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Formula for Harmfulness of Cell Phone Waves for One Type of Pollution

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Abstract: A simplified formula expression is presented in this article to find penetrating capacity of a cell phone wave or a radio wave in terms of comparison with a corresponding light wave. This is done such that anyone can use the formula. Our world can control frequencies of cell phone waves or radio waves, and time limits for using these waves. This control can also control cell phone wave pollution. It is suggested that cell phone waves or radio waves should have frequency at least (more than) 10 GHz for a safer world. It is further suggested to increase frequency of cell phone waves or radio waves as much as possible for a safer world.
Keywords: Microwave pollution, frequency of cell phones, harmful waves, electromagnetic pollution.

INTRODUCTION

There are many classifications for pollutions. Recently, sound pollution and light pollution have also been classified for pollutions. Electromagnetic waves produced by humans are also pollutions. Cell phone waves are also electromagnetic waves, which are always being a topic of concern in medical field. Do cell phone waves produce brain cancer? This is a major question in medical field in connection with cell phone waves. Do cell phone waves affect the existence of sparrow birds? There are many such questions. The most acceptable one is that cell phone electromagnetic waves are also pollutions. This particular pollution can be classified in two types: (i) In terms of penetrating capacity of a single ray (wave) with a particular wavelength or frequency; (ii) In terms of number of rays with a particular wavelength or frequency. Both of them harm humans, animals, birds, in general any living being. The level of harmfulness of (ii) depends on the power used to produce electromagnetic waves. So, there is an obvious solution for (ii). But a small amount of power is sufficient to create high level penetrating electromagnetic waves. Certainly, there is a need for measurement of harmfulness for penetrating capacity of a single electromagnetic wave. There is one article [5] providing Planck's equation for magnetic field waves. Also, this article [5] provides a method of finding a light ray with a particular frequency corresponding to a given magnetic field wave with a particular wavelength. The theory for this article [5] is based on basic mathematics and basic physics, but deep ones. The purpose of the present article is to simplify this deep theory into a simple formula in such a way that the formula can be used by almost all individuals to find harmfulness of cell phone waves. The authors have already published articles [1, 4, 15-23] for deep theory and for pollution control, and there are recent articles [2, 3, 6-14] for harmfulness of cell phone waves.

Although the article may be used by individuals who do not know physics and mathematics, there is a need to explain few things in terms fundamental concepts with reference to the articles mentioned above.

An electromagnetic wave is an energy wave which can travel with the speed of light in vacuum. An electromagnetic wave is either exclusively an electric field wave induced by varying electric fields or exclusively a magnetic field wave induced by varying magnetic field waves. An electromagnetic wave is an electric field wave if and only if its wavelength is less than 1.063 millimeter (approximately); and an electromagnetic wave is a magnetic field wave if and only if its wavelength is greater than 1.063 mm [3, 8]. Light waves, X-rays and gamma rays are known electric field waves. Radio waves (including cell phone waves) and gravitational waves are known magnetic fields waves. Microwaves, alpha rays, and beta rays are not electromagnetic waves, in view of their speed in vacuum. Let us call electric field waves as light rays, and magnetic field waves as radio waves. For each electromagnetic wave: frequency = (velocity of light in vacuum)/wavelength, and wavelength = (velocity of light in

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vacuum)/frequency. Basic unit for frequency is Hertz or Hz. Basic unit for wavelength is meter. Let us remember that light waves are electric field waves and radio waves are magnetic field waves. To each light wave (or radio wave, respectively) there is a corresponding radio wave (or light wave, respectively) such that both of them have same penetrating capacity.

Let us discuss again our general topic. It is known that ozone layer in atmosphere protects us from ultraviolet radiations. Ultraviolet radiations are used to kill germs in preparation of good drinking water [19]. So, ultraviolet rays are harmful to living beings because they penetrate to short depth. There is no measurement of harmfulness of an ultraviolet ray because of penetration. It is known that ultraviolet rays affect our skin (to the extent of getting skin cancer), not flesh, and not bones. So, it is understood that ultraviolet rays penetrate up to the level of skin. X-rays can penetrate skin and flesh, but not bones. X-rays are also used to kill cancer cells in fleshes and skins. So, X-rays are more harmful to living beings than ultraviolet rays because of their level of penetration. It is known that X-rays affect our skin and flesh to extent of getting cancer in these parts of our bodies. Gamma rays can penetrate skin, flesh, bones and even metals. A short term exposure of our body to gamma rays for a short time ensures total damage of all organs of our body which ensures death. Ultraviolet rays, X-rays and gamma rays are light waves. The wavelength of an ultraviolet ray is longer than the wavelength of an X-ray, and the wavelength of an X-ray is longer than the wavelength of a gamma ray. So, the general conclusion/law about the penetrating capacity of light waves is the following. If wavelength of a first light wave is shorter than wavelength of a second light wave, then the first wave has more penetrating capacity than that of the second wave. There are no exact measurements for penetrating capacities of light waves. But, the above law gives a comparison about penetrating capacity of light waves with different wavelengths [5, 20, 23]. The following is the general law for penetrating capacity of radio waves. If wavelength of a first radio wave is shorter than wavelength of a second radio wave, then the second wave has more penetrating capacity than that of the first wave. Equivalently, if frequency of a first radio wave is greater than frequency of a second radio wave, then the second wave has more penetrating capacity than that of the first wave. Penetrating power of radio waves has also been used in medical field. Penetrating radio waves are also harmful to living beings [23]. Unfortunately, there is no clear understanding about penetrating levels of radio waves; like skin level, flesh level, bones level etc. For a radio wave with a given frequency, it is possible to find a light wave with a corresponding wavelength such that both of them have same level of penetrating capacities. So, based on our experience in penetrating capacities of corresponding light waves, it is possible to understand the penetrating capacities of corresponding radio waves [2 , 21]. The measurement of harmfulness of a given radio wave can be assessed only in this way. The procedure of finding corresponding light wave is simplified in the present article so that anyone can use it.

EVATUATION OF THE FORMULA

The wavelength of light wave in meter = (3.77×10^{-15}) × (Frequency of radio wave in Hertz)

The explanation for usage of this formula is the following. Choose one frequency of a radio wave for which harmfulness has to be found. Convert the frequency in terms of Hertz or Hz. For example, use the followings for conversions. 1 KHz = 1000 Hz, 1 MHz = 1000 KHz, 1 GHz = 1000 MHz, etc. Multiply the frequency in Hz by the number $3.77\text{x}10^{-15}$. This gives the required corresponding wavelength of a light wave in meter. Using this wavelength, it is possible to fix the type of nature of light ray by using the table of the following type. From the nature of the light, it is possible to understand that the harmfulness of the given radio wave as the harmfulness of the corresponding light ray (Table 1).

Table 1. Wavelengths of a light ray and nature of light

Wave length of a light ray (in m)	**Nature of light**
Greater than 0.62×10^{-6} m	Infra red rays (not visible)
0.62×10^{-6} m to 0.75×10^{-6} m	Red rays
0.59×10^{-6} m to 0.62×10^{-6} m	Orange rays
0.57×10^{-6} m to 0.59×10^{-6} m	Yellow rays

0.495×10^{-6} m to 0.57×10^{-6} m	Green rays
0.45×10^{-6} m to 0.495×10^{-6} m	Blue rays
0.38×10^{-6} m to 0.45×10^{-6} m	Violet rays
10^{-8} m to 0.38×10^{-6} m	Ultraviolet rays (not visible)
10^{-11} m to 10^{-8} m	X-rays
Less than 10^{-11} m	Gamma rays

For example, the following table 2 provides an illustration for computation.

Table 2. Computation table for corresponding wavelength of light and cell phone frequencies

Frequency of cell phone wave	**Corresponding wavelength of light**	**Nature of corresponding light wave**	**Conclusion**
100 GHz	0.377×10^{-5} m	Infrared	Safe
10 GHz	0.377×10^{-6}m	Violet/ultraviolet ray	Somewhat safe
1GHz	3.77×10^{-6} m	Nearly ultraviolet ray	Somewhat safe
100 MHz	3.77×10^{-7} m	Ultraviolet ray	Somewhat not safe
10 MHz	3.77×10^{-8} m	Ultraviolet/nearly X-ray	Not safe
1MHz	3.77×10^{-9} m	X-ray	Risk
1KHz	3.77×10^{-12} m	Gamma ray	Disaster

Many cell phone waves have frequency between 100 MHz and 1 GHz. So, our cell phone world is in between "somewhat safe" and "somewhat not safe". To ensure a safety cell phone world, it is obvious that frequency of our cell phone waves should be at least 10 GHz. Existing walkie-talkies do not operate in a safe frequency. Since, there are very few walkie-talkies which also operate only for short times, our world is safe.

DISCUSSION

The formula given above is certainly helpful in understanding harmfulness in terms penetrating capacities of a magnetic field wave or a radio wave. The other type of harmfulness should also be discussed. Infra red rays have less penetrating capacity. But, they are highly harmful when the number of infra red rays is increased, or when density of rays is increased. Let us consider CO_2 laser units. They produce only infrared rays, but they are capable of cutting metals. When a CO_2 laser is applied on a metal, their rays may penetrate only an atom height-depth [13, 20]. Since the rays are huge are numbers, a high energy transferred through this small height is enough to melt surface elements of the metal. When this done continuously for few seconds, laser cuts the metal having a small width. One may understand harmfulness of high power applied for a long time, even if penetrating capacity is very low. The situation is applicable even for radio waves. Many radio waves with very large frequency are harmful when they are applied simultaneously for a long time. All these facts can be applied constructively. For example, when ultraviolet rays can kill harmful germs during production of drinking water, cell phone waves having equal amount of penetrating capacity can also do the same job, constructively. If X-rays can be used to make a person as a cancer patient, cell phone waves having equal amount of penetrating capacity can also do the same job, destructively. One can produce and release low frequency radio waves or cell phone waves from a tower and one can ensure non-existence of all living beings around the tower within a year. A calculation can be done by using the formula mentioned above and based on experience of harmfulness of light rays.

CONCLUSION

Edition found an electric bulb using carbon filament, which was modified as a tungsten filament bulb. It consumed more energy but produced harmless almost non-violet light rays. Now LED bulbs are available which produce bright violet rays by consuming almost nil energy. So, for energy consumption, there is a need to accept light pollution. Similar thing is applicable even for cell phone waves. If humans are particular in speed of processing signals and sending signals to long distances,

then there is a compulsory acceptance of cell phone wave pollution. To maintain ecology in our environment, humans should try to reduce their likeness in getting immediate reception of data through cell phones; as it was done in olden days. The meaning of this statement need not be explained. Apart from this general conclusion, the following precise conclusion should be observed. Time of using low frequency cell phone waves or radio waves should be reduced as much as possible by every individual, for the benefit of all living beings in this world and for the benefit of our own present environment.

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