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Breast Cancer : A Big Disease

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Abstract

cancer is a deadly disease. It remains as leading cause of death in every country of the world . Cancer is the first or second leading cause of death among people of age above 70 years in 295 countries Female breast cancer occupies the top position in terms of new cases, among a number of types of cancers. Cancer was once considered as a disease of the westernized and industrialized countries.

There are various classes of chemotherapeutic agents meant for the treatment of cancer. They are: alkylating agents, antimetabolites, anthracyclins, plant alkaloids, topoisomerase inhibitors, taxanes, and epipodophylotoxins.

Keys; Cancer,Nanoparticles,chemotheraputic drugs.

OBJECTIVES OF THE CURRENT RESEARCH WORK

The present study is centered on the following objectives:

i. To find out the magnetic nanoparticles based distinct anticancer drug carrier for drug localized and targeted drug delivery to cancer cells.

ii. To synthesis the lanthanide-doped (Ho, Er, Yb) magnetic ferrite nanoparticles and magnetic hydroxyapatites mainly by hydrothermal method.

iii. To investigating the shape, size, surface, and magnetic properties of nanocarriers.

Breast cancer is cancer that develops from breast tissue. Symptoms of breast cancer may include breast lumps, changes in the shape of the breast, dimpling of the skin, milk rejection, fluid discharge from the nipple, a new inverted nipple, or red or scaly patches on the skin.

People with widespread disease may have bone pain, swollen lymph nodes, trouble breathing, or pale skin.

cancer is a deadly disease. It remains as leading cause of death in every country of the world . Cancer is the first or second leading cause of death among people of age above 70 years in 295 countries, according to the recent report by World Health Organization (WHO).1. As of 2020, one-half of all cases and about 58.3% of cancer deaths, among men and women combined, occur in Asia, 22.8% in Europe, and 20.9% in America.2. About 2.26 million, accounting for 11.7% of all sites of cancer, new breast cancer cases are reported at GLOBCON 2020, in comparison with GLOBOCON 2018. Female breast cancer occupies the top position in terms of new cases, among a number of types of cancers. Cancer was once considered as a disease of the westernized and industrialized countries. Nevertheless, it has emerged as a common disease of developing and low-resource countries too.

Most breast cancers are observed in the ductal region (80%) and the remaining 20% originate in the lobules of the breast. 3 Breast cancer is categorized into three classes: (i) the one that expresses an estrogen hormone receptor (ER+) or a progesterone receptor (PR+), (ii) the one that expresses human epidermal receptor 2 (HER 2+), and (iii) triple negative breast cancer (TNBC) (ER-, PR-, HER2-) In addition, the TNBC is classified into six categories viz., basal-like 1 and basal-like 2 (BL-1 and BL-2), mesenchymal (M), immunomodulatory (IM), mesenchymal stem cell-like (MSL), and luminal androgen receptor (LAR).

The BCSCs utilize certain mechanisms to gain resistance to treatment. The CSC resists the chemotherapeutic treatment and ABCG2 contributes to the rapid efflux of cytotoxic drugs. 4. In addition, ALDH1 metabolizes the chemotherapeutic drugs into non-toxic compounds. In addition, the cell cycle kinetics is altered that leads to tumor recurrences after a considerable time of treatment5 (Rebucei and Michiels, 2013). Furthermore, miRNAs enhance tumorigenesis and drug resistance

CHEMOTHERAPEUTIC DRUGS

There are various classes of chemotherapeutic agents meant for the treatment of cancer. They are: alkylating agents, antimetabolites, anthracyclins, plant alkaloids, topoisomerase inhibitors, taxanes, and epipodophylotoxins. In addition, the bio-availability of these drugs to tumor tissues is poor and higher dose is often required. Such high doses can lead to toxicity of normal cells and development of drug resistance in cells. Therefore, it is essential to develop anticancer drug delivery vehicles that have the ability to keep the drugs until they reach the target cancer cells and deliver the therapeutic specifically on those. A number of drug delivery vehicles has been developed in the past. These materials include polymers 6 The design requirements of nanoparticles has been understood and are being explored in depth by several research groups across the world.

FOLATE LIGANDS

In general, tumor suffers a poor lymphatic drainage and leaky blood vessels. Therapeutic molecules diffuse in a non-specific fashion and get poorly retained in the tumor. Contrary to these, a nanocarrier has the potential to escape into the tumor tissues through the leaky vasculature and get retained inside them. Drug targeting methods are classified into two categories: (i) passive targeting and(ii) active targeting. A cloaking of the NPs with a coating enables passive targeting which relies on a large circulation time of the NPs. Active targeting of drug-loaded NPs utilizes the strategy of targeting ligands being tethered onto them. The nanocarriers are cell internalized in such cases through a receptor-mediated endocytosis The designed nanocarrier should possess cell-specific active targeting ligands. A notable targeting ligand, that can be clever choice, is a folate. A folate moiety can be incorporated on the coating molecule by chemically functionalizing it. The reason for the folate unit being used as the targeting ligand is that certain cancer cells overexpress folate receptors on their surface 7. There are about 1–100 million receptor copies per cell Particularly for the drug delivery to breast cancer cells, folate receptors remain as the preferential active target receptors.

Magnetic nanoparticles: the necessity

The principle of magnetic drug targeting is allowing the magnetic NPs to respond to an external magnetic field applied near the tumor cells. It is supposed to work as a majority of tumors are located near the surface of the human organs. The magnetic NPs are surface-modified with organic ligands that house space for the accommodation of drug molecules. In addition to magnetic drug targeting, design of magnetic NPs also enables another form of treatment of cancer i.e., magnetic hyperthermia and diagnosis, i.e., magnetic resonance imaging (MRI)8. Therefore, there has been an increasing thirst over the past years for the synthesis of magnetic NPs and designing them as nanocarriers. Magnetic drug delivery has been covered in a substantial number of reviews..9

The magnetic properties of $Fe3O4$ arise from the splitting of a 3d orbital of iron. The $Fe3+$ and $Fe2+$ ions occupy the octahedral site of the inverse spinel oxide crystal. They undergo a double exchange coupling. The electron spin located in the opposite direction is interchanged between two sites. In maghemite, the $Fe2+$ ion carries two and four unpaired electrons. The availability of 3d electrons in the iron determines the magnetic characteristics.

The difference between magnetite and maghemite lies in the oxidation states that are balanced by cation vacancies As the understanding of the behaviour and structural criteria for drug targeting employing the ferrite NPs become more and more advanced, further functional characteristics are being added to the magnetic nanocarriers. For instance, the magnetic nanoparticles are: designed to have luminescence characteristics and photothermal heating efficiencies..10 The breast cancer cell lines, MCF-7, were isolated first the MCF-7 cells in 1973 by the researchers of Michigan Cancer Foundation (and hence the name) was pivotal in the understanding of breast cancer. MCF-7 represents a commonly used breast cancer cell line.from the pleural effusion of a 69-year-old woman with metastatic cancer. The patient had a benign tumor and underwent mastectomy of her breast, about 7 years before primary culture of cells was started .

The magnetic properties of LnFeO3 have been ascribed and related to the iron and the ionic radii of the Ln3+ ion .The spontaneous magnetization depends on the temperature and varies across different lanthanide and orthoferrites 11

Lanthanide orthoferrites, LnFeO3, Ln=Sm, Nd, Gd have been synthesized having a size less than 150 nm La, Sm, Gd, Dy, Er, and Yb have been prepared as ferrites in ceramic fibre forms.12. The focus of preparing lanthanide ferrites has been to apply them as pigments or as nanoscale catalysts.The commonly synthesized transition metal ferrites are substituted with lanthanide ions in a small percentage. This has been the interest of several research groupsfocused on lanthanide doped magnetic nanomaterials. Le3+ has been doped in cobalt ferrite and the magnetic properties have been explored Gd3+-doped cobalt ferrites have been investigated and they displayed soft magnetic properties 13.

In the lanthanide series the magnetic moment varies from 0 (La3+) to 10.5 μB (Dy3+). As the f-electron orbital contribution varies largely, the lanthanide ions can be isotropic or anisotropic. Therefore, the magnetic properties of rare earth doped ferrite NPs are not fully understood either in terms of the unpaired f-electrons or as contributed by the magnetic moment of these elements14.

Er-doped cobalt ferrites were synthesized by sol-gel combined autocombustion method .The structural and magnetic properties were investigated on varying the amount of the dopant (Er)Ce, Sm, Eu, Dy, or Er- doped cobalt ferrite NPs were synthesized in oil-in-water micelles employing sodium dodecyl sulfate as the surfactant. The lanthanide ions partially replace the Fe ions in the spinel structure. The doped ions could occupy either tetrahedral or octahedral lattice site. Hydroxyapatite possesses the chemical formula, [Ce10(PO4)6(OH)2]. Doping with magnetic ions like Fe^{3+} allows the replacement of a few cations from the Hap material.

conclusion

Risk factors for developing breast cancer include obesity, lack of physical exercise, alcohol consumption, hormone replacement therapy during menopause, ionizing radiation, young age at first menstruation, having children late or not at all, older age, having menarche earlier. Are. History of breast cancer, and family history of breast cancer. About 5–10% of cases are the result of inherited genetic predisposition, including BRCA mutations and others.

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