THERMODYNAMIC METHOD OF THE DESCRIPTION OF THE SYMBIOTIC RELATIONSHIP BETWEEN HUMANITY AND THE ENVIRONMENT

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ABSTRACT. Human beings are not only complex physiological systems but also social ones. The normal state of a human being is ensured by the complex symbiosis between the Society in general and the Biosphere as the sources of continuous development and improvement, being in a process of permanent symbiotic interaction. A human being is a complex thermodynamic system and the application of the laws of thermodynamics gives the special expression of the energy consumption per day that is of the order of 10700 (kJ). The recovery of the respective energy expenses is performed by the food consumption in the form of qualitative lipids, fats and proteins, otherwise it quantitatively leads to the development of various diseases. Most diseases come precisely from air pollution, as well as from the consumption of poor quality food, both being the negative factors that lead to deviation from the stationary state and the equilibrium of the symbiosis with the Biosphere. Anthropogenic pollutants have negative effects on atmospheric composition. Carbon dioxide is one of the largest components of all pollutants with a negative effect on the human respiratory system. Polluting aerosol particles have the same negative effects. The modern task remains to always find an optimal solution to reducing anthropogenic pollutants in the atmosphere and biosphere.

Key words: human being, energy consumption, Biosphere, carbon dioxide, anthropogenic pollutants.

ТЕРМОДИНАМИЧЕН МЕТОД ЗА ОПИСАНИЕТО НА СИМБИОТИЧНА ВЗАИМОВРЪЗКА НА ЧОВЕЧЕСТВОТО И ОКОЛНАТА СРЕДА

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РЕЗЮМЕ: Човекът е не само сложна физиологична система, но и сложна социална. Нормалното състояние на човека се осигурява от сложната симбиоза между Обществото като цяло и Биосферата и те са като източници на непрекъснато развитие и усъвършенстване, намиращи се в процес на постоянно симбиотично взаимодействие. Човекът е сложна термодинамична система и прилагането на законите на термодинамиката се описва количествено чрез израза на консумацията на енергия на ден, която е от порядъка 10000 (kJ). Възстановяването на съответните енергийни разходи се осъществява от консумацията на хранителни вещества под формата на качествени липиди, мазнини и протеини, иначе в противен случай води количествено до развитие на различни заболявания. Повечето заболявания идват именно от замърсяването на въздуха, както и от консумацията на некачествени храни, които са негативните фактори и водят към отклонението от стационарното състояние и равновесие за симбиозата с биосферата. Антропогенните замърсители имат отрицателен ефект върху състава на атмосферата. Въглеродният диоксид е един от компонентите с най-голям дял от всички замърсители с отрицателен ефект върху дихателната система на човека. Замърсяващите аерозолни частици имат същите отрицателни ефекти. Съвременната задача винаги остава да се намира оптималното решение за намаляване на антропогенните замърсители в атмосферата и биосферата като цяло.

Ключови думи: човек, изразходване на енергия, биосфера, въглероден диоксид, антропогенни замърсители.

Introduction

Human beings play a great role in the existence and maintenance of the ecosystem and of the biosphere as a whole. From this environment, human beings use a lot of natural resources and the most important components providing the existence of a normal physiological state of human beings. Without the biosphere, humanity cannot exist and act normally if that biosphere is depleted or destroyed. Recently, this biosphere has been subjected to a destructive action leading to the ecological catastrophe.

Human beings as a whole are the integrative component of this system and therefore there is a symbiosis with this environment. The symbiosis must be stable for a long time guarantee the future generation the normal existence of this system. This symbiosis between humanity, the sphere of material goods created by the people, and the biosphere can be represented by the diagram (Fig. 1). The diagram shows the interaction between the components of this system by the arrows. The corresponding interaction between people and the material goods is explained trivially as follows: people use them to guarantee their normal physiological, physical, and spiritual satisfaction as vital elements to ensure a long vital period for their existence. The biosphere, as a huge mass of plants, animals, and natural resources, provides, directly or indirectly, the use of these elements to ensure a normal life process. At the same time, the task of man is to ensure the existence of this component of the system. Water as a major vital component ensures the existence of the whole subsystem by maintaining a natural plant population and existence of humanity in general. Today's current situation is such that the biosphere, reaching its maximum evolutionary development in symbiosis with the human being, is exposed to risk factors as a result of human activity of the achievement of modern technologies. Waste products originating from anthropogenic activity become problematic sources of pollution of the ecosystem and the final result is that the air contains larger amounts of pollutants.

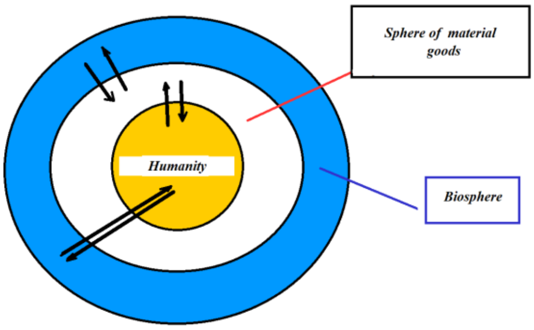

Fig. 1. Diagram reflecting the existence of the equilibrium and steady state of the complex system: Humanity-Material products-Biosphere

The substances that are the most common air pollutants are:

- Carbon dioxide;
- Carbon monoxide;
- Hydrocarbons;
- Aldehydes;
- Radioactive substances and heavy metals;
- Sulphur dioxide - Sulphur dioxide SO_2 is a colourless gas, which is a product of volcanic eruptions and various industrial processes. Sulphur dioxide is usually released during the combustion of coal and oil. Further oxygen enrichment and reactions with water lead to the production of H_2SO_4 (sulphuric acid) and acid rain;
- Nitrogen oxides.

The consequences of air pollution are as follows:

- Greenhouse effect,
- Dust particles,
- Increased ultraviolet radiation,
- Acid rain,
- Increasing ozone concentrations,
- Increase in nitric oxide levels

The origins of pollutants are:

1. Natural sources:

- Volcanic eruptions;
- Fires;
- The process of decay and respiration of humans and animals;
- Processes below the earth's surface.

2. Pollutants as a result of human activity

- Motor vehicles - cars, planes;
- Power plants, , factories, and other industrial enterprises;
- Burning of wood for heating;
- Oil stations;
- Organic waste that releases methane;
- Chemical, biological, and nuclear weapons.

Pollution from diesel engines: Emissions from motor vehicles are among the biggest factors for air pollution. Carbon monoxide is poisonous and, if inhaled in large quantities, can cause suffocation or death. Sulphur oxide and nitric oxide are also poisonous gases. In larger doses, carbon dioxide makes it difficult for animals and humans to breathe. The accumulation of this gas in the atmosphere also leads to general warming of the planet (greenhouse effect). In high-traffic settlements and other places where fuels are burned, the air contains large amounts of carbon dioxide, carbon monoxide, and other polluting gases that pose a threat to human health.

Air polluted with nitric oxide and sulphur oxide dissolves well in the small water droplets forming the clouds, which result in acid rain and affects plants, corrodes metals, and destroys rocks, buildings, cultural monuments. When such rain falls over rivers and lakes, some of the animals in them die. Pollution from human waste is the biggest problem for the ecosystem. About 150 million tones of plastic float in our oceans, and another 12 million tonnes are added each year - 500,000 tonnes from Europe alone. This is equivalent to huge amounts of plastic, enough to fill the 180 trucks that are dumped into our waters every day. Landlocked countries are not excluded: for example, about 40 tonnes of plastic make their way from Austria across the Danube to the Black Sea each year. These data are presented by Rinku Verma, K.S. Vinoda, M. Papireddy, A.N.S. Gowda (2016). We are surrounded by plastic which is a disposable package. These ineffective materials are described by Hannah Ritchie, Max Roser (2018). In the first decade of this century, more plastic was made than all plastic for the past 2,000 years. And every year, tons of plastic end up in the world's oceans. Studies estimate that there are now 15 trillion pieces of plastic in the world's oceans. The problem is growing into a crisis. Urgent action is needed to tackle the global epidemic of plastic pollution.

Bioeconophysical entropic approach for describing the equilibrium and steady state of the components of the complex system of the biosphere

The physical law of the conservation of energy is not only a pure physical law for the explanation of the phenomena from pure physical thermodynamic point of view. It has a much more universal character which is the basis for all processes and phenomena in nature and the biosphere as a whole. The latest integration scientific platforms, which include a whole arsenal of all scientific fields, try to explain deeply the processes of socio-economic phenomena in symbiosis with the humanity and the natural resources in the biosphere. This explanation is given by Tei, Chung and Săvoiu (2018).

The equilibrium processes in nature and society can be explained by thermodynamic aspects leading to the development of the new scientific platform - bioeconophysics (*ibid.*). It uses the entropic approach that serves as a parameter for qualitative and quantitative assessment of the current state of this complex system: Humanity-Material and spiritual goods-Biosphere. According to this entropic bioeconophysical concept, the following points and goals are proposed to be taken into account:

- The Earth has limited resources and energy reserves;
- Production is governed by the complex transformational efficient process of limited supply of raw materials and energy;
- The laws of conservation of principles and conservation of energy are fundamental.

The rapid development of society over the past 400 years implies a disturbance of the balance and equilibrium of the components of the biosphere. An elementary example when describing the process of photosynthesis in plants is the following: the whole mass of carbon dioxide is derived from the corresponding mass of plants in the biosphere and if the amount of carbon dioxide in the air does not change over time, then the corresponding balance and equilibrium is maintained.

Entropy is not just a pure thermodynamic quantity that explains the reversibility of the process from thermodynamic point of view. It also shows an evolutionary process or development of this complex system. From a statistical point of view, entropy also depends on the number of components in a given system. An increase in the number of components of this system leads to an increase in entropy. The purely thermodynamic description of entropy says that for a closed system, the entropy remains unchanged and in principle the processes have properties of reversibility.

If applied to the complex system Humanity-Material and spiritual goods-Biosphere, then this system is closed with respect to the open space of the great distance from the Earth (distance where the humanity has reached by spacecraft) and can be distinguished by some "mental barrier" or "membrane" that closes this system and then, according to the thermodynamic theory, the processes are in equilibrium in this complex closed system; then the respective entropy is maximum and stable with the same average value over time.

This is true when the technological and production process has reached a high level of development and there is no development in the evolutionary plan for some improvement. The other elements of this complex system "adapt" or "get used" to this level and the system as a whole is in a stationary state. The corresponding levels and quantities of the plant world are set to an average value and the other components, such as the animal world, are accordingly "adjusted" to this level. This is one of the complex philosophical aspects for the explanation of the processes in nature in general. The corresponding component of material goods increases its quantity of the components for the case of evolutionary progress in the technological aspect and the resulting entropy, which consists of the three components, can in principle increase, decrease, or be the same level. The resulting entropy may decrease due to of the large decrease of the entropy of Biosphere because of the presence of pollutants and of the destruction of the natural population of animals and plants. Each component of this complex system is characterised by the amount of structural components and natural resources. The concept of entropy of this complex system, that *de facto* means an approach for the explanation of evolution or development over time and the reversibility of processes, has the following expression:

$$\frac{dS}{dt} = \frac{dS_{h.b.}}{dt} + \frac{dS_{m.p.}}{dt} + \frac{dS_{b-ra}}{dt} \tag{1}$$

The indices are: h.b. - human being or human population; m.p. - the sphere of material goods (products); b-ra - biosphere.

When we discuss human entropy, the following can be clarified: the respective entropy is taken into account not only as a large number of populations, but also as the health status of human beings. From a biophysical point of view, a human being is an open system with respect to the other components of this complex system. For a person to appear in a normal physiological state and to exist for a long time, it is necessary to have a constant exchange in terms of intake of quality nutrients and also of material goods (housing, clothes, etc.) and spiritual development (education, art, training, spiritual performing, etc.).

These important human aspects can exist at a normal rate if the relevant components of this complex system are at least in a steady state, if not in an equilibrium state.

Excessive overproduction in the conditions of over market competition leads to an increase in the corresponding entropy of material products. There may be a situation where a part of this area will not be used effectively, and only some important structural elements can be used effectively by human beings. There are also such paradoxical moments as: "something is used once for a short time and then discarded ...", or when we talk about bottled products in the form of plastic, then this part which is a pollutant for the seas and oceans will be inefficiently used. Recently, the process of recycling of waste products has been used in order to reduce environmental pollution.

The corresponding evolutionary entropy component of material products, *de facto*, consists of two parts: the effective part and the inefficient part:

$$\frac{dS_{m.p.}}{dt} = \frac{dS_{eff}}{dt} + \frac{dS_{ineff}}{dt} \tag{2}$$

The effective part of the material goods in this area ensures the normal state of health of the person:

$$\frac{dS_{eff}}{dt} = \frac{dS_{h.b.}}{dt} \tag{3}$$

The corresponding biosphere is accumulated with inefficient waste and then the entropy component of the biosphere will again consist of two subcomponents:

$$\frac{dS'_{b-ra}}{dt} = \frac{dS_{b-ra}}{dt} - \frac{dS_{ineff}}{dt} \tag{4}$$

The minus sign of S_{ineff} means that the biosphere as a whole is depleted (destroyed) due to the presence of waste products in the environment, and then the residue part of the natural biosphere may decrease over time. If S_{ineff} for example consists of carbon dioxide, then a certain amount of this carbon dioxide can be used during the process of photosynthesis and the condition of stationary state $\frac{dS'_{b-ra}}{dt} = 0$ gives the expression:

$$\frac{dS_{b-ra}}{dt} = \frac{dS_{ineff}(CO_2)}{dt} \tag{5}$$

This is the case when the amounts of carbon dioxide are within normal values for the ambient air and the corresponding amount of the population of the plants is maintained at the normal values. The case when the amount of carbon dioxide exceeds some critical value, then:

$$\frac{dS_{ineff}(CO_2)}{dt} \geq \left(\frac{dS_{b-ra}}{dt}\right)_{crit} \tag{6}$$

Then, it is the case of the cumulative accumulation of the excess carbon dioxide that, over time, leads to the greenhouse effect. Its value, respectively, leads to the gradual slowing down of the self-destruction of the biosphere (some species of plants, populations of animals, marine animals and fish, etc. disappear over time). The multi-step process of photosynthesis is usually represented by a summary equation:

$$6CO_2 + 6H_2O \xrightarrow{h\nu} C_6H_{12}O_6 + 6O_2$$

The resulting entropy of the process of glucose formation during the photosynthesis is negative. This description is given by Costanzo, E. and Rubbino, A. (1979), as well as in *Entropy and Biology photosynthesis* (2021).

The decrease of the entropy during the photosynthesis is related to the complex process of the transformation from an aggregate gaseous state in the form of carbon dioxide to a solid state as the form of glucose. In fact, we know from the thermodynamic point of view that the entropy decreases with the transition into the solid state. According to expression (5), if the inefficient part decreases over time due to the fact that the respective quantity of this part decreases, then: $\frac{dS_{ineff}(CO_2)}{dt} < 0$ and then the evolution of the entropy of the component of biosphere is negative $\frac{dS_{b-ra}}{dt} < 0$, showing the thermodynamical aspect of the transformation from gas into a solid state as the form of glucose. For the cases when there is an accumulation of plastic waste in the environment, it decomposes slowly. There is no natural mechanism for bioconversion of plastic waste to any final product that will be useful (efficient) for the biosphere. Rather, it will always remain an inefficient product with a destructive effect on the biosphere. Therefore, the initial task at the legislative level is to develop regulations in order to prevent the presence of plastic waste in the environment or, rather, to stop the production of these plastic materials in the near future.

Energy based on chemical fuels is the biggest pollutant of the atmosphere. As a result, in addition to carbon dioxide and sulphur dioxide, the type of the acid rain is formed. Acid rain is the precipitation that is abnormally acidic due to the elevated levels of acidity (pH<7). It often has a detrimental effect on the plants, marine life, and infrastructure. Acid rain originates from the emissions of sulphur dioxide and nitric oxide, which react with the water molecules in the atmosphere and form acids. This is described by Carter N. Lane (2003).

All chemical fuels contain a higher percentage of sulphur. Hydrogen sulphide that is obtained from the decomposition of organic matter reaches 100 million tons. Sulphur is also found in oil. Sulphur in the atmosphere exists in the form of compounds - hydrogen sulphide, sulphur dioxide, sulphur trioxide. These gases dissolved in water droplets are found in clouds and fog and form sulphuric acid. This is how acid rain is produced. Nitrogen oxides (formed under the influence of high temperature in internal combustion engines) are an integral part of car flue gases and automotive gases. In the same way, when they react with water vapour in the clouds, they form nitric acid, which in turn is another component of acidic rain.

The destructive effect of sulphur dioxide has the result of the dead forest, especially in areas where thermal power plants or heavy machinery companies operate. Sulphur dioxide also acts directly on plants, passing through the leaves and dissolves in the vital juices, oxidising them to form sulphuric acid which is harmful to living matter. Initially, sulphur dioxide damages the cells.

Another type of pollutant is the material particles. Fine dust particles are part of atmospheric dust. The current definition comes from the National Air Quality Standard for Particulate Matter (PM) introduced in 1987 by the US Environmental Protection Agency (PM-Standard). This is described by James H. Vincent. The original definition of fine particulate matter was based on the 1959 Johannesburg Convention and assumed a particle diameter limit of 5 μm. These aspects are described in "Air quality criteria for particulate matter".

Fine dust particles affect human health and are responsible for increasing cases of allergies, asthma attacks, respiratory disorders, lung cancer, and an increased risk of otitis media in children that are described by Lee YG, Lee PH, Choi SM, An MH, Jang AS.(2021).

Substituting expression (3) into (2) and (2) into (1), respectively, we obtain:

$$\frac{dS}{dt} = 2.\frac{dS_{h.b.}}{dt} + \frac{dS_{ineff}}{dt} + \frac{dS_{b-ra}}{dt} \tag{7}$$

Expression (4) gives:

$$\frac{dS_{b-ra}}{dt} = \frac{dS'_{b-ra}}{dt} + \frac{dS_{ineff}}{dt} \tag{8}$$

The substitution of (8) into (7) gives:

$$\frac{dS}{dt} = 2.\frac{dS_{h.b}}{dt} + 2.\frac{dS_{ineff}}{dt} + \frac{dS'_{b-ra}}{dt} \tag{9}$$

The condition of the whole system being stationary is valid when the entropy of this whole complex system is constant over time:

$$\frac{dS}{dt} = 0 \tag{10}$$

Then:

$$\begin{aligned} &2.\frac{dS_{h.b}}{dt} + 2.\frac{dS_{ineff}}{dt} + \frac{dS'_{b-ra}}{dt} = 0 \\ &2.\frac{dS_{h.b}}{dt} = -2.\frac{dS_{ineff}}{dt} - \frac{dS'_{b-ra}}{dt}; \\ &\frac{dS_{h.b.}}{dt} = -\frac{dS_{ineff}}{dt} - \frac{1}{2}.\frac{dS'_{b-ra}}{dt} \end{aligned} \tag{11}$$

The entropy human being can be considered to be almost unchanged (slightly changed) for a wide interval of time, of the order of ten years, and is shown by Carlos Silva and Kalyan Annamalai (2008), (2009) (Fig. 2).

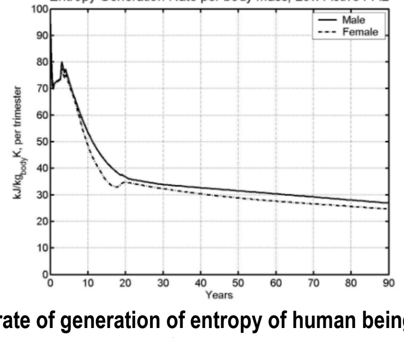

Fig. 2 The rate of generation of entropy of human being (by Carlos Silva, Kalyan Annamalai)

Then $\frac{dS_{h.b.}}{dt} = 0$ and the respective expression is:

$$-\frac{dS_{ineff}}{dt} - \frac{1}{2}.\frac{dS^{/}_{b-ra}}{dt} = 0;\ -\frac{dS_{ineff}}{dt} = \frac{1}{2}.\frac{dS^{/}_{b-ra}}{dt} \quad (12)$$

$$\frac{dS^{/}_{b-ra}}{dt} = -2.\frac{dS_{ineff}}{dt} \quad (13)$$

Expression (13) points to a very important moment: when the inefficient part decreases with time as a quantity (S_{ineff}<0), then ($S^{/}_{b-ra}$ >0), i.e. there is at least a double increase for the biosphere component in the parameters that describe the state of the biosphere. This is described in the World disaster report as: "The United Nations Intergovernmental Panel on Climate Change (IPCC) announced early 2001 that the Earth's atmosphere would warm twice as fast as ten years ago."

Another example that shows twice the amount of the structural element of the biosphere is described by David Wallace-Wells, (2017) as: "The permafrost in the Arctic contains 1.8 trillion tons of carbon, at least twice as much as is currently in the atmosphere."

The condition of stationarity of the whole system (10) with the direct application of expression (1) gives the following:

$$\frac{dS_{h.b.}}{dt} + \frac{dS_{m.p.}}{dt} + \frac{dS_{b-ra}}{dt} = 0 \quad (14)$$

The maintaining of the life of the human being $\frac{dS_{h.b.}}{dt}$ is based on these two components: material products $\frac{dS_{m.p.}}{dt}$ and the biosphere

$$\frac{dS_{b-ra}}{dt} : \frac{dS_{h.b.}}{dt} = -\frac{dS_{m.p.}}{dt} - \frac{dS_{b-ra}}{dt} \quad (15)$$

Throughout one’s life, one consumes the important elements of the biosphere (oxygen, water, natural resources, etc.), as well as in the sense of accumulating of material goods to maintain one’s normal physiological and spiritual state. Cumulative entropy reaches the plateau for the rest of one’s life. In childhood and youth, the condition is characterised by an increase in the value of cumulative entropy (Fig. 3).

Quantitatively, the following result is observed from expression (15).

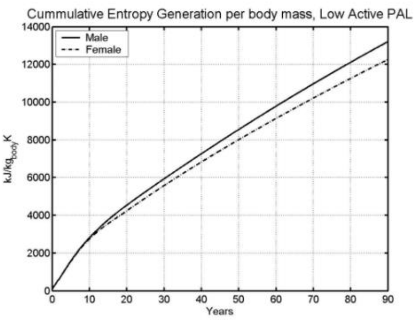

Fig. 3 Cumulative entropy generation per body mass (by Carlos Silva, Kalyan Annamalai**)**

If there is a depletion of the biosphere for an elementary time interval, then dS_{b-ra}<0 and the material products related to that can decrease $dS_{m.p.}$<0, then $dS_{h.b.}$>0 and relating to this we get that human entropy increases.

The increase in human entropy also occurs for the cases when the person is ill or manifests a pathological condition for a long period of time (development of chronic diseases) due to the fact that the biosphere contains more and more poor quality elements.

With the increase of the age of a human being, the sphere of material goods becomes more and more insignificant and it loses its important role, and the achievement of the plateau in Fig. 3 is reached. The mediators or enzymes for motivation, stimuli for life and human activity throughout life, are serotonin, dopamine, norandrenaline which are described by Dfarhud, Malmir and Khanahmadi (2014).The reduction of these mediators leads to a lack of motivation and human activity and the result is the increasing of entropy.

Quantitative expressions in the field of material goods have been described in detail in scientific works with the application of the concept of bioeconophysics by M. Petrov (2019), (2020), (2021). This is based on the physiological state of a human being of the receptor interaction of the relevant organs with the intake of substances with different molar masses in the form of nutrients and drugs by the application of the laws of thermodynamics with a complex econophysical approach. The energy necessary for a human being that is expressed in J/moles depends on the molar mass *M* of the substance (food, medicals, water, air, etc.), the quantity in moles of the receptors $\nu_{rec} \approx m_{body}/M_{body}$, pre-exponential factor *A* in hours minus one (h^{-1}), dose interval *τ* for the receiving of substances in hours, dose mass or food m_f in grams.

$$P_{mole} = \frac{2.M \cdot R \cdot T \cdot m_{body}}{m_f.M_{body}.\ln 2}.\ln\left(\frac{A.\tau}{4.\ln 2}\right);\ \text{[J/mole]} \quad (16)$$

Numerical values of the respective kinetic parameters: A = 0.53 h^{-1}; τ ≈ 6 h; m_f = 500 g (m_f - average mass of nutrients and other components).The average molar (effective) mass of the human body is about 20 (g/mol) that is described by Helmenstine and Anne Marie (2020). The number of moles of nutrients per intake is $\nu = m_f/M$ and the corresponding total value of *P* is:

$$P = P_{mole} \cdot \nu = \frac{2.R.T.m_{body}}{M_{body}.\ln 2}.\ln\left(\frac{A.\tau}{4.\ln 2}\right) \quad (17)$$

Interestingly, the substitution of the numerical values for the corresponding parameters into (17) are: m_{body} = 70 kg = 70000 g, A = 0.53 h^{-1}; τ = 6 h, M_{body} = (20 g/mol) we get P = 10700233 (J) = 10700.233 (kJ). The values for the energy expenses for the human body for a single day are of the order of 10000 kJ. Reimbursement of the corresponding energy expenses is performed by the intake of food in the form of lipids, fats, and proteins, provided that ineffective harmful components in food are missing; otherwise this quantitatively leads to increased human entropy and, in turn, to the development of various diseases. Exposure to dangerous chemicals is also a problem, which is mentioned by Almada, Golden, Osofsky and Myers (2017).

Humans can be exposed to a wide range of dangerous chemicals. The volume of chemicals used today and the continued growth of chemical production show that their impact on humans and the environment will continue to grow. This raises concerns about the health consequences of exposure to chemical mixtures throughout our lives, especially during vulnerable stages of life, such as early childhood, pregnancy, old age, with the development of allergic states.

It is very important to mention that the described expressions are the ideal cases when the human physiological system works only with the consumption of effective substances that ensure a standard and normal physiological state.

Conclusions

The state of ecosystems in symbiosis with a human being is in an evolutionary state with the change of the entropy of both the biosphere and the human being. The number of new diseases increases with time. New epidemics with unknown aetiologies appear and all these new epidemics are based on the current state of the ecosystem which is polluted with more and more increasing quantity of ineffective elements.

Human health is influenced by a number of very complex factors. The elements of the biosphere and the components of material products exert influence on human health. In fact, a perfectly healthy person can be characterised by minimum possible entropy. This minimum value is obtained when the human being consumes more increasing effective elements like qualitative foods and water and employs a varied planning of activities: trips, rest in the fresh air in tourist complexes, sports, hobbies, etc. All of the above-mentioned additional effective elements give higher values of entropy (increasing variety of useful activities) and, respectively, the human being will have more or less entropy.

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