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Research Article

Characteristics of liposome used for drug delivery system

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ABSTRACT

Liposome as a drug delivery system is emerges as a one of the potential in pharmaceutical industries. The properties of nano-medicines such as release from dosage forms at specific sites as well as drug circulation and absorption into body membranes are dramatically affected by some physical and chemical characteristics of liposome as a drug delivery system. Zeta potential is a scientific term used for electro kinetic potential in colloidal systems which has a major effect on the various properties of liposome. There are various challenges in the field of drug delivery system, including poor solubility and stability. Presently, colloidal nano-carriers are emerges as a potential drug delivery system. Furthermore, they show an unlimited capacity in the field of drug targeting. Particle size and charge are two major factors which could play key roles in this regard. In this paper synthesis of liposome by extrusion method and the effect of zeta potential and particle size are considered.

Keywords: Nano-drug delivery, Zeta potential, Drug targeting, Particle size, Particle charge

Introduction:

Liposomes have gained popularity as bio membrane models [I] and have been extensively studied in terms of ion permeability, fluidity, phase transition and transformation to other mesomorphic structures [2-5-J. Liposomes have also been focused on the medical field especially in drug delivery systems [6]. Zeta potential is a scientific term for electro kinetic potential in colloidal systems, i.e., electric potential in the interfacial double layer at the location of the slipping plane versus a point in the bulk fluid away from the interface [7]. This term expresses the potential difference between the dispersion medium and the stationary layer of fluid attached to the dispersed particle. Although zeta potential is not equal to the Stern potential or electric surface potential in the double layer, it is often the only available path for the characterization of double-layer properties [7]. Coulomb interactions are the strongest physical forces between any two objects. Electro kinetic or ζ-potential is defined as the average electrostatic potential existing at the hydrodynamic plane of shear, somewhere between the Stern plane and the end of the diffuse layer, normally considered to be 0.2 nm from the surface [8,9]. On the other hand, the electric double layer formed at the boundary between a solid surface and an electrolyte solution determines its electro kinetic (interfacial double layer or charge) properties. Thus, zeta potential can be defined as the electro kinetic value associating a realistic magnitude of surface charge [10-15]. Measurement of ζ-potential is currently the simplest and most straightforward way to characterize the surface of charged colloids, and conclusions are easily drawn from the analysis of its data regarding concentration, distribution, adsorption, ionisation, exposure or shielding of charged moieties [9]; its unit is usually milivolt [13]. Zeta potential can affect the pharmacokinetic properties of nanosystems in the body [13,16] or may affect the phagocytises of the nanoparticles in the blood stream [17-119]. Nanoparticles can be detected by electrostatic methods, by condensation on particles to grow them until they are measurable optically, or by other methods. Electrostatic methods require that the particles be charged and are not very sensitive [20].To fully characterize the charge conditions of particles, zeta potential measurements should be performed in distilled water and in the original dispersion medium of the suspension. Very often, ZP

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measurements are performed in buffers of varying molarities, physiological salt solution (some pharmacists think being physiological is a priori good) or other media. These measurements are rather meaningless for determining surface potential [21] or physical long-term stability under these measuring conditions [22]. although ZP is not measurable directly, it can be calculated using theoretical models. Electrokinetic phenomena and lectroacoustic phenomena are the usual sources of data for calculation of ZP. The ZP of dispersion is measured by applying an electric field across the dispersion [23]. Particles within the dispersion with a ZP will migrate toward the electrode of opposite charge with a velocity proportional to the magnitude of the zeta potential. Nanoparticle surface is a very important consideration in targeting drug delivery. Indeed, , once in the blood stream, conventional nanoparticles (no surface medication) and negatively charged particles can be rapidly opsonized and massively cleared by fixed macrophages. It is well known that the reticuloendothelial system (RES), mainly the liver and spleen, is a major obstacle to active targeting because of its ability to recognize these systems, remove them from systemic circulation, and consequently, avoid the effective delivery of the nano drug to organs other than those of the RES. Surface modification of these polymer nanoparticulate systems with hydrophilic polymers is the most common way to control the opsonization process and to improve the surface properties, especially surface charge, of the system [25].

Material and method:

Phosphatidylcholine (soya bean) was purchased from Himedia witha a case no(8002-43-5) cholesterol and span 80 also purchased from Himedia. Filtration assembly (simple glass), Sonicator (Ultrasonic Cleaner)(Toshcon, Ajmer), 0.2 micron nitrocellulose membrane filter, Orbital Shaker (REMI).

Protocol of liposome preparation by extrusion method:-

- Phosphatidyl choline , cholesterol and span 80 was taken in 100ml round bottom flask with different proportions.
- Chloroform is used as a solvent to mix the lipids with a concentration 2ml/10mg of lipids taken.
- The mix was kept on shaker to evaporate the solvent.
- After 3 to 4 hours lipid film was observed on the bottom of round bottom flask.
- The lipid film was rehydrated by phosphate buffer saline of PH7.4 with a concentration of 3ml/10mg of lipid.
- Rehydration procedure was carried out till hazy solution was observed. This was achieved by keeping the round bottom flask on shaker of about 100 rpm for about 4to5 hours.
- Empty liposome was observed under microscope.
- Zeta potential and particle size of liposome was analyzed and confirm.

Results:

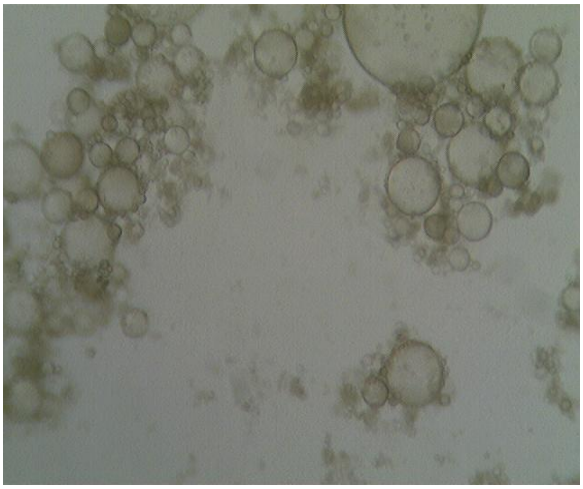


Figure 1: Microscopic photograph of bare liposome

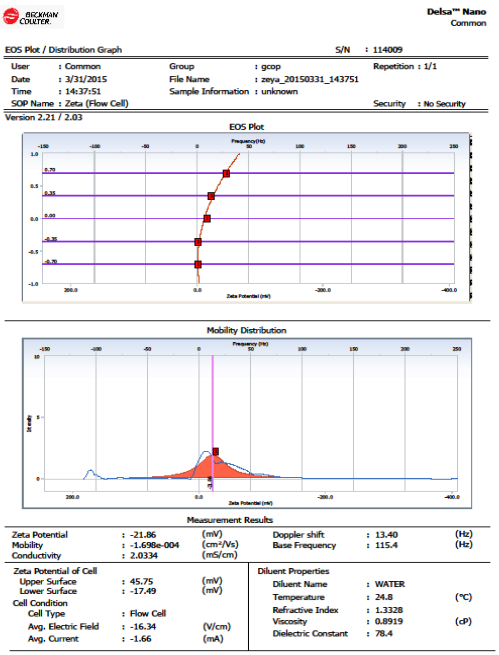


Figure 2: Zeta Potential of Liposomes

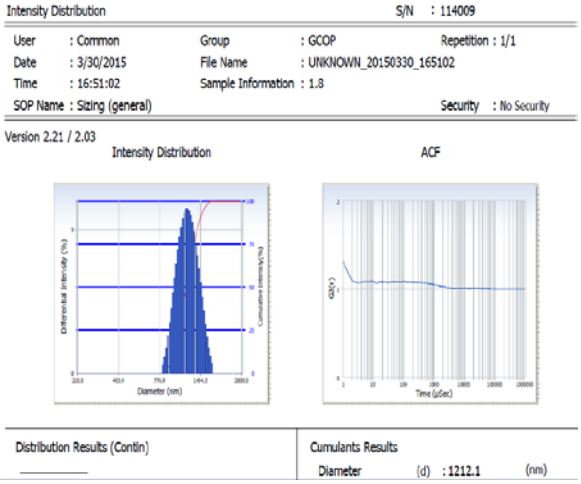
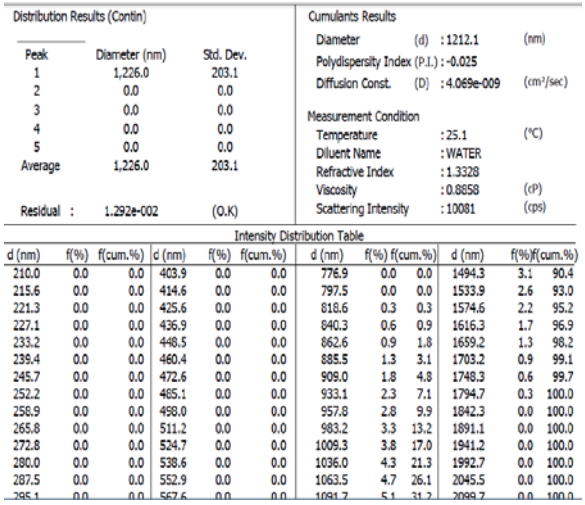


Figure 3: Particle size of Liposomes



Distribution Results (Contin)

Peak	Diameter (nm)	Std. Dev.
1	1,226.0	203.1
2	0.0	0.0
3	0.0	0.0
4	0.0	0.0
5	0.0	0.0
Average	1,226.0	203.1

Residual : 1.292e-002 (O.K)

Cumulants Results

Diameter (d) : 1212.1 (nm)
Polydispersity Index (P.I.) : -0.025
Diffusion Const. (D) : 4.069e-009 (cm²/sec)

Measurement Condition

Temperature : 25.1 (°C)
Diluent Name : WATER
Refractive Index : 1.3328
Viscosity : 0.8858 (cP)
Scattering Intensity : 10081 (cps)

Intensity Distribution Table

d (nm)	f(%)	f(cum.%)	d (nm)	f(%)	f(cum.%)	d (nm)	f(%)	f(cum.%)	d (nm)	f(%)	f(cum.%)
210.0	0.0	0.0	403.9	0.0	0.0	776.9	0.0	0.0	1494.3	3.1	90.4
215.6	0.0	0.0	414.6	0.0	0.0	797.5	0.0	0.0	1533.9	2.6	93.0
221.3	0.0	0.0	425.6	0.0	0.0	818.6	0.3	0.3	1574.6	2.2	95.2
227.1	0.0	0.0	436.9	0.0	0.0	840.3	0.6	0.9	1616.3	1.7	96.9
233.2	0.0	0.0	448.5	0.0	0.0	862.6	0.9	1.8	1659.2	1.3	98.2
239.4	0.0	0.0	460.4	0.0	0.0	885.5	1.3	3.1	1703.2	0.9	99.1
245.7	0.0	0.0	472.6	0.0	0.0	909.0	1.8	4.8	1748.3	0.6	99.7
252.2	0.0	0.0	485.1	0.0	0.0	933.1	2.3	7.1	1794.7	0.3	100.0
258.9	0.0	0.0	498.0	0.0	0.0	957.8	2.8	9.9	1842.3	0.0	100.0
265.8	0.0	0.0	511.2	0.0	0.0	983.2	3.3	13.2	1891.1	0.0	100.0
272.8	0.0	0.0	524.7	0.0	0.0	1009.3	3.8	17.0	1941.2	0.0	100.0
280.0	0.0	0.0	538.6	0.0	0.0	1036.0	4.3	21.3	1992.7	0.0	100.0
287.5	0.0	0.0	552.9	0.0	0.0	1063.5	4.7	26.1	2045.5	0.0	100.0
295.1	0.0	0.0	567.6	0.0	0.0	1091.7	5.1	31.2	2099.7	0.0	100.0

Figure 4: Intensity Distribution Table

Discussion:

Physicochemical properties, such as particle size, shape and surface charge, play a key role in the cellular uptake of liposome. The uptake of liposome by cells can be viewed as a two step process: first, a binding step on the cell membrane and second, the internalization step. The present study shows that liposome prepare are round in shape, zeta potential and particle size of liposome -21 and 500nm respectively. The result obtained need to be further trials as to use for drug delivery system.

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