

# Anti-breast cancer potential of MnO<sub>2</sub> nanoparticles using *Terminalia chebula* fruit extract against MCF-7 cell line through in vitro cell cycle and apoptotic studies

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## Abstract

Since decades, cancer has become reason of major concern as it is the leading cause of mortality worldwide. Many therapeutic strategies have come up in the scientific world, but its pitiful to know that synthetic chemotherapeutic agents either cause adverse effects or cancer cells develop resistance to these agents. Plant derived chemotherapeutic agent present wide range of therapeutics, and most are yet to be discovered. In the present study, we have analysed the anti-proliferative, and apoptogenic properties of manganese oxide nanoparticles MnO<sub>2</sub> NPs derived from *Terminalia chebula* (TC) fruit on breast adenocarcinoma, MCF7 cell lines. The formation of MnO<sub>2</sub>NPs was confirmed through scanning electron microscopy (SEM), transmission electron microscopy (TEM) and high-resolution transmission electron microscopy (HR-TEM). The morphology of the material was studied using SEM analysis, which suggested a agglomeration having spherical shape with an average diameter of 47.6nm. Further, the TEM and HR-TEM images confirmed the rod shape of the as-prepared MnO<sub>2</sub> NPs with an interplanar distance of 0.271 nm. The anticancer efficacy of MnO<sub>2</sub>NPs was evaluated against MCF-7 breast cancer cell line, which showed up to 86% inhibition of the cells at 320µg/mL concentration.

The MnO<sub>2</sub> NPs was found to be cytotoxic, and was able to induce apoptosis in MCF7 cell lines.

## Introduction

Cancer has established itself to be the greatest biological enemy to mankind. Past three decades, it has been the major cause of mortality worldwide and hence has become the serious issue in the health care industry. For the year 2017, American Cancer Society estimated that about 318,420 in males and 282,500 in females will die after suffering from cancer [1]. Above mentioned is the enumeration of only United States of America in the year 2017. If we study the statistics of fast developing country like India, the trend of death rate is analogous to that of USA. The fatality rate ascribable to cancer in India is nearly to 200,100 males and 195,300 women. The number quoted cancer accounts for all types of cancer [2]. Cancer is a dreadful disease in which cells undergo several genetic and epigenetic changes and lose control over their multiplication. Henceforth, they divide in an undisciplined manner forming an indefinite mass of cells called neoplasm or tumour. Cancer can crop up to almost all types of cells/tissues of the body say in oral squamous, cervix epithelial cells, breast connective tissue, etc. Depending on organs exhibiting the tumorigenesis, cancer has been noted by about hundreds of terms [3]. Table 1.

Since past two decades, several advancements have been seen in the field of cancer diagnostics and therapeutics. Several screening tests, medical imaging and symptoms have been observed which correctly diagnose the cancer in the patient. Histopathological examination of the tumour cells can be very helpful in identifying the transformed cells. Several strategies that involve cancer treatment are chemotherapy, radiotherapy, surgery. Newly, targeted therapy and hormonal therapy have come into play to kill cancer cells specifically without damaging the normal cells. The medicine for chemotherapy is either of plant origin without any side effects or the synthetic one with harmful side effects. Hence, the study is taken to identify the medicinal plant with anti-cancerous activity [4].

India is a home of great ecological diversity both in terms of flora and fauna and has blessed mankind with huge potential resources that can serve as therapeutics to a number of diseases. Indian flora has paved way for the emergence of the herbal medicines all over the