



2-101/46018/2016

Field of Invention

Present invention relates to the natural antibacterial fridge which provides natural coolness to the stored material without requiring any electricity or any other artificial form of energy. In particular, present invention provides alternative which can keep fruits and vegetables bacteria free and thus fresh for 6 to 8 days and milk products for 1 day. In the proposed invention the whole fridge structure is made up of brass. The primary objective is to retain the freshness of fruits, vegetables and milk products by using structure made up of brass which is germicidal with wood wool evaporative pads and water. Moreover it can also help in increasing the shelf life of fruits and vegetables.

Background of Invention:

[0001] Raw fruits and vegetables purchased from the market can be associated with pathogenic microbial load, which should be cured before consuming them. The FDA, India (Food and Drug Association) does not recommend using any soap, cleaning agents or detergent to wash fruits and vegetables but thorough washing with fresh water can help to reduce the number of microbial communities but not to a great extent.

Fresh fruits and vegetables provide mankind with an abundance of benefits. These play an important role in health and have the ability to prevent many diseases such as heart disease, cancers and diabetes (Liu, 2003; Pandey and Rizvi, 2009).

However, the recent increase in reports of food borne illnesses associated with fresh fruits and vegetables has raised concerns regarding the safety of these products (WHO, 2008). Fresh vegetables are

vulnerable to be contaminated by pathogens (Hosein *et al.* 2008; Taban and Halkman, 2011) at several points throughout the pre-harvest and post-harvest systems, *via* soil, water, animals, insects, equipment and human handling (Beuchat, 2002; Hoyle, 2008).

[0002] Bacterial pathogens are considered as the most common agents causing food borne diseases and such pathogens involved are *Salmonella* spp., *E. coli* O157:H7, *Shigella* spp., *Campylobacter* spp., *Yersinia* spp., *Staphylococcus aureus* and *Listeria* spp. (Cetinkaya *et al.* 2008; WHO, 2008; Hosein *et al.* 2008). Further, WHO reports that leafy green vegetables are of great concern in terms of microbiological hazards (WHO, 2008).

Viable bacterial count (VBC) is an important indication of bacteriological quality of food products and high bacterial load in foods could pose a health risk to consumers (Aycicek *et al.* 2006 and Hosein *et al.* 2008).

Most of the leafy vegetables are easily contaminated by soil and they provide increased surface area for bacterial colonization. Infiltration of pathogens into cracks, wounds, crevices, stomatal cavities and intercellular spaces of fruits and vegetables has been demonstrated by several researchers (Harapas *et al.* 2010; Taban and Halkman, 2011; Saldaña *et al.* 2011). Therefore even though thorough washing can be effective more vigorous processing is needed to reduce the pathogen number and make vegetable safe for consumption. These results emphasize the necessity for awareness among consumers regarding the microbiological quality of fresh vegetables and the potential health hazard of pathogenic bacteria present in vegetables should not be underestimated.

[0003] There are two completely different families of bacteria: pathogenic bacteria, the kind that cause food borne illness, and spoilage bacteria, the kind of bacteria that cause foods to deteriorate and develop unpleasant

odors, tastes, and textures. Pathogenic bacteria can grow rapidly in the "Danger Zone," the temperature range between 40°F and 140 °F, but they do not generally affect the taste, smell, or appearance of a food. In other words, one cannot tell that a pathogen is present.

Spoilage bacteria can grow at low temperatures in the electrical refrigerator. Eventually they cause food to develop off or bad tastes and smells. Food that has been stored too long in the electrical refrigerator or freezer most likely to develop some bacteria such as *Listeria monocytogenes* which thrive at cold temperatures, and if present, will multiply in the refrigerator over time and could cause illness.

In recent years, however, a number of illnesses and deaths in the consuming public have been traced to psychrotrophic pathogens. Psychrotrophs are defined as organisms which may propagate at temperatures normally regarded as refrigeration temperatures, i.e. 34 to 45 degrees F. These organisms, because of their unique nature, are capable of not only surviving but actually thriving under refrigeration. Such organisms have been encountered in foods on a large scale only recently with the introduction of refrigerated foods on a large scale

Also currently, it is known in the fresh food compartment of the refrigerator which is used for low-temperature preservation, harmful bacteria can not only prevail due to confounding store a variety of food, but also to promote a large number of harmful bacteria breeding and reproduction, causing serious pollution to food, food store will soon become rancid deterioration, reach for a long time preservation effect, people eat, it will endanger people's health. The results showed that low temperature inside the refrigerator can suppress the growth of normal bacteria, but for some ability to adapt bacteria such as hepatitis virus, influenza virus, *E. coli*, salmonella and other bacteria, the refrigerator cold temperature environment is still the growth and reproduction hotbed, its growth and

metabolism in the process will produce many metabolic gases such as methane, hydrogen sulfide, methyl mercaptan, methyl amine odor of gas, mixed with a variety of smelly gas that will make refrigerator odors.

Bacteria of the species *Escherichia coli* were long thought to be relatively harmless, but now it has been discovered that enterotoxigenic strains of *Escherichia coli* have the ability to grow and produce toxin under refrigeration conditions. Enterotoxigenic strains of *E. coli* produce heat labile and/or heat stable enterotoxins. The organism is believed to be the cause of most travellers diarrhoea and other dysentery-like symptoms.

Moreover, many bacteria can contaminate food and cause illness without causing any change in the outward appearance or flavour of the food. No amount of training or education can completely overcome these obstacles to food safety.

[0004] Further, refrigeration systems generally require a significant amount of energy to operate. Heat is added to the kitchen area from the motor, the compressor and the heat of compression of the refrigerant. The A/c unit will work a little harder to take care of this extra heat. This plus the cost of running the fridge, will increase power consumption which increases the electric Bill.

[0005] Cooling occurs when refrigerant, circulating in a closed system through pipes and various parts, i.e. compressor, condenser, expansion valve or evaporator, evaporates to a gas which then condenses back to a liquid in a continuous cycle under considerable pressure. The pressure exerts a strain on the joints of the system and causes leakage. Any leak in the refrigeration system, which are often difficult to detect, is consequently a risk to the environment and it is essential to prevent leaks of refrigerant particularly with a C.F.C. content. One of the most efficient refrigerants in use is dichlorodifluorocarbon also called refrigerant-

12. However this and other refrigerants contain CFC (synthetic chlorofluorocarbon) which is harmful to the environment particularly because of its damaging effects to the ozone layer.

[0006] For some years there has been a growing recognition and concern that humans are suffering adverse effects, notably cancers, from living and/or working in ambient electromagnetic fields.

Exposure to electromagnetic fields is not a new phenomenon. However, during the 20th century, environmental exposure to man-made electromagnetic fields has been steadily increasing as growing electricity demand, ever-advancing technologies and changes in social behaviour have created more and more artificial sources. Everyone is exposed to a complex mix of weak electric and magnetic fields, both at home and at work, from the generation and transmission of electricity, domestic appliances and industrial equipments, to telecommunications and broadcasting.

**Typical electric field strengths measured near household appliances
(at a distance of 30 cm)**

(From: Federal Office for Radiation Safety, Germany 1999)

Electric appliance	Electric field strength (V/m)
--------------------	-------------------------------

Refrigerator	120
---------------------	------------

The effects of these radiations on human health are discussed not only in public, the term "electrosmog" a lot, but also investigated by a series of well-known research institutions

Despite many such studies and public discussions, the measures were aimed at avoiding or reducing radiated emissions magnetic fields from AC-powered devices been very modest.

Therefore, a need for a natural dynamic intelligent antibacterial fridge, the process efficient and easy to use, keep food, reducing pathogens, in order to meet people's demand for high-end green refrigerator. The art, therefore, has long sought a procedure for producing sterile, cooled natural foods which are convenient and attractive in taste and appearance while, at the same time, avoiding the problems aforesaid.

[0007] Advantages of using brass structure:

Copper and its alloys (brass) are natural antimicrobial materials. Ancient civilizations exploited the **antimicrobial properties of copper** long before the concept of microbes became understood in the nineteenth century. Copper alloy "touch surfaces" has intrinsic efficacies to destroy a wide range of microorganisms that threaten public health.

The copper in brass makes brass germicidal. Depending upon the type and concentration of pathogens and the medium they are in, brass kills these microorganisms within a few minutes to hours of contact.

Benefits of Copper:

Helps healthy growth, Regulates blood flow, useful in heart problems, Helps to lose extra fat, Gives luster to skin, Useful in preventing **Anaemia, Amoebiasis, Cough, Acidity, Piles** etc.

The influence of copper upon human health is due to the fact that it is part of enzymes, which are proteins that help biochemical reactions occur in every cell

Benefits of Zinc :

Zinc from the Brass helps human body as it improves resistance power to diseases, improves skin tone and cures skin problems, Nourishes healthy hair.

Mechanism of Brass:

FIG.7,the utility model smart antimicrobial pesticide degradation natural fridge made up of brass exhibit the oligodynamic effect which was discovered in 1893 as a toxic effect of metal ions on living cells, algae, molds, spores, fungi, viruses, prokaryotic and eukaryotic microorganisms. This antimicrobial effect is shown by ions of copper which is the main constituent of the brass.

In 1973, researchers at Battelle Columbus Laboratories conducted a comprehensive literature, technology and patent search that traced the history of understanding the "bacteriostatic and sanitizing properties of copper and copper alloy surfaces" which demonstrated that copper, in very small quantities, has the power to control a wide range of molds, fungi, algae and harmful microbes.

Examples of some of the molecular mechanisms noted by various researchers include the following:

- The 3-dimensional structure of proteins can be altered by copper, so that the proteins can no longer perform their normal functions. The result is inactivation of bacteria or viruses.
- Copper complexes form radicals that inactivate viruses.
- Copper may disrupt enzyme structures, and functions by binding to sulfur- or carboxylate-containing groups and amino groups of proteins.
- Copper facilitates deleterious activity in superoxide radicals. Repeated redox reactions on site-specific macromolecules generate OH⁻ radicals, thereby causing "multiple hit damage" at target sites.
- Copper damages the respiratory chain in *Escherichia coli* cells, and is associated with impaired cellular metabolism.
- Faster corrosion correlates with faster inactivation of microorganisms.

This may be due to increased availability of cupric ion, Cu²⁺, which is

believed to be responsible for the antimicrobial action—Copper's antimicrobial action probably attacks the overall structure of the virus and therefore has a broad-spectrum effect.

For example, brass doorknobs disinfect themselves of many bacteria within a period of eight hours. Antimicrobial properties of copper are effective against methicillin-resistant *Staphylococcus aureus* (MRSA), *Escherichia coli* O157:H7 and other pathogens. Copper has the intrinsic ability to kill a variety of potentially harmful pathogens. Several of the aforementioned bacteria are responsible for a large portion of the nearly two million hospital-acquired infections contracted each year in the United States. Frequently touched surfaces in hospitals and public facilities harbour bacteria and increase the risk for contracting infections. Covering touch surfaces with copper alloys can help reduce microbial contamination associated with hospital-acquired infections on these surfaces.

Objects of the Invention:

An objective of the present invention is to provide ecofriendly antimicrobial fridge.

Another objective of the present invention is to preserve the garden freshness of the vegetables and fruits.

Another objective of the present invention is to reduce the bacteria present in the fruits and vegetables.

Another objective of the present invention is to prevent the use of refrigerants contain CFC (synthetic chlorofluorocarbon) which is harmful to the environment particularly because of its damaging effects to the ozone layer.

Yet another objective of the present invention is to save human being from exposure to electromagnetic fields generated due to electric refrigerator.

Yet another objective of the present invention is to provide natural coolness to the stored material without requiring any electricity or any other artificial form of energy

Yet another objective of the present invention is to totally cut down the electricity bills of the customers by using natural antibacterial fridge.

More particularly, present invention relates to the natural antimicrobial fridge which does not use electricity. In particular, present invention provides alternative which can keep fruits and vegetables bacteria free and fresh for 6 to 8 days and milk products for 1 day. In the proposed invention the whole fridge structure is made up of brass which is germicidal with wood wool pads and water. It does not require any

electricity or any artificial energy and therefore no recurring cost. Moreover it can also help in increasing the shelf life of fruits and vegetables.

Description of invention:

It is a natural fridge made entirely made from brass to store vegetables, fruits and also milk product. It provides natural coolness to the stored material without requiring any electricity or any other artificial form of energy. Fruits, vegetables and milk can be stored fresh without deteriorating their quality for 6 to 8 days retaining their original taste. The utility model is also intended to provide a natural fridge preservation disinfection device with the help of brass.

A natural smart antimicrobial pesticide degradation apparatus comprising: brass structure, wooden wool pads and water, an intelligent anti-bacterial environment generated by the brass which itself is sufficient for bacterial degradation .The utility model is intended to provide a natural fridge which is used in order to solve the problems of the prior art.

In order to achieve the above objects, the present utility model is used as follows:

It works on the principle of evaporation .It has two tanks namely upper (Fig.1) and lower (Fig.5) and in between them the main body (Fig 7.21). Main body has four vertical sides out of which front one is the door (Fig.4) and the other three vertical sides (Fig.2) are fitted with wooden wool pads which are kept wet with help of water which comes from the holes of the upper tank. Back side (Fig 2.7) of the main body is open which can be closed with fitting cover (Fig.3) having wooden wool pads. The top upper tank is used to fill the water. The upper tank has very small size holes so that water can pass through them slowly. Water from the upper tank drips down the three vertical sides of the main body and gets evaporated taking away heat from the inside, leaving the main body cool. The bottom tank is used to store the water. A small faucet tap (Fig 5.16) is also provided at the right lower end of lower tank to take out the water for

recycling. The main body has one door in the front which has small holes through which air can pass in and out to control the odor. In the main body, shelves (Fig 6.18) are provided which are supported on L shaped hooks (Fig 6.19) made up of brass to store vegetables, fruits and milk etc. Apart from this the main body also has three slopes upside (Fig 2.8) and downside (Fig 2.9) each for smooth flow of water through the wooden wool pads to the lower tank.

The utility model (Fig.7) is a natural smart antibacterial fridge which works and perform the desired objects in the following steps:

The natural fridge is made on by completely filling the upper tank with water (Fig.1)

The water from the upper tank through the small holes pours down towards the three vertical sides of the main body consisting of wooden wool pads. (Fig.2)

In the process wooden wool pads gets wet and as water from the upper tank drips down the side, it gets evaporated taking away heat from inside, leaving the main body cool (Fig 7.21)

Water is slowly collected by the lower tank and is stored in it. (Fig.5)

Water stored in the bottom tank and the wet wooden wool pads helps in maintaining the cool effect and helps in keeping the stored item (fruits and vegetables) fresh. The anti-bacterial environment generated by the brass is sufficient for bacterial degradation present in fruits and vegetables kept in this natural fridge.

This natural antibacterial fridge can be used for domestic as well as for industrial purpose.

Description of drawings:

Fig 1: represents the upper tank (1) with cover (2) and small holes inside (3).

Fig 2: represents the main body (shown in fig.7) having three vertical sides with square shaped openings (4) on the left side (5) and on the right side (6) which are fitted with wooden wool evaporative pads and the back side is open (7).It also represents the upper slopes (8) and lower slopes (9)

Fig 3: represents the fitting cover with wooden wool evaporative pads and square shaped openings (10) which can be fitted on the back side of the main body having handles (11) through which it can be taken out and fit in the main body.

Fig 4: represents the opening door on the front side of the main body with holes (12) at appropriate locations, handle (13) and one rotator plate (14), by rotating it door can be opened or closed and hinges (15) through which door is attached to the main body.

Fig 5: represents the lower tank with a small faucet tap (16) with stand at the bottom (17)

Fig 6: represents the shelves (18) inside the main body and L shaped brass hooks (19) on which shelves are kept in the main body

Fig 7: represents the utility model with its front view

(20) Upper tank

(21) Main body with three vertical sides and door in front

(22) Lower tank with tap

Fig 8 represents the back view of the utility model.

K. Bharti
3/12/16

Bharti
3/12/16
13

Experiment

The utility model is a natural fridge smart antimicrobial degradation apparatus perform the following steps:

The natural fridge is made on by completely filling the upper tank with water.

The water from the upper tank through the small holes pours down toward the three vertical sides of the main body consisting of wooden wools.

In the process wooden wool gets wet and as water from the upper tank drips down the side, it gets evaporated taking away heat from inside, leaving the main body cool.

Water is slowly collected by the lower tank and is stored in it.

Water stored in the bottom tank and the wet chics helps in maintaining the cool effect and helps in keeping the stored item (fruits and vegetables) fresh.

After 10 hours or so water from the bottom tank with the help of faucet tap is taken out and then it is put (recycled) back to the upper tank

This is the process for one complete day

For the next day change the water by taking it out from the faucet tap and repeat the process.

It is highly recommended to keep fruits and vegetables for at least 10 hours to minimize their bacterial content and for 28 hours to near about complete removal of bacteria's from them before consuming. By doing this you can increase the life force energy of fruits and vegetables and keep them fresh for 6-7 days

For better working keep the natural antimicrobial fridge in ventilated space, clean the surface of brass or copper from inside and outside every week and change the wooden wool pads once in every three months.

Experimentation has been done to cover the following two aspects:

- 1) Preservation of garden freshness of fruits and vegetables
- 2) Percentage of bacteria reduced when fruits and vegetables are kept inside it.

For collection of raw vegetables and fruits to identify dominating microbial (bacterial communities) the main fruits and vegetables market (Bittan) of Bhopal city (Madhya Pradesh, India) was selected. It is centrally located, here we could observe fruits and vegetables grown nearby Bhopal regions as well as imported from other states of the country.

Fresh Tomato, Papaya, Cabbage, Hari Mirch, Nimbu, Kakadi, Gourd, Palak, Mat hi, Amrood, Anar, Banana, Cauliflower, Orange, Palak were selected, which are a very common part of our daily meals.

They have been kept in this antibacterial fridge and tested for freshness.

Results for which has been shown in the table one given below:

S.No.	Name of fruits and vegetables involved in study	Average No of days for which it can remain fresh
1	BANANA	2
2	APPLE	7
3	ORANGE	7
4	TOMATO	7
5	PAPAYA	7
6	CAULIFLOWER	5
7	CABBAGE	7
8	HARI MIRCH	8
9	NIMBU	7
10	KAKADI	7
11	GOURD	7
12	PALAK	5
13	MATHI	5
14	AMROOD	7
15	ANAR	8

TABLE-1

Another microbiological test to find out total reduction in the bacterial count has been carried out on Banana, Cauliflower and Orange.

In the case of **banana**, two bananas are taken from the bunch of 12 bananas; one is kept outside and other in this natural antibacterial fridge. After 28 hours both were taken to laboratory under same condition and tested (Test method reference IS: 5402) for bacterial count. It has been

found that the bacterial count for the banana which is kept in this natural antibacterial fridge has been reduced to almost 85% in comparison to banana which is kept outside.

In the case of **orange**, one orange is divided into two equal halves, one half is kept inside the natural antibacterial fridge and the other half is kept outside. After 28 hours both were taken to laboratory under same condition and tested (Test method reference IS: 5402) for bacterial count. It has been found that the bacterial count of one half which is kept inside the natural antibacterial fridge has been reduced to almost 80% as compared to other half.

In the case of **cauliflower**, two equal pieces from the same cauliflower are cut one piece is kept inside the natural antibacterial fridge and the other piece is kept outside. After 28 hours both were taken to laboratory under same condition and tested (Test method reference IS: 5402) for bacterial count. It has been found that the bacterial count of one piece which is kept inside the natural antibacterial fridge has been reduced to almost 78% as compared to the other.

Results of the bacterial count has been summarized in the table-2 given below:

S.No.	Name of fruits and vegetables involved in study	Approximate Percentage of bacterial count reduced
1	BANANA	85
2	ORANGE	80
3	CAULIFLOWER	78

TABLE-2

K. Bhatia

3/12/16

Bhatia
3/12/16

TPO MUMBAI 08-12-2016 14:52

References

1. Jackson V, Blair IS, McDowell DA, et al. The incidence of significant foodborne pathogens in domestic refrigerators. *Food Control* 2007; 18: 346-51.
2. Behravesh CB, Williams IT, Tauxe RV. Emergin foodborne pathogens and problems: expanding prevention efforts before slaughter or harvest. In: Institute of Medicine (US). *Improving Food Safety Through a One Health Approach: Workshop Summary*. Washington (DC): National Academies Press (US); 2012. A14. Available from: <http://www.ncbi.nlm.nih.gov/books/NBK114501>
3. Haddad N, Burns CM, Bolla JM et al. Long-term survival of *Campylobacter jejuni* at low temperatures is dependent on polynucleotide phosphorilase activity. *Appl Environ Microbiol* 2009; 75: 7310-18.
4. Rossvoll E, Ronning HT, Granum PE et al. Toxin production and growth of pathogens subjected to temperature fluctuations simulating consumer handling of cold cuts. *Int J Food Microbiol* 2014; doi.: 10.1016.
5. Ingham SC. Growth of *Aeromonas hydrophila* and *Plesiomonas shigelloides* on cooked crayfish tails during cold storage under air, vacuum and a modified temperature. *J Food Prot* 1990; 53: 665-67.

6. De Jonghe V, Coorevits A, Van Hoorde K. Influence of storage conditions on the growth of *Pseudomonas* species in refrigerated raw milk. *Appl Environ Microbiol* 2011; 77: 460-70.
7. M. F. Ashby; Kara Johnson (2002). *Materials and design: the art and science of material selection in product design*. Butterworth-Heinemann. pp. 223—. ISBN 978-0-7506-5554-5. Retrieved 12 May 2011.
8. Stagnation Time, Composition, pH, and Orthophosphate Effects on Metal Leaching from Brass. Washington DC: United States Environmental Protection Agency. September 1996. p. 7. EPA/600/R-96/103.
9. San Francisco Superior Court, *People v. IlcoUnican Corp., et al.* (No. 307102) and *Mateel Environmental Justice Foundation v. IlcoUnican Corp., et al.* (No. 305765).
10. Requirements for Low Lead Plumbing Products in California, Fact Sheet, Department of Toxic Substances Control, State of California, February 2009.

11. San Francisco Superior Court, People v. IlcoUnican Corp., et al. (No. 307102) and Mateel Environmental Justice Foundation v. IlcoUnican Corp., et al. (No. 305765).
12. EPA registers copper-containing alloy products, May 2008.
13. Noyce, J.O., Michels, H., and Keevil, C.W. (2006). "Potential use of copper surfaces to reduce survival of epidemic methicillin-resistant *Staphylococcus aureus* in the healthcare environment" (PDF). *Journal of Hospital Infection* **63** (3): 289–297. doi:10.1016/j.jhin.2005.12.008. PMID 16650507.
14. Michel, James H., Moran, Wilton, R., Michels, Harold T., and Estelle, Adam A. (June 20, 2011). "Antimicrobial copper displaces stainless steel, germs for medical applications: Alloys have natural germ-killing properties". *Tube and Pipe Journal*.
15. Kuhn, Phyllis J. (1983) Doorknobs: A Source of Nosocomial Infection? *Diagnostic Medicine*.
16. Schmidt, MG (2011). "Copper surfaces in the ICU reduced the relative risk of acquiring an infection while hospitalized". *BMC Proceedings* **5**: O53. doi:10.1186/1753-6561-5-S6-O53.

17. "TouchSurfaces Clinical Trials: Home". coppertouchsurfaces.org
18. TouchSurfaces Clinical Trials: Research Proves. Coppertouchsurfaces.org. Retrieved on 2011-12-09.
19. World Health Organization's 1st International Conference on Prevention and Infection Control (ICPIC) in Geneva, Switzerland on July 1st, 2011
20. "355 Copper Alloys Now Approved by EPA as Antimicrobial". Appliance Magazine. June 28, 2011.
21. Espírito Santo, Christopher, Taudte, Nadine, Nies, Dietrich H., and Grass, Gregor (2007). "Contribution of copper ion resistance to survival of *Escherichia coli* on metallic copper surfaces". *Applied and Environmental Microbiology* **74** (4):977–86. doi:10.1128/AEM.01938-07. PMC 2258564. PMID 18156321.
22. Michels, H.T., Wilks, S.A., Noyce, J.O., and Keevil, C.W., 2005, Copper Alloys for Human Infectious Disease Control, Materials Science and Technology Conference: Copper for the 21st Century Symposium, September 25–28, Pittsburgh, P.A

23. Santo, C. E.; Lam, E. W.; Elowsky, C. G.; Quaranta, D.; Domaille, D. W.; Chang, C. J.; Grass, G. (2010). "Bacterial Killing by Dry Metallic Copper Surfaces". *Applied and Environmental Microbiology* **77** (3): 794–802. doi:10.1128/AEM.01599-10.PMC 3028699. PMID 21148701

24. Bradley, A. J., Thewlis, J. (1 October 1926). "The Structure of γ -Brass". *Proceedings of the Royal Society*. doi:10.1098/rspa.1926.0134.

25. Craddock, P.T., Cowell, M. and Stead, I. (2004). "Britain's first brass". *Antiquaries Journal* **84**: 339–46. doi:10.1017/S000358150004587X.

26. National Pollutant Inventory – Copper and compounds fact sheet. Npi.gov.au. Retrieved on 2011-12-09.

27. Joseph R. Davis (1 January 2001). *Copper and Copper Alloys*. ASM International. p. 7. ISBN 978-0-87170-726-0.

28. Niiyama, N., Sasahara, T., Mase, H., 2009, Clinical Trial of the Antimicrobial Effects of Copper and its Alloy in the Hospital Ward, *Journal of Japan Research Institute for Advanced Copper-Base Materials and Technologies*, Vol. 48, No. 1, pp. 0. 1.

29. Sasahara, T., Kikuno, R., Fujiki, K., Takayama, Y., Sunagawa, K., and Inoue, M., 2008 The Journal of the Japanese Association for Infectious Diseases, 82, p. 407
30. Clinical trial shows copper continuously reduces bacterial burden by 83% and reduces the risk of infection by 58%; <http://www.antimicrobialcopper.com/uk/scientific-proof/clinical-trials.aspx>.
31. Sasahara, T., Niiyama, N., Abe, M., Fujiki, K., Takayama, Y., Ozawa, T., Kikuno, R., and Saito, H., 2008, Environmental Infection, 23, p. 224.
32. Niiyama N., Amoh Y., Abe M., Saito H., Sasahara T., Katsuoka K. (2009). "The Use of Metallic Copper for Prevention of Spreading Methicillin-resistant Staphylococcus aureus Contamination in Hospitals". Jpn J Dermatol **119** (5): 899–906.
33. Mehtar S., Wiid I., Todorov S.D. (2007). "The antimicrobial activity of copper and copper alloys against nosocomial pathogens and Mycobacterium tuberculosis isolated from healthcare facilities in the Western Cape: an in-vitro study". Journal of Hospital Infection: 1–7.
34. Michels, H.T., Estelle, A. A., Michel, J.H., and Moran, W.R., 2010, Clinical Testing of Antimicrobial Copper Alloys, Proceedings of Cu2010.

35. Sasahara, T. Niiyama, M., and Ueno, Miho, 2007, Use of copper and its alloys to reduce bacterial contamination in hospitals, Journal of Japan Research Institute for Advanced Copper-Base Materials and Technologies. Vol. 46, pp. 12–16.

36. Sasahara T., Niiyama N. (2008). "Bactericidal activity and sensitization capacity of copper and its alloy". Journal of the JRICu **47**: 1.

37. Samuni, A., Chevion, M., and Czapski, G. (1984). "Roles of Copper and Superoxide Anion Radicals in the Radiation-Induced Inactivation of T7 Bacteriophage". Radiat. Res. **99** (3): 562-572. doi:10.2307/3576330. JSTOR 3576330. PMID 6473714.

38. Manzi, C; Enrich, J; Ebner, H; Dallinger, R; Krumschnabel, G (2004). "Copper-induced formation of reactive oxygen species causes cell death and disruption of calcium homeostasis in trout hepatocytes". Toxicology **196** (1–2): 57-64. doi:10.1016/j.tox.2003.11.001. PMID 15036756.

39. Domek, MJ; Lechevallier, MW; Cameron, SC; McFeters, GA (1984). "Evidence for the role of copper in the injury process of coliform bacteria in drinking water" (PDF). Applied and environmental microbiology **48** (2): 289–93. PMC 241505. PMID 6385846.

40. Domek, MJ; Robbins, JE; Anderson, ME; McFeters, GA (1987). "Metabolism of *Escherichia coli* injured by copper". *Canadian journal of microbiology* **33** (1): 57–62. doi:10.1139/m87-010. PMID 3552166.
41. Michels, H.T., Wilks, S.A., Noyce, J.O., Keevil, C.W. (2005), Copper Alloys for Human Infectious Disease Control, Presented at Materials Science and Technology Conference, September 25–28, 2005, Pittsburgh, PA; Copper for the 21st Century Symposium.
42. Michels, Harold T. (October 2006), "Anti-Microbial Characteristics of Copper", *ASTM Standardization News* **34** (10): 28–31, retrieved 2014-02-03
43. BioHealth Partnership Publication (2007): Lowering Infection Rates in Hospitals and Healthcare Facilities - The Role of Copper Alloys in Battling Infectious Organisms, Edition 1, March.
44. Thurman R.B., Gerba C.P. (1989). "The Molecular Mechanisms of Copper and Silver Ion Disinfection of Bacteria and Viruses". *CRC Critical Reviews in Environmental Control* **18** (4): 295–315. doi:10.1080/10643388909388351.

45. Dick, R.J., Wray, J.A., and Johnston, H.N. (1973), A Literature and Technology Search on the Bacteriostatic and Sanitizing Properties of Copper and Copper Alloy Surfaces, Phase 1 Final Report, INCRA Project No. 212, June 29, 1973, contracted to Battelle Columbus Laboratories, Columbus, Ohio, US.
46. Dollwet, H.H.A. and Sorenson, J.R.J. Historic uses of copper compounds in medicine, Trace Elements in Medicine, Vol. 2, No. 2, 1985, pp. 80–87.
47. Aycicek, H., Oguz, U. and Karci, K (2006). Determination of total aerobic and indicator bacteria on some raw eaten vegetables from wholesalers in Ankara, Turkey. International Journal of Hygiene and Environmental Health **209**: 197–201.
48. Beuchat, L. R. (2002). Ecological factors influencing survival and growth of human pathogens on raw fruits and vegetables. Microbes and Infection **4**: 413–423.
49. Beuchat, L. R., Abdul-raouf, U. M. and Ammar, M. S. (1993). Survival and Growth of Escherichia coli 0157:H7 on Salad Vegetables. Applied and environmental microbiology **59**: 1999-2006.

50. Harapas, D., Premier, R., Tomkins, B., Franz, P. and Ajlouni, S. (2010). Persistence of *Escherichia coli* on injured vegetable plants. *International Journal of Food Microbiology*. **19**(3): 161-174.

51. Hoyle, B. (2008). Rise in foodborne outbreaks from leafy greens proves puzzling. *Microbe* 3: 269–270.

52. World Health Organization (WHO) (2008). Microbiological hazards in fresh fruits and vegetables. Microbiological Risk assessment series. www.who.int/foodsafety/publications/fsmanagement/..en (Accessed Jan 2010).

K. Bhatia
03/12/16

Bhatia
03/12/16

TPO MUMBAI 08-12-2016 14:52

2016/04/08/2016

CLAIMS



We claim:

- 1) A brass made antibacterial fridge comprising of two tanks namely upper (Fig.1) and lower (Fig.5) and in between them the main body (Fig 7) where shelves (Fig 6.18) are provided which are supported on L shaped hooks (Fig 6.19) made up of brass to store vegetables, fruits and milk etc. Main body has four vertical sides out of which front one is the door (Fig.4) and the other three vertical sides (Fig.2) are fitted with wooden wool pads which are kept wet with help of water which comes from the holes of the upper tank. Water from the upper tank drips down the three vertical sides of the main body and gets evaporated taking away heat from inside, leaving the main body cool. The bottom tank is used to store the water.
- 2) A brass made antibacterial fridge as claimed in claim-1 wherein one door in the front which has small holes through which air can pass in and out to control the odor.
- 3) A brass made antibacterial fridge as claimed in claim-1 wherein a small faucet tap (Fig 5.16) is also provided at the right lower end of lower tank to take out the water for recycling.
- 4) A brass made antibacterial fridge as claimed in claim-1 wherein its main body, three vertical sides, front door, upper and lower tank all can be made up of either of brass or copper.
- 5) A brass made antibacterial fridge as claimed in claim-1 wherein net made up of brass or copper is used in the main body in the three vertical sides to increase the antibacterial effect of copper.

- 6) A brass or copper made antibacterial fridge substantially as herein described and illustrated with reference to the accompanying drawing.