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DEVELOPING A NOVEL DRUG DELIVERY SYSTEM FOR TARGETING INFECTIOUS DISEASES

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Abstract

When it comes to treating infectious disorders, the ability to send nanoparticles straight into the targeted cells is crucial. The potential for a medicinal ingredient to be chemically bonded to the nanoparticles has opened up a new avenue for medication delivery. Remarkably, the discovery of graphene and carbon nanotubes has provided a superior therapeutic and imaging agent for use in biomedical applications. Pharmaceutical drug delivery technologies like liquid crystals, vesicles, and micelles have been developed for decades, but their use has been restricted because of their high manufacturing costs.

Keywords: biodegradation, equal biodistribution, targeted drugs

1. INTRODUCTION

It is one of the most neglected diseases in the world, primarily affecting the poorest of the poor in 85 developing countries. An estimated 2 million new cases of leishmaniasis occur each year, and 350 million people are at risk of getting it. Malaria, which was nearly eradicated thirty years ago, is now resurfacing, impacting over 500 million people yearly and killing one to three million people [2]. An illness that is common in Russia, sub-Saharan Africa, and the Indian subcontinent, cholera is mostly transmitted via tainted drinking water and unhygienic surroundings [4]. Every year, the World Health Organization (WHO) reports an estimated 200,000 cases. Nearly 2 million people die from tuberculosis each year, and the World Health Organization predicts that if more efficient measures are not taken, almost 1 million individuals would contract the disease between 2000 and 2020 [6].

Infectious infections were the primary cause of death globally at the start of the 20th century. The majority of infectious illness deaths in underdeveloped nations happen to children and young people, depriving them of a healthy and productive life [11]. Life-threatening illnesses can result from malfunctions or misunderstandings brought on by bacterial, viral, or protozoan infections [15]. Because of their size and form, these infectious agents can be transported to particular cellular compartments. They are nanometers in size. Nanotherapy seeks to cure infectious diseases at the molecular level by utilizing the chemical and physical properties of nanomaterials [13][14]. Because of their distinct chemical and physical characteristics, nanoparticles may be readily delivered to the targeted cells and attached to the therapeutic or diagnostic drug or biomolecules [12]. This is one of their main advantages in biomedical applications. Because of their similar size to cells and tissue systems, nanoparticles can be created to have a variety of sizes and external surface characteristics [10]. Nanoparticles' distinct chemical and physical characteristics make them appropriate for use in infectious disease detection, imaging, and treatment [16]. The toxicity and time release of the medicine in the circulatory system have been reduced by the nanoparticles due to their precise and targeted character [8]. These characteristics make them a state-of-the-art drug delivery system, monitoring tool, and diagnostic instrument that has been proposed to take a very careful look at the concept of "magic bullets."

2. LITERATURE REVIEW

The properties of medications, such as solubility, controlled release, and site-specific administration, can be regulated. Since the nanoparticles are created through chemical alteration, they can be altered to meet the environmental requirements of any biomedical application. Since the majority of nanoparticles dissolve in both organic and aqueous solvents, they can be functionalized for use in biomedicine. The application of

nanotechnology to drug delivery, design, and immunization has been investigated as a potential substitute for the existing antibiotic-based treatment. In contrast to bigger particles, nanomaterials can penetrate biological membranes and enter cells, tissues, and organs. After being inhaled or consumed, they can enter the bloodstream, and some of them can even pass through the skin. Additionally, pharmacokinetics and biodistribution of medicinal medicines to target organs can be enhanced by nanoscale drug delivery systems, leading to increased efficacy.

Because of their surface properties, synthesized nanoparticles are frequently unsuitable for biological applications. The proper functionalization procedures can be used to create a stable and highly active biomolecule nanoparticle hybrid system for a variety of biological applications, including antibacterial agents. The antibacterial action is mostly determined by the physicochemical characteristics of selected biomolecules, interface/linking agents, and nanoparticles.

3. METHODOLOGY

Controlling infectious diseases greatly depends on the quick and accurate identification of the pathogenic agent. The M Chip (mobile micro fluidic chip for immunoassay on protein markers) deserves mention here because it functioned as a miniature enzyme linked immunosorbent assay (ELISA) in resource-constrained environments, performed similarly to lab-based gold standard immunoassays, and was flexible enough to work with different blood sample types (whole blood, plasma, or serum). Chips offer exceptional sensitivity to both HIV and syphilis, allowing for prompt diagnosis of potentially infected patients and more specific test confirmation of their samples in remote underdeveloped nations.

Better adjuvants and vaccine delivery methods can be developed thanks to vaccine nanoengineering. A vaccine's efficacy is determined by how well it stimulates and interacts with the immune system. The development of nanoparticles has enabled their application as colloidal vaccine carriers and innovative adjuvants to vaccinate afflicted animals. The new class of nanoparticle adjuvants aims to concurrently increase humoral, cellular, and mucosal immune responses while minimizing side effects and prolonging the immune response. Calcium phosphate nanoparticles are a potent adjuvant in contrast to alum. It generates enormous titers of immunoglobulin G2a antibody without generating inflammation at the administration site, which contributed to a considerable amount of protection against HSV-2 infection. Nanotherapy can benefit from the conjugation of certain water-soluble or insoluble medications on or within nanoparticles.

4. DATA ANALYSIS TECHNIQUES

Gold nanoparticles' special physical and chemical characteristics make them suitable for both loading and unloading medications. Gold nanoparticles can be absorbed by cells without causing cytotoxicity24.

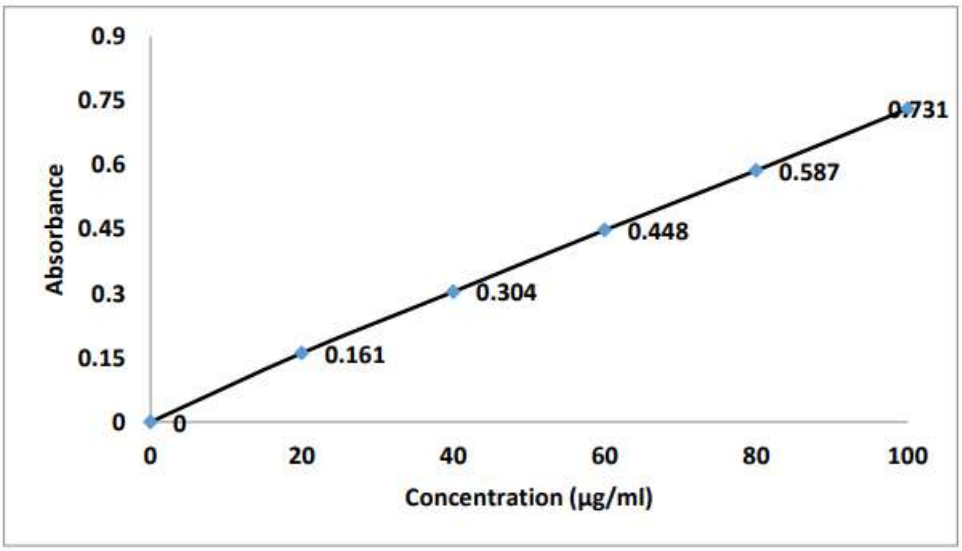

Figure 1: Standard graph of Etoposide in methanol

These days, immunohistochemistry makes extensive use of gold nanoparticles to detect protein-protein interactions. They have also been used for selective medication delivery as nontoxic drug carriers.

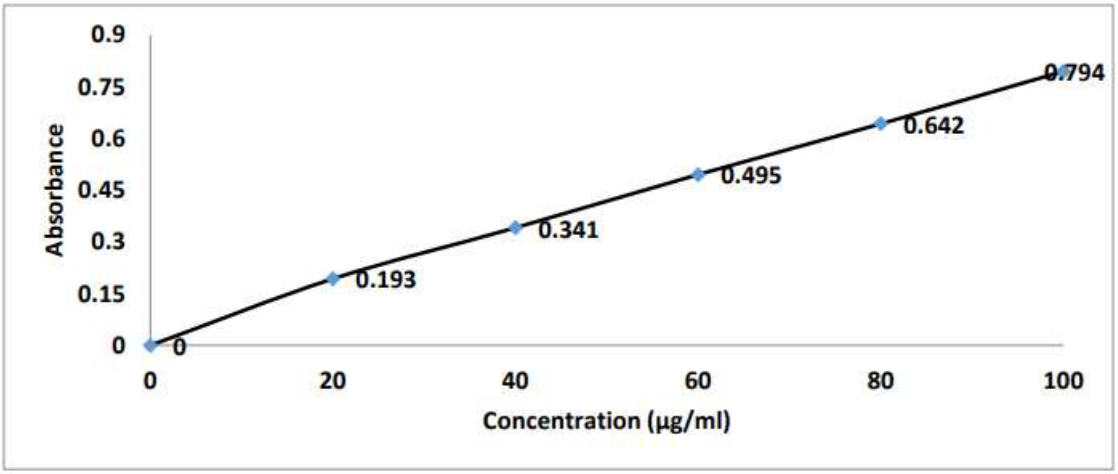

Figure 2: Standard graph of Etoposide in PBS

When given intravenously at the recommended dosage, polyethylene glycol-coated colloidal gold nanoparticles with an integrated TNF α have been shown to improve tumor thermal treatment and slow tumor growth in mice.

Table 1: single factor method

	Total	Percent of variance	Cumulative percentage	Total	Percent of variance	Cumulative percentage
What effects do various methods of assessment have on comprehending how food insecurity affects mental health?	15.217	39.017	39.017	15.217	39.017	39.017
How can scholars and professionals properly evaluate the connection between mental health and food insecurity?	2.436	6.247	45.264			
What are the most effective ways to gauge mental health outcomes and food insecurity in areas that are at risk?	2.273	5.829	51.093			
What role can community-based initiatives, such as urban agriculture or food cooperatives, play in addressing food insecurity and promoting mental health?	1.584	4.061	55.155			
How can food assistance programs (e.g., food banks, SNAP) be designed or modified to better support mental health?	1.340	3.437	58.592			
Which programs or treatments are the most successful at addressing food insecurity and enhancing mental health outcomes in populations that are at risk?	1.268	3.252	61.844			

What are the social and financial consequences of mental health conditions linked to food insecurity in communities that are already at risk?	1.144	2.934	64.778	
What effects does food insecurity have on social functioning, general well-being, and mental health-related quality of life?	1.055	2.705	67.483	
What effects does food insecurity have on vulnerable communities' mental health outcomes throughout the short and long term?	0.968	2.483	69.967	
How do other social determinants of health (such as poverty and housing instability) relate with food insecurity and mental health?	0.856	2.196	72.163	
How do other social determinants of health (such as poverty and housing instability) relate with food insecurity and mental health?	0.717	1.838	74.001	

Quaternary ammonium-covered gold nanoparticles operate as antimicrobial agents by electrostatically interacting with plasmid DNA, thereby shielding it from enzyme digestion.

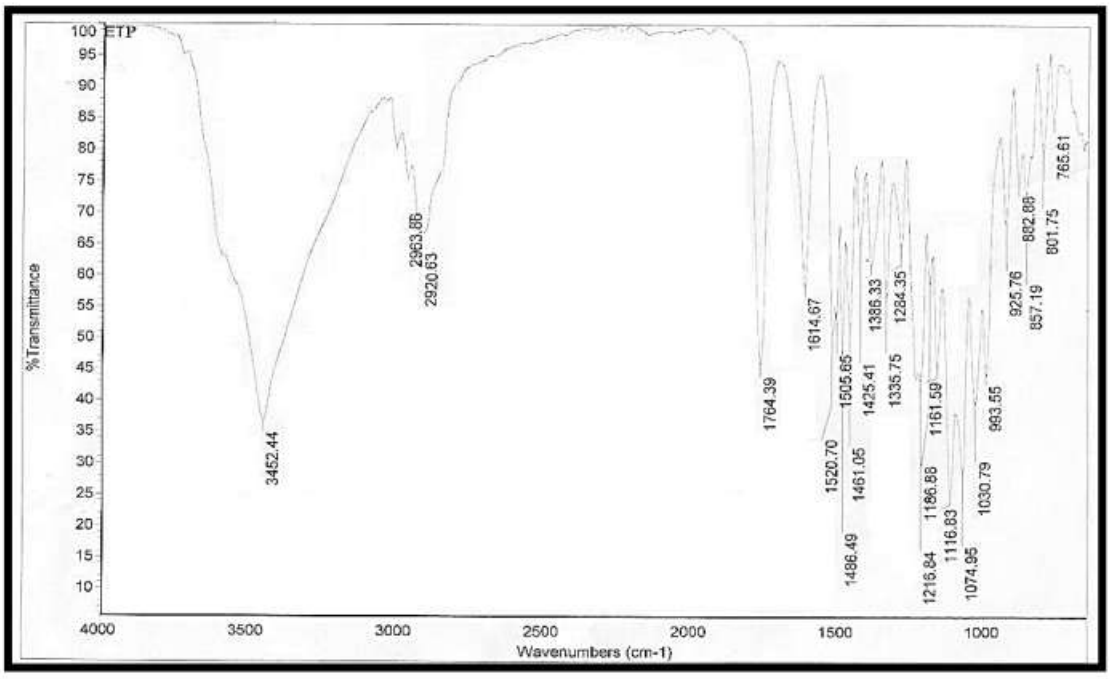

Figure 3: FTIR spectra of Etoposide

The unaltered drugs are released straight into the target cells when they are noncovalently enclosed in a monolayer of gold nanoparticles. By preventing both amyloid generation and the restoration of the amyloidogenic capacity, this therapy had a significant impact on the Ab aggregates.

5. CONCLUSION

The most important objective in pharmaceutical research and development is to create targeted medication delivery systems. Physical or biological variables might override the therapeutic targeting principle and lead to increased drug concentrations at the pathophysiologically relevant site. Reduced frequency of dosing, more consistent drug release, less dose-dependent side effects, and less variation in plasma drug levels are the benefits of the targeted delivery system. medication toxicity would be significantly reduced, dosage would be lowered, and therapeutic efficacy would be enhanced using the novel medication targeting strategy. To improve renewal methods, target-oriented medication delivery was created. A targeted delivery system's working principle is based on a technique that delivers drugs to particular parts of the body over an extended period of time. The required plasma/tissue levels of medications in the body are maintained in part by this drug delivery method. Therefore, it might prevent the medication from destroying any healthy tissue.

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