INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES
[ISSN: 0975-4725; CODEN(USA):IJPS00]
Journal Homepage: https://www.ijpsjournal.com

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Review Article

A Comprehensive Review: The Purposes and Targeting Locations of Silica-Based Nanocomposition for Cancer Nanotechnology

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ARTICLE INFO

Received: 22 April 2024
Accepted: 26 April 2024
Published: 03 May 2024
Keywords:
Nanotheranostic, Cancer, Nano silicon dioxide, Nanopestic treatments.
DOI:
10.5281/zenodo.11110023

ABSTRACT

Recently, nanotheranostic imaging has drawn attention for its potential to diagnose diseases and aid in the treatment of cancer. The most popular model for nanotheranostic treatment is one of several or many nanopestic treatments utilized for patients. The main uses for silica are in the demonstration of optical, magnetic, and electric characteristics, as well as in the treatment of cancer. Silica also has specific characteristics and shape that may be used to cure infectious diseases. It can also be prepared in certain ways to produce nonparticles and results. Silicon divide has two target locations that are specifically targeted to cancer cells. for the combustion-based preparation of nano silicon dioxide particles.

INTRODUCTION

A collection of cells known as cancer include the body's aberrant cell proliferation. Cancer refers to the "Uncontrolled growth of cells that have damaged DNA expression." A cancer neoplasm can be classified as benign or malignant. Benign cancer is limited to the original tissue, but malignant cancer has the potential to spread to other organs. In 2018, the WHO reported 9.6 million deaths, or 1 in 6 deaths (1:6). Numerous organs, including the lungs, prostate, colon, stomach, liver, esophagus, skin, blood, cervix, breast, thyroid, and so on, are affected by cancer. In the five years following a diagnosis, 33.4 million people had cancer, of which 8.1 million died (a ratio of 1:6). Multifunctioning cells are a characteristic of many illnesses. "Known what to do and when to do it" is ingrained in healthy cells.1

Some known Causes of Cancer:-

	Cause	Example
1.	Lifestyle	Tobacco & alcohol Consumption diet

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Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

2.	Environmental exposures	Air, drinking water
3.	Organic Chemicals	Benzene, Coltar
4.	Inorganic chemicals & metals	Arsenic, Cadmium, nickel
5.	Fibers	Asbestos
6.	Radiation	Sunlight(ultraviolet)
		Radioactive material
7	Drugs	Diethylstilbestrol(Des)
8	Viruses	Espstein-Barr AIDS, Papilloma2-4

Features and morphologies of SiO2:-

Silicon dioxide, or SiO2, is the metal oxide silica belongs to the fourteenth group of the periodic table. This kind of salicylic acid polymer consists of linked tetrahedral SiO4 units. SiO2 is present in a variety of forms, including amorphous, trydimite, cristobalite, and quarters. The food and pharmaceutical industries employ amorphous SiO2, which is regarded as a biosafe material.5 There are no significant health issues associated with this. SiO2 is often utilized in catalyst chemical sensor chromatography and uremic because to its large surface area and increased surface reactivity. When compared to when it is free from, 2-devinyl-2-purpopherophertide a hydro-photosensitizing anticancer implanted in SiO2 is more effective in killing cancer cells.6

Targeting Sites of SiO2 for Cancer Cells

Active targeting

Ligands are affixed to the surface of cancer cells in this active targeting method. And think of EPR as an efficient way to boost the effectiveness of cancer treatment. Modified liposomes were the first active targeting agent in 1980. Small molecules, peptides, antibodies, and nucleic acids are among them. Inactive targeting is only one of several types of targeting that exist.7

- Tumor cell targeting
- Vascular cell targeting
- Nuclear cell targeting8

PassiveTargeting:9

Maeda published the first paper on passive targeting in 1986. They will be used in the process of angiogenesis, which is the development of new blood vessels. They give every cell in the body oxygen, vitamins, and nutrition. The key effects of surface characteristics, topography, particle size, and morphology on passive targeting capacity are discussed in this section.

Silica-Based Nanocomposite for multi channel imaging:10

There are numerous other imaging modalities, including blood testing, ultrasound sound position emission tomography, CT scan, MRI, X-ray, and fluorescence optical imaging.

Silica Based Nanocomposite for MRI

MRI is a very effective method for finding tumor images because it can provide images of the body that other imaging tests find difficult to notice in soft tissue. MRI is the most effective and straightforward method for identifying cancer cells. MRIs are used specifically to view cancer cells in the brain and spinal cord. Gd 3+ chelates have been utilized extensively in hospitals. T1, weight MRI agent Gd chelate frequently exhibits high toxicity during excretion and a brief blood circulation time period.11 The Gd3+ chelate will lengthen the blood circulation time and reduce Gd3+ leakage when it is incorporated into silica nanoparticles.

Silica-BasedFluorescentOpticalImaging(FOI)

The FOI is a novel form of optical fluorescence imaging. The size and position of tumor cells can also be determined with the use of fluorescent optical technology, which is incredibly sensitive and quick. For fluorescence optical imaging, silica coating material is used to promote biocompatibility.12 Each fluorescent silica nanoparticle resolving in bright fluorescence can contain hundreds of fluorescent dye molecules carried by the silica matrix. The size of the synthetic silica nanoparticle dots is around 7 mm, and they have an effect on increasing the pace of

excretion and glomerular filtration. According to certain research, MSN sizes will drop to less than 50 nm.13

Combinational Therapy for Silica Based Nanocomposition:

Neither chemotherapy nor any other kind of treatment In any event, radiation and surgery are employed to treat cancer. In any clinical therapy, combination therapy has long been used. Combination therapy refers to the widely accepted practice of treating a condition using multiple medications. The phrase is also occasionally used to refer to a combination of multiple therapies, such as radiotherapy and surgery. The best therapeutic outcomes come from a combination of therapies rather than from individual treatment approaches.14 Additionally, the silica nanocomposite magnetic, electric, and optical capabilities can be integrated with chemotherapy in a single therapeutic plan.15-17

Method of preparation for nanoparticles of Silicon Dioxide:

Silicon Dioxide prepared by Combustion method: 20 milliliters of NaCl were mixed with 2 grams of silica gel, and the mixture was agitated at 850 degrees Celsius to produce sodium silicate. HNag was added drop by drop until the precipitation was ready, and the excess sodium nitrate and hydroxide were removed by repeatedly washing the precipitate with distilled water.18-23 After that, raise the pH to 10 and mix 0.15 g of glucose that has been dissolved in water with gel-formed suspension at 3000C until a black, brownish powder forms.24-27 As inferred from TG investigations, the resulting powder was calcined at various temperatures ranging from 4500C to 8500C. After two hours of calcinations at 8000C, a pure white powder was produced.28-30

RESULT/CONCLUSION:

As a result, multifunctional A silica nanocomposite featuring several performance forms Combinational therapy with multimodal imaging and firm multichannel imaging (such as MRI, FOI) with a general profile such as Size, Stage phenotypic. Silica can be used as more than just a covering for matrices that connect several imaging and therapeutic medication types. Real-time imaging during therapy, especially fluorescence imaging, can help establish a surgeon's understanding of the tumor and track the phenotypic and size of the tumor as well as the effectiveness of the treatment over time. There are two medication target locations that are more successful at affecting cancerous cells when a drug is used to target those areas.

REFERENCE:

1. Yannan Yang, C.Y.(26October2015). Advances in silica based nanoparticles for targeted cancer.Australian Institute for Bioengineering and Nanotechnology, The University of Queensland, QLD.
2. Linlin Li, T.L, (2014). Multifunctional Silica-Based Nanocomposites for www.aspbs.com/jbn,Vol.10, 1784 1809.
3. http://globocan.iarc.fr/Pages/fact_sheets_cancer.aspx
4. A. Jemal, F. Bray, M.M. Center, J. Ferlay, E. Ward, and D. Forman, Global Cancer Statistics. Ca-Can J. Clin.61, 69(2011).
5. H. S. Nalwa (ed.), Encyclopedia Nano science and Nanotechnology, American Scientific Publishers, Los Angeles, CA (2004/2011). Vols.1-25.
6. H. S. Nalwa and T. Webster (eds.), Cancer Nanotechnology:Nanomaterials for Cancer Diagnosis and Therapy, American Scientific Publishers, LosAngeles, CA (2007).
7. M. Ferrari, Cancer nanotechnology: Opportunities and challenges. Nat. Rev. Cancer 5, 161(2005).
8. A. Schroeder, D. A. Heller, M. M. Winslow, J. E. Dahlman, G. W. Pratt, R.Langer, T. Jackes, and D. G. Anderson, Treating

Metastatic Cancer with Nanotechnology. Nat. Rev. Cancer 12, 39 (2012).

9. D. Jones, Cancer nanotechnology: Small, but heading for the big time. Nat. Rev. Drug Discov. 6, 174 (2007). Linlin Li, T.L. (2014). Multifunctional Silica-Based Nanocomposites for www.aspbs.com/jbn, Vol. 10, 1784-1809.
10. R. Siegel, D. Naishadham, and A. Jemal, Cancerstatistics, 2013. Ca-Cancer. J. Clin. 63,11 (2013).
11. Mahmoudi, M,; Sant, S.; Wang, B.; Laurent, S.;Sen, T., Superparamagnet iron oxide. Nanoparticles (SPIONs): Development, surface modification and application and in chemotherapy. Adv Drug Deliver Rev 2011, 63 (1-2), 24-46.
12. Kanasty, R.; Dorkin, J. R.; Vegas, A.; Anderson, D., Delivery materials for RNA therapeutics Natmater 2013, 12 (11), 967-977.
13. Vallet- Ragi, M.; Ramila, A.; del Real, R.P.; Perez-Pariente, J., A new property of MCM-41: Drug delivery system. Chem Master 2001, 13(2), 308-311.
14. Wu, S. H.; Mou, C.Y.; Lin, H.P., Synthesis of mesoporous silica nanoparticles. Chem Soc Rev 2013, 42(9), 3862-3875.
15. Li, Z. X. Barnes, J.C.; Bosoy, A.; Stoddart, J. F.; Zink, J. I., Mesoporous silica nanoparticles in biomedical applications. Chem Soc Rev 2012, 41 (7), 2590-2605.
16. Tang, F. Q.; Li, L.L.; Chen, D., Mesoporous Silica Nanoparticles: Synthesis, Biocompatibility And Drug Delivery. Adv Mater 2012, 24 (12), 1504-1534.
17. La Van, D. A.; Mc Guire, T.; Langer, R., Small-scale systems for invivo drug delivery. Nat Biotechnol 2003, 21 (10) 1184-1191.
18. Langer, R., New Methods of Drug Delivery. Science 1990, 249 (4976), 1527-1533.
19. Shi. J..; Xiao, Z. Y.; Kamaly, N.; Farokhzad. O. C. Self Assembled Targeted Nanoparticles: Evolution of Technologues and Benchto Veside Translation. Accounts Chem Res 2011, 44 (10) 1123-1134.
20. Bangham, A. D.; Standish, M. M.; Watkins, J. C., Diffusion of Univalent lons across Lamellae of Swollen Phospholipids. J Mol Biol 1965,13 (1), 238.
21. Barreto, J. A.; O' Malley, W.; Kubeil, M.; Graham, B.; Stephan, H.; Spiccia, L., Nanomaterials: Applications in Cancer Imaging and Therapy. Adv Mater 2011, 23(12), H18- H40.
22. Zhang, L.; Gu, F. X. ;Chan, J. M.; Wang, A. Z.; Langer, R. S.; Farokhzad, O. C., Nanoparticles in medicine: Therapeutic applications and developments. Clin pharmacol Ther 2008, 83 (5), 761-769.
23. Kumari, A.; Yadav, S. C., Biodegradable polymeric nanoparticles based drug Delivery systems, Colloid Surface B 2010, 75(1), 1-18.
24. Wang, X.; Wang, Y. Q.; Chen, Z.; shin, D. M., Advances of Cancer Therapy by Nanotechnology. Cancer Res Treat 2009, 41(1), 1-11.
25. Cegnarm M.; Kristl, J.; Kos, J., Nanosclae polymer carriers to deliver chemotherapeutic agents Totumours. Expert Opin Biol Th 2005, 5(12), 1557-1569.
26. Salve, R.; Kumar. P., Ngamchertdtrakul, W.; Gajbhiy, V.; Yantasee, W.Stinuli-responsive mesoporous silica nanoparticles: A Custom-tailored next generation approach in cargodelivery. Master. Sci. Eng. C 2021, 124, 112084 [CrossRef] [Pubmed].
27. Xi, X.; Shi, J.; Deng, Q.; Xu, N.; Huang, F.; Xiang .X. Biodegradable and self-flurescent ditelluride-bridged mesoporous Organo silica /polyethylene glycol-nanocomposite for dual responsive drug delivery and enhanced therapy efficiency. Mater. Today Chem. 2022, 23, 100660. [CrossRef].

28. Popescu, R .C.' Andronescu, E.; Vasile,. S. Recent advances in magnetite nanoparticle functionalization for nanomedicine. Nanomaterials 2019, 9, 1791. [CrossFef].
29. Demin, A. M.; Pershina, A. G.; Minin, A. S.; Brikunova, O. Y.; Murzakaev, A. M.; Perekucha, N. A.; Romashchenko, A. V.; Shevelev, O.B.; Ulmin, M. A.; Byzov.i.V.; etal. Smart design of pH-responsive system based onp HLIP-modified magnetite Nanoparticles for tumor MRI. ACS Appl. Mater. Interfaces 2021, 13, 36800. [FrossRef][PubMed].
30. Liu, D.; Li, J.; Wang, C.; An, L.; Linww, J.; Tian, Q.; Yang, S. UltrasmallFe@Fe3O4nanoparticlesas T1-T2 dual-mode MRI contras tagents for targeted tumor imagig, Nanomedicie 2021, 32, 102335 [CrossRef] [PubMed].

HOW TO CITE: Nitin W. Pawar, Poonam D. Awaghate, Anand Asawa, Mayur S. Tekade, Jagdish V. Manwar, A Comprehensive Review: The Purposes and Targeting Locations of Silica-Based Nanocomposition for Cancer Nanotechnology, Int. J. of Pharm. Sci., 2024, Vol 2, Issue 5, 147-151. https://doi.org/10.5281/zenodo.11110023