A POSSIBLE WAY FOR PREVENTING THE NOVEL CORONAVIRUS

by

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All living cells are affected deadly by their environmental temperature, a relatively higher temperature results in a higher metabolic rate, but when it reaches a threshold, its death acceleration occurs. The same principle is also valid for the Covid-19 virus. This paper suggests a sample way to its prevention by a hot cup of water under the noise. The vapor with a high temperature can make the virus greatly inactive. An optimal height from a boiling water surface is recommended.

Key words: *metabolic rate, thermal therapy, geometric potential*

Introduction

Recently the novel coronavirus (Covid-19) was broken out worldwide widely, and infected patients rocketed, among which a high death was reported [1, 2]. The Covid-19 is a complex virus with a large specific surface area and a high surface geometric potential [3-7], which can guarantee the virus to absorb much more energy from its environment than the spherical cells, as a result, the cells around the virus will gradually starve to death [3]. However, all viruses are extremely sensitive to the environment temperature change. Li reported that thermal therapy is extremely effective for virus-induced eye diseases [8]. We think that temperature might be a suitable way to prevent virus transmission, and there might be the simplest option: that is a cup of hot water.

Virus's complex boundary

Figure 1 illustrates some viruses shapes, among which the Covid-19 virus has the most complex surface morphology [3].

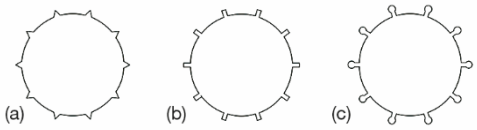

Figure 1. Various viruses surfaces; (a) influenza virus, (b) HIV, (c) Covid-19

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According to the geometric potential theory [3-7], the surface energy produced by the boundary can be expressed:

$$E = \frac{k}{r^n} \tag{1}$$

where r is the equivalent radius of the protruding parts on the cell surface, k – a material constant, and n – a shape factor, for a sphere, $n = 1$. The virus attraction to energy from its environment can be calculated:

$$F = -\frac{\mathrm{d}E}{\mathrm{d}r} = \frac{k}{r^{n+1}} \tag{2}$$

When $n = 1$, we have the gravity for the spherical Earth.

The Covid-19 virus might have a hierarchical surface, and the last cascade has a minimal radius; as a result, the virus has the maximal ability to absorb energy from its environment.

Virus metabolic rate

Generally, the metabolic rate of a cell or a virus is written in the form [9-13]:

$$MR \propto M^a \tag{2}$$

where MR is the metabolic rate, M-cell or virus mass, a-scaling exponent, its maximal value is 1, while its general value is either 2/3 for Rubner law or 3/4 for Kleiber's 3/4 law [10].

Geometrically, the mass scales with its surface with a power of 2/3:

$$M \propto S^{\frac{2}{3}} \tag{3}$$

where S is the virus surface area. So we have:

$$MR \propto S^{\frac{2a}{3}} \tag{4}$$

Equation (4) implies a higher surface area results in a higher metabolic rate. In this article, we assume that:

$$MR \propto FS \tag{5}$$

Equation (5) implies a virus with a higher surface area and higher surface energy is more metabolically active.

As the virus surface is not a sphere, it can be written:

$$S \propto r^{\beta} \tag{6}$$

where β is the fractal dimension. For a sphere, $\beta = 2$. After a simple calculation, we have the following scaling law:

$$MR \propto r^{\beta - n} \tag{7}$$

Equation (7) means that a reduced spherical cell size can improve its metabolic activity; this can explain why the infected mice and the global warming can reduce the body size of some small animals, *e.g.*, ants. [14, 15].

Effect of temperature on metabolic rate

In [8], the scaling index a in eq. (1) is expressed:

$$a = \frac{3}{4} + \frac{T - T_b}{40} \tag{8}$$

where T_b [°C] is the body temperature.

Equation (8) is valid for a limited range of *biologically relevant* temperatures between approximately 0 °C and 40 °C. When the temperature is higher than 40 °C, a negative effect on *MR* occurs and the cell or the virus will accelerate its death. According to [8], we have:

$$MR_{human} < MR_{virus} \text{ for } T < T_b \tag{9}$$

$$MR_{human} >> MR_{virus} \text{ for } T > T_b \tag{10}$$

Equation (9) says that when $T < T_b$, the virus is much more metabolically active than human cells, however, when $T > T_b$, the virus becomes extremely inactive compared with the human cells. The maximal temperature should be [8]:

$$T_{max} = 10 + T_b \tag{5}$$

The body temperature of human beings ranges from 36.0 ℃ to 37.0 ℃, so the maximum temperature should be about 46 ℃. The increase of temperature leads to the increase of metabolic rate, a decrease of life span and also stimulates the immune response. Covid-19 rarely affects monkeys, a possible explanation is that the body temperature is higher than that of human beings.

Hot vapor

A cup of hot water can produce enough hot vapor to kill the virus in the inhaled air; at least it can make the inhaled viruses metabolically inactive. Furthermore, according to the geometric potential theory [3-7], hot water molecules are easily absorbed on the surface of the virus, and therefore the virus is fallen into the ground as a drop of water.

To have a cup of hot tea makes diseases away, as an old Chinese saying. Enjoy a hot spring or Sauna at a hot steam room. Take a hotter bath are also helpful for preventing the present novel coronavirus (Covid-19). Furthermore, the vapor with high temperatures can also purify the air, fig. 2.

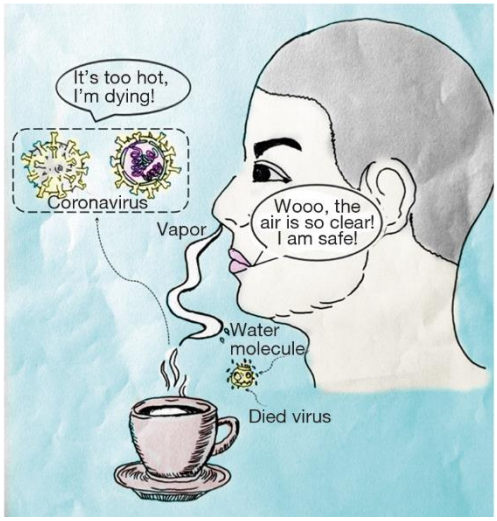

Figure 2. A possible way for preventing the novel coronavirus (Covid-19)

Too hot vapor is harmful to the human being, so we carried out an experiment to find an optimal height from the boiling water surface. A 250 mL beaker was used, where 100 mL water was filled, and it was put into an oil bath, which was heated up to 150 ℃, while the environment was 14 ℃, fig. 3. The oil level and the water level are on the same horizontal line. After the water boiling, a thermometer was used

to measure temperature above the boiling water surface, each point was measured at least five times, and its average was used; the results were listed in tab. 1. Figure 4 showed that the temperature reduced exponentially, and it reached its environment temperature 700 mm apart from the boiling water surface. The optimal height for the nose to inhale the vapor was 75 mm from the boiling water surface.

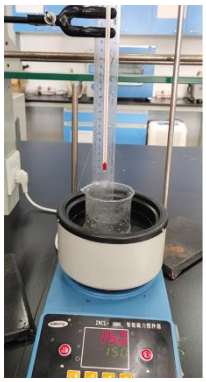

Figure 3. Experiment set-up

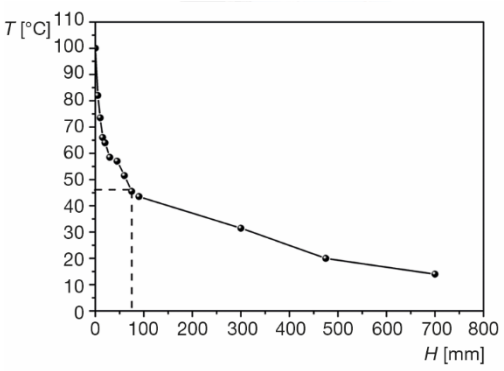

Figure 4. Temperature change above the boiling water surface

Table 1. Temperature change above the boiling water surface

H [mm]	*T* [°C]	Average temperature [°C]
0	100	100
5	81-83	82
10	72-75	73.5
15	64-68	66
20	63-65	64
30	57-60	58.5
45	56-58	57
60	50-53	51.5
75	44-47	45.5
90	42-45	43.5
300	31-32	31.5
475	20	20
700	14	14

Conclusion

Hereby we suggest the simplest way to prevent Covid-19 from widespread, a cup of hot tea is extremely helpful for health and free from virus infection. Our experiment shows that the vapor temperature reduces exponentially, and the optimal height from the boiling surface is recommended from 50 mm to 100 mm. In winter, the value should be less than that in summer.

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