the yellow ball is processed with the fermentation of amylase enzyme. Furthermore, the many minor elements and the catalase or amylase enzyme in the loess and amylase makes some interaction with the far-infrared radiation

and the immunity of body is considered to be improved by the rise of humidity and body temperature.

We can summarize the following three points as important actions of FIR and not yet un-identified factors for users' experience healing effects based on recent topics, wave energy[24], bioresonance[25], and anti-aging[26]:

1) Improvement of blood circulation through eliminating of congestion of red cells in blood,
2) Relief of pains caused by the muscle relaxation, and
3) Sleep and stress by stabilization of nervous system through the relaxation of all the body.

We would like to build and operate a practical experience house represented in the old Korean Ondol heating system based on the Japanese anti-aging therapy system of Professor Yoshikazu Yonei[26].

As next research programs, it is also under consideration the following development items including the performance improvement study of present bio-products of using yellow loess ball, bio-products: cushions for car sheets, mattresses and beds for hospital patient bed, water of yellow loess precipitation, hip bath unit, bio-feed additives, and bio-loess paint, etc[27].

6. Conclusion

Yellow loess ball sufficiently utilizing the honeycomb structure is a far infrared radiation material including many minor elements and catalase enzyme. It is possible to enhance the therapeutic effect of the far-infrared radiation by the temperature control of mattresses or bed set differently in the body parts of the head, torso, and feet. This temperature control style of mattresses or bed is especially based on application of traditional Korean Ondol heating culture. Our goal is to validate the efficacy of bio-products of yellow loess with the practice of experience room and anti-aging human dock system, We want to make the clinical test with clinical doctors for the performance improvement of loess ball use bio products while providing a particulate and biological characteristics of physical and chemical properties of yellow loess in the future.

The examination on measurement data of the surface temperature of the loess ball using DITI and medical preclinical data by use of DITI, the recent living test data of Somatoscope photographs, and the users'experience cases indicates that various healing effects of users' experience cases can be explained the following three points based on the important actions of FIR and the particle design technique of Hwangto yellow loess ball: 1) Improvement of blood circulation, 2) Relief of pains, and 3) Deep sleep and relief of stress.

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