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Development and evaluation of N-acetyl glucosamine-decorated vitamin-E-based micelles incorporating resveratrol for cancer therapy

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ABSTRACT

Treatment of cancerous cells like diseases underwent huge latest advancement scenario treatments with a molecular focus targeted therapy. However, non-specifically approaches through the pharmaceutical phytochemicals help a promising alternative approach for cancers. The present research study was seeking to aim at formulating the Resveratrol (RES) loaded Vitamin-E (Vit.E) micelles to improve their bioavailability and reduce toxicity. Resveratrol is a Phyto origin anticancer constituent, lipophilic in nature, with limited water solubility, resulting in poor oral bioavailability and consequently frequent dosing. Thin-film hydration (solvent casting) technique was employed in the building of RES-loaded Vit.E micelles. Prepared micelles are characterized for various parameters and the findings of *in vitro* evaluation studies revealed proposed micelles having the particle size of 243.4 (d. nm), polydispersity index (PDI) 0.330, zeta potential (−12.4 mV), percentage of entrapment efficiency (80.57% ± 1.06%), and percentage of drug loading (2.77 ± 1.23%), drug release *in vitro* (75.96%), haemolytic activity *in vitro*, and cytotoxicity studies *in vitro*. Furthermore, DSC and P-XRD analysis demonstrated that RES was effectively encapsulated within Vit.E micelles. Drug release studies revealed that dissolution of drug was improved because of loading into micelles and Transmission electron microscopy (TEM) imaging study confirmed spherically of micelles.

1. Introduction

Chemotherapy is a widely employed cancer therapeutic modality. However, on the other hand, has several restrictions due to the some types of physical and chemical attributes such as hydrophobicity, solubility, partition coefficient, short half-life, dissociation constant, ionization, instability, or toxicity to typical healthy cells or organs [1]. Resveratrol (RES), is a polyphenolic phytoalexin with broad-spectrum antitumor effects against a large variety of tumors [2]. However, efficient administration of RES to tumour target is very challenging, as of its poor physicochemical properties [2,3]. As a result, researchers have turned to tailored medication delivery methods to help them overcome these challenges. To deliver anticancer drugs, various nanocarrier drug delivery methods have been explored, including polymer conjugates, polymeric micelles, polymeric nanoparticles, nanosponges, niosomes, and liposomes [4,5]. Moreover, further modification of the nanoparticle's surface by attaching targeting moieties, making it stimuli sensitive, or increasing circulation time can significantly enhance the therapeutic potential of these nanocarriers [6]. Cancer cells differ in their physiology from normal ones. Because, of the lack of blood flow to tumour tissue, malignant cells are under hypoxic circumstances, which causes changes in metabolic pathways, such as blocking the process of oxygen-dependent mitochondrial phosphorylation [7]. Increased glycolysis results in rapid ATP availability at the expense of significant amounts of glucose, resulting in the generation of lactic acid. This results in a large rise in glucose demand in tumor cells that is about 200-fold greater than that of healthy cells this is known as the "Warburg effect." [8]. Polymeric micelles are a potential approach as they spontaneously self-assemble into nano-sized constructions. Micelles offers some benefits as drug carrier such as increased bioavailability, reduced toxic side effects, possibility for attachment of targeting moieties, storage stability, long blood circulation time, and lower contacts with reticuloendothelial system (RES) [9]. Ideal polymeric micelle should ensure a small particle size for the enhanced permeability and retention effect (EPR), a low critical micelle concentration for improved stability, a long circulation time in blood, and a high cellular uptake by using tumour specific targeting ligands. Despite numerous publications on polymeric micelles syntheses for drug delivery, few publications address

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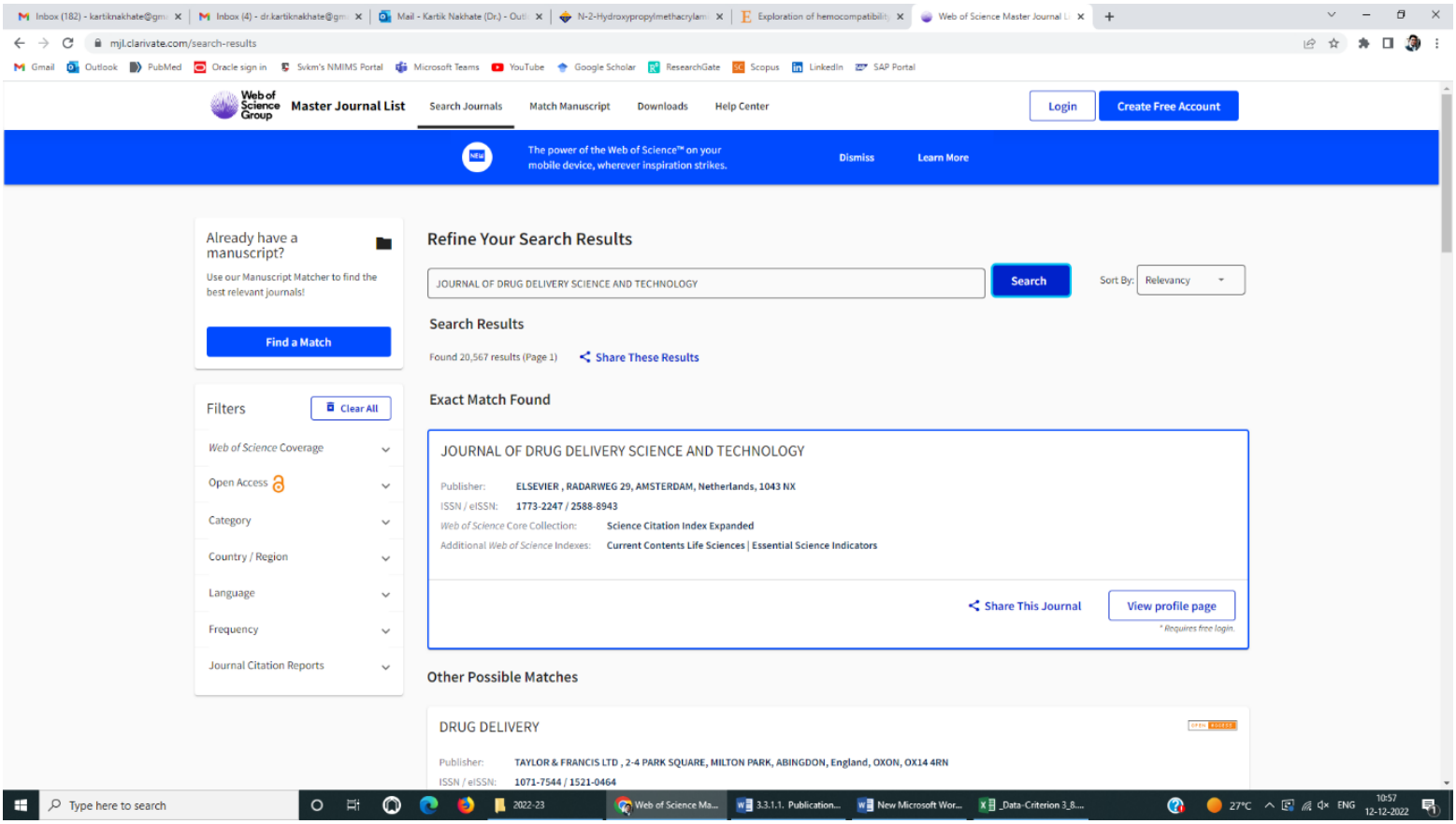
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