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RESEARCH ARTICLE

He-Ne Monochromatic Light with Selenium nanoparticles as Medical Technique

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Abstract

In this study, the photo-thermal dealing of cancer with Se nanoparticles is studied. This processes for tissue under the influence of heat by a laser source with dose injection the selenium nanoparticles on the affected area. The bio-heat equation is solved by numerical simulation methods. Results are summarized in the effect on the increase of temperature at different time stages. These results appeared that the depth diffusion increasing heat raising during the increasing the time duration of exposure. Thus, it concludes the peak value of depth with controlled temperature.

Keywords: *Selenium nanoparticles; Heat raising; Medical technique.*

Introduction

In the expectable photo-therapy PTH constructed on simple heating, i.e., hyperthermia [1], and locations there in], furthermost behavior disappointments product from insufficient temperature rises in the tumor tissues. Thus, it is important to use a thermal construction agent with a good photo-thermal property to secure irrevocable destruction of tumor cells in a short time without destructive neighboring healthy cells in therapy. Being a nonmetallic element, it belongs to the many groups between isotopes called nuclear isomers [2].

It exists in three well defined allotropic forms such as amorphous Se, which is red color, crystalline trigonal having helical chains, which is black in color, and crystalline monoclinic having Se rings that are red in color [3]. Se is a major structural component of many enzymes, and other applications. These enzymes show important roles in anti-oxidation, imitation, muscle function, and tumor deterrence.

Se is used in the electronic industries for industrialized rectifiers and photoelectric cells, glass and ceramic manufacturing industries as a decolorizer, paint industry as pigments, metallurgy as lubricants, and in various aerospace devices. Se is used in the agricultural industry for plant breeding [4]. The plants Se content in stones and roots of the plant. Se has added importance in medicine for the effective controlling of the diseases.

Se compounds are effectively used as anti-fungal agents in shampoos for the treatment of the dry scalp, e.g., Selsun, an anti-seborrheic having Se sulfide is anti-cancer a well-known drug used to treat dandruff. Various inorganic treated with Se showed a rise in the concentration of and organic forms of Se such as sodium selenite, Se is used as a dietetic supplement along with various Selenium is flaunted to pack a punch [5, 10].

This essential mineral is richly plentiful in foods similar seafood, organ meats, grains, and dairy yields. Despite being important to human health, selenium is informed to be toxic when taken at high doses that surpass the level required to stay healthy. Moreover, a safe range of selenium consumption has yet to be clearly distinct [10, 11]. Many Canadians get the nutrients they requisite from a healthy and stable diet [12, 16].

Mathematical Analysis

A mathematical model for calculating the tissue temperature during the treatment could in a valuable way complement the invasive temperature measurements.

Model heating of tissue during laser treatment irradiation. During all medical laser applications based on heating, it is desirable to have complete knowledge of the temperature distribution. Invasive temperature measurements can provide information of the tissue temperature at discrete points only. The number of probes that can be implanted is restricted by patient tolerance and practical aspects and thus the tissue temperature knowledge is limited.

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Bio-Heat Equation

A treatment can be optimized with respect to the heat application geometry by maximizing the therapeutic effect while minimizing unwanted side effects.

The outcome of a treatment can be evaluated based on the model predictions. It can also be used for extensive parametric studies in order to characterize the stability of various treatment parameters. New treatment strategies can be suggested and evaluated to better understand the heating of tissue during laser irradiation we need to look more in detail on the thermal properties of tissue Among the general factors to consider to understand transfer of heat in tissue are: The thermo physical properties of the tissue (heat capacity, thermal conductivity etc).

Geometry of the irradiated organism Heat production due to absorption of laser light. Heat production due to metabolic processes. Heat flow due to perfusion of blood. The balance of thermal energy in a small "control volume" can be stated:

$$q_{gain} = q_{storage} + q_{loss} + W$$

Where the terms are the rates of heat gained by light absorption and from the surrounding control volumes, stored by the tissue, lost through the boundary of the volume and W work performed by the tissue and metabolic heating Mechanisms of heat flow The two main mechanisms for heat flow inside a tissue is through conduction, meaning that the gradient in temperature within the tissue itself drives the flow, and through convection of thermal energy by the perfusing blood. Blood perfusion the blood transports thermal energy both in and out from the control volume studied. The net inflow can be written as:

$$q_p = -\omega_b \rho_b c_b \rho (T - T_a)$$

Where ω is the blood perfusion (volume blood per unit mass tissue per unit time, 1/s), ρ_b and c_b are the density and specific heat of the blood, and Ta is the temperature of the arterial blood. The conducted heat flow is governed by the Fourier law of heat conduction. The law states that the amount of thermal energy conducted through a medium is proportional to the cross sectional area, the temperature difference and the length of time. It is inversely proportional to the length across the medium. In the following results, the effect of temperature with time duration is appeared with limited times and exposure position region.

The thermal properties of Brain tissue:

Material	Conductivity ($W\ m^{-1}\ K^{-1}$)	Density ($kg\ m^{-3}$)$\times10^{-3}$	Specific heat ($kJ\ kg^{-1}\ K^{-1}$)	Diffusivity ($m^2\ s^{-1}\times10^7$)
Brain	0.16-0.57	1.04-1.05	3.6-3.7	0.44-1.4

Figure (1) :The effect of temperature with variation of position through the tumor region at different values of time duration.

Figure (2): The three dimensions plot with increasing the value of time and the depth at limited bounded quantities.

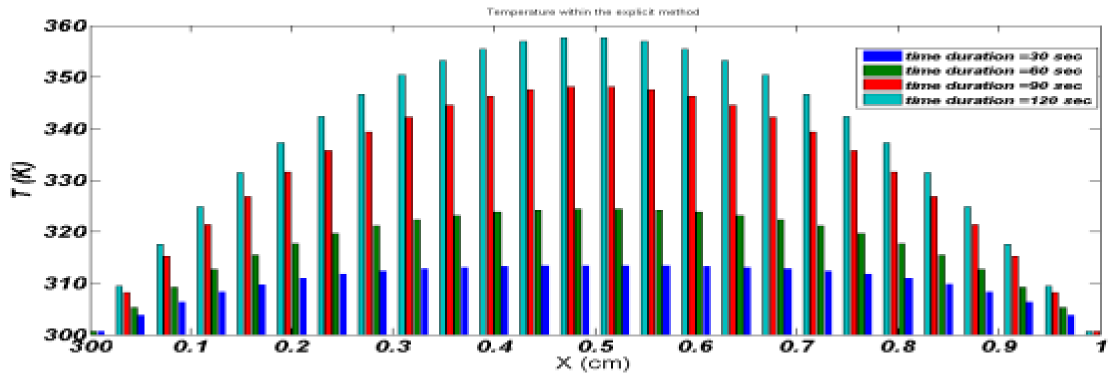

Figure 1 :The effect of temperature with variation of position through the tumor region at different values of time duration

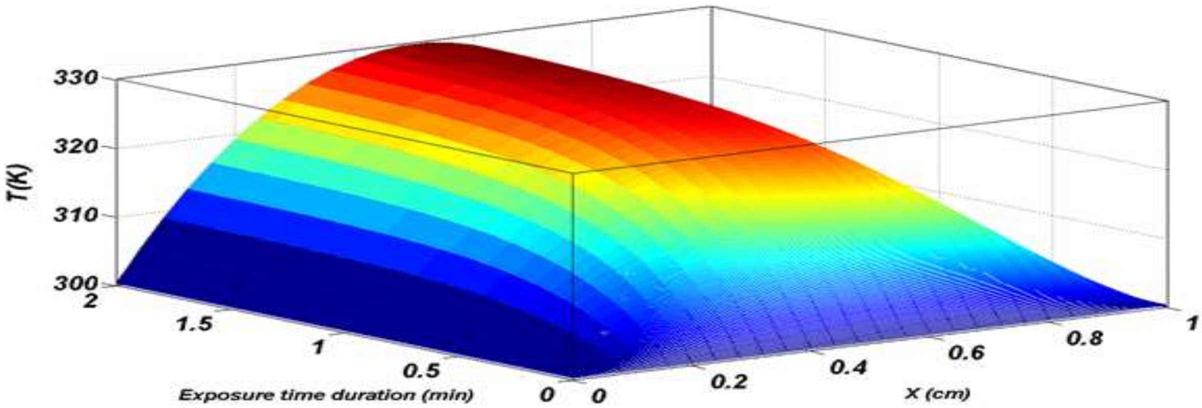

Figure 2: The three dimensions plot with increasing the value of time and the depth at limited bounded quantities

Conclusions

The results appeared that the effect of temperature cumulative is obtained the rising in deepness diffusion with the limit time interval of contact.

The restraining of temperature was estimated in the value (47 ^{O}C) for protection the other tissue cells. The time duration was tested with (120 sec). One concludes the treatment of the tumor in this processes success with using the Se -NPs.

References

1. Jordan A, Maier-Hauff K, Wust P, Johaunsen M (2006) In Nanomaterials for Cancer Therapy. Edited by: Kumar C. Weinheim: Wiley-VCH.
2. S Patai, Z Rappaport (1978) The chemistry of organic selenium and tellurium compounds, “The Chemistry of Triple Bonded Functional Groups.
3. VS Minaev, SP Timoshenkov, VV Kalugin (2005) J. Optoelectron. Adv. Mater., 7: 17-17.
4. Y Mehdi, JL Hornick, L Istasse, I Dufrasne (2013) Molecules, 18: 32-92.
5. Vinceti M, Filippini T, Del Giovane C, et al (2018) Selenium for preventing cancer. Cochran Database Syst. Rev. 1:CD005195. doi: 1002/14651858.CD005195.pub4.
6. National Institutes of Health. Selenium. [Internet] (2018) [cited May 2018]. Available from https://ods.od.nih.gov/factsheets/Selenium-HealthProfessional/
7. Statistics Canada. Use of nutritional supplements (2015) [Internet] 2017. [Cited May 2018]. Available from https://www.statcan.gc.ca/pub/82-625-x/2017001/article/14831-eng.htm

8. Shen S, Kong F, Guo X, Wu L, Shen H, Xie M, Wang X, Jin Y, Ge YC (2013) MCTS stabilized Fe3O4 particles with extremely low toxicity as highly efficient near-infrared photothermal agents for in vivo tumor ablation. Nanoscale, 5: 8056-8066.
9. Dunn AW, Ehsan SM, Mast D, Pauletti GM, Xu H, Zhang J, Ewing RC, Shi D (2015) Photo thermal effects and toxicity of Fe3O4 nanoparticles via near infrared laser irradiation for cancer therapy. Mater. Sci. Eng. C Mater. Biol. Appl., 46: 97-102.
10. Yuan G, Yuan Y, Xu K, Luo Q (2014) Biocompatible PE Gylated Fe3O4 nanoparticles as photothermal agents for near-infrared light modulated cancer therapy. Int. J. Mol. Sci., 15: 18776-18788.
11. Wang J, Zhao H, Zhou Z, Zhou P, Yan Y, Wang M, Yang H, Zhang Y, Yang SM (2016) R/SPECT imaging guided photothermal therapy of tumor-targeting Fe@Fe3O4 nanoparticles in vivo with low mononuclear phagocyte uptake. ACS Appl. Mater. Interfaces, 8: 19872-19882.
12. Ren X, Zheng R, Fang X, Wang X, Zhang X, Yang W, Sha X (2016) Red blood cell membrane camouflaged magnetic nanoclusters for imaging-guided photothermal therapy. Biomaterials, 92: 13-24.
13. Ishida T, Maeda R, Ichihara M, Irimura K, Kiwada H (2003) Accelerated clearance of PEGylated liposomes in rats after repeated injections. J. Control. Release, 88: 35-42.
14. Estelrich J, Busquets MA, Morán MC (2017) Effect of PEGylation on ligand-targeted magnetoliposomes: A missed goal. ACS Omega, 2: 6544-6555.
15. Rao L, Bu LL, Xu JH, Cai B, Yu GT, Yu X, He Z, Huang Q, Li A, Guo SS et al (2015) Red blood cell membrane as a biomimetic Nanocoating for prolonged circulation time and reduced accelerated blood clearance. Small, 11: 6225-6236.
16. Rao L, Bu LL, Cai B, Xu JH, Li A, Zhang WF, Sun ZJ, Guo SS, Liu W, Wang TH et al (2016) Cancer cell membrane-coated up conversion nanoprobes for highly specific tumor imaging. Adv. Mater., 28: 3460-3466.

