

RESEARCH ARTICLE

Formulation and Evaluation of Lycopene Nanoparticles for Breast Cancer

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ABSTRACT

Aim: Lycopene is owned to carotenoids that manifest better pharmacological possessions such as antioxidant, anti-inflammatory, and anticancer. As an outcome of very little water solubility, it has a restricted systemic absorption after oral route.

Methods: Lycopene-loaded sentinel lymph nodes (SLNs) by hot homogenization method, using some alteration were formulated. The size of nanoparticles (NPs) was characterized using scanning electron microscope (SEM). Also, encapsulation efficiency, drug loading (DL), and drug release were calculated.

Results: SEM revealed spherical SLNs. High EE and DL were procured.

Conclusion: We formulated a stable lycopene-SLNs with better physicochemical properties.

Keywords: Breast Cancer, *Karkinos*, Lycopene Nanoparticles.

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INTRODUCTION

Word cancer is obtained from Hippocrates, who used 'Karkinos' to express tumors.¹ Cancer is a major public health burden. Cancer is an uncontrolled growth of cells that can cause death. Cancer cells disturb normal cells. Cancer cells are the outcome of imbalance in the body, and cancer may be treated by impairing imbalance caused. Millions of people each year are distinguished with cancer. Cancer leads to 3,800 million people dying annually across the world.² Cancer is a serious danger to human health; it has set off the second-largest root of death after cardiovascular diseases. The highest mortality rate cancers are lung, stomach, and liver cancer.³ Cancer is an integrated genetic disease that is due to environmental factors. Carcinogens can be found in food, water, air, chemicals, and sunlight that people are revealed to. Ninety percent of cancers find its root in epithelia. Unhealthy lifestyles, and a modern Western diet will enhance cancer incidence.⁴

Cancer is the major concern for people and the foreseeable future. Chemotherapy is a chief clinical method to treat some tumors successfully. Naturally sourced compounds are currently used in chemotherapy and have a favorable future.⁵ Some chemicals derived should continue to constitute a significant number of new drug candidates. Small molecule

natural products accounted for about half of the new chemical entities approved from 2000 to 2006.⁶

Nature is a reservoir of novel therapeutic candidate compounds as a potential anticancer agent.⁷ As per recent reports, the need for natural products in cancer drug development has been immensely emphasized.^{8,9}

Cancer of breasts is the usual non-coetaneous malignancy, considered for the leading root of death across the earth.¹⁰

95% of breast cancers route up from epithelial parts of the breast.

Types of cancers of the breast:

- *in situ*
- invasive

In situ carcinomas might emerge in the ductal or lobular epithelium, but abide constricted there, with no annexation of the implicit basement membrane. There is an insignificant probability for metastasis. When there is an augmentation of the ductal malignancy far off the basement membrane constituting the epithelial boundary, then the malignancy is considered invasive ductal or lobular cancer. The possibility of death prevails in invasive disease.¹¹

Lycopene is a natural pigment prepared by plants. It is a red-colored pigment present in tomato, watermelon.¹² Lycopene is lipophilic, and can be dispersed in organic solvents and oils.¹³

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Table 1: Composition, particle size, encapsulation size of SLNs

Batch number	Lipid type and concentration (g)	Lycopene concentration	Oil phase surfactant concentration(g)	Aqueous phase surfactant concentration(g)	Particle size (nm)	DI	EE	Drug loading (mg/g)
F1	0.6	0	0.06	0.57	158 ± 6.18	0.708 ± 0.234	0	0
F2	0.8	0	0.1	0.7	129 ± 5.29	0.438 ± 0.146	0	0
F3	0.62	0	0.12	0.6	167 ± 4.29	0.889 ± 0.125	0	0
F4	0.82	0	0.15	0.67	144 ± 3.43	0.934 ± 0.144	0	0
F5	0.64	0.058	0.06	0.53	167 ± 2.34	0.494 ± 0.154	99 ± 0.34	56.9 ± 0.5
F6	0.67	0.054	0.11	0.6	160 ± 5.43	0.552 ± 0.161	101.9 ± 0.5	51.9 ± 0.44
F7	0.7	0.057	0.14	0.74	120 ± 3.4	0.164 ± 0.109	104 ± 0.246	49.54 ± 0.55
F8	0.65	0.053	0.06	0.49	161 ± 2.34	0.182 ± 0.254	91.54 ± 0.75	54.68 ± 0.56
F9	0.72	0.054	0.11	0.58	140 ± 1.23	0.258 ± 0.109	94.65 ± 0.56	52.9 ± 0.93
F10	0.78	0.059	0.14	0.76	129 ± 1.45	0.178 ± 0.225	98.2 ± 0.879	49.9 ± 0.39

It is a carotenoid and has no vitamin A pursuit. It is a highly unsaturated, straight-chain hydrocarbon. This different property of lycopene makes it a potent antioxidant.¹⁴

SLNs show more controlled release characteristics, so we tried to develop SLNs using hot homogenization method by Riangjanapatee *et al.*

MATERIAL AND METHODS

All the materials used were of analytical grade. All the solvents used were extra pure.

Lycopene Extraction

Tomatoes were procured from the market and after washing were air-dried. Tomatoes were extracted out using petroleum ether for at least 30 minutes using mixers. Then the extract was filtered with filter paper, the solvent was separated in vacuum by rotary evaporator at 40°C.

The antisolvent precipitation method was used for the isolation of lycopene.

The extract was dispersed in ethyl acetate. To precipitate lycopene completely, methanol was incorporated into the extract solution. Sediment was dissolved in ethyl acetate, and precipitation was replicated. The material was filtered, and the solvent left was evaporated by N₂ gas. Red sediments obtained were employed for the manufacture of SLNs (Table 1).

Formulation of Lycopene SLNs

A hot homogenization method was used for the preparation of SLNs. Lipid phase was dispersed by heating at 10°C. Myristic acid was used as a zeta enhancer.

RESULTS AND DISCUSSION

Morphological Characteristics of NPs

The particle size of the formulated NPs was noted after formulating by scanning electron microscopy.

Encapsulation Efficiency (%) and Drug Loading

EE was estimated as the lycopene percentage entrapped. Suspension carrying lycopene-SLNs and tween 80 was put in a centrifuge tube and centrifuged for 8 minutes. Hexane was added to the filtrate and placed for 10 minutes and the hydrophobic

phase was isolated by a separating funnel, and the amount of free lycopene was estimated using spectrophotometric means. To obtain a calibration plot, standard solutions were formulated by serial dilution with hexane. The stock solutions were prepared and the calibration curve involving six calibration points was plotted.

CONCLUSION

Nanoparticles manifested good physicochemical characterization, obtained small size of NPs is an optimistical parameter to SLNs preparation to oral use. Lycopene-SLNs formulated also showed better absorption in the intestine. EE of lycopene-SLNs kept in reserve for 3 months, showed that leakage prevails at 4°C. This exploration could be a beginner approach to suggest that using these kinds of carotenoid-SLNs in the formulation of various beverages and dairy products as supplementary materials of food

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