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## **DEVELOPMENT OF NANOEMULSION CONTAINING LYCOPENE FROM RED GUAVA TARGETING THE INFLAMMATION–CANCER AXIS**

**Andreanne Gomes Vasconcelos**

*The Bridge, University of Lincoln, Joseph Ruston Building, Lincoln, United Kingdom  
People & Science Research, Development and Innovation Ltd., Center for Support of  
Technological Development, University of Brasília, Brazil  
Research Center in Applied Morphology and Immunology (NuPMIA), Faculty of Medicine,  
University of Brasília (UnB), Brasília, Brazil*  
[agomesvasconcelos@lincoln.ac.uk](mailto:agomesvasconcelos@lincoln.ac.uk)

**Bruno Silva Sá**

*People & Science Research, Development and Innovation Ltd., Center for Support of  
Technological Development, University of Brasília, Brazil  
Research Center in Applied Morphology and Immunology (NuPMIA), Faculty of Medicine,  
University of Brasília (UnB), Brasília, Brazil*  
[brunosilvasa13@gmail.com](mailto:brunosilvasa13@gmail.com)

**Jhones do Nascimento Dias**

*People & Science Research, Development and Innovation Ltd., Center for Support of  
Technological Development, University of Brasília, Brazil  
Research Center in Applied Morphology and Immunology (NuPMIA), Faculty of Medicine,  
University of Brasília (UnB), Brasília, Brazil*  
[jhonesnd@gmail.com](mailto:jhonesnd@gmail.com)

**José Roberto de S. A. Leite**

*People & Science Research, Development and Innovation Ltd., Center for Support of Technological Development, University of Brasília, Brazil  
Research Center in Applied Morphology and Immunology (NuPMIA), Faculty of Medicine, University of Brasília (UnB), Brasília, Brazil  
[jrsaleite@gmail.com](mailto:jrsaleite@gmail.com)*

**Peter Eaton**

*The Bridge, University of Lincoln, Joseph Ruston Building, Lincoln, United Kingdom  
[peaton@lincoln.ac.uk](mailto:peaton@lincoln.ac.uk)*

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### **Abstract**

**Research Objectives:** *Chronic inflammation is a well-established contributor to carcinogenesis and an important therapeutic target. Lycopene, a natural carotenoid with antioxidant and anti-inflammatory properties, has shown potential anticancer effects; however, its application is limited by poor solubility and bioavailability. Therefore, this study evaluated the effects of a nanoemulsion containing lycopene from red guava (*Psidium guajava* L.) in inflammation-related cancer cell models.*

**Methodology:** *Lycopene (LPG) was extracted from highly mature red guava and characterized by UV–Vis spectrophotometry and high-performance liquid chromatography (HPLC). A lycopene nanoemulsion (NanoLPG) was produced and physicochemically characterized by Dynamic Light Scattering (DLS). Human keratinocytes (HaCaT) and squamous carcinoma cells (SCC-9) were cultured as 2D monolayers and 3D spheroids. Cell viability was assessed by a luciferase-based assay following exposure to LPG or NanoLPG at concentrations ranging from 200 to 6.25 µg/mL. Morphological analyses were performed using Scanning Electron Microscopy (SEM).*

**Findings:** *LPG exhibited an absorption spectrum and chromatographic profile consistent with lycopene standards. NanoLPG presented mean particle diameter of  $256.90 \pm 3.50$  nm, polydispersity index of  $0.25 \pm 0.02$ , and zeta potential of  $-44.30 \pm 1.17$  mV. In viability assays, LPG did not affect HaCaT cells in 2D or 3D models, while reductions in SCC-9 viability were observed from 6.25 µg/mL. NanoLPG reduced cancer cell viability in both cell models, without evidence of toxicity in normal cells. SEM analyses showed that inflammatory stimulation with TNF- $\alpha$  altered epithelial integrity, evidenced by surface exfoliation and the presence of apoptotic cells, whereas treatment with LPG or NanoLPG was associated with attenuation of alterations.*

**Research Outcomes:** *These outcomes highlight the relevance of integrating natural bioactive compounds with nanostructured delivery systems for biotechnological research in inflammation-associated models.*

**Future Scope:** *Future studies will incorporate advanced TEM and AFM analyses, alongside molecular biology approaches, to further characterize cellular responses associated with inflammation-related cancer processes.*

**Keywords:**

Natural Products, Nanotechnology, Inflammation, Skin Cancer

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