Ricinoleic acid Encapsulation into Liposomal Matrix for cutaneous Application

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Statement of Purpose: Ricinoleic acid (RA) is a C18 fatty acid (FA) with a double bond at the C 9 position and a hydroxyl group at the C(12) position (cis-12-hydroxyoctadeca-9-enoic acid). RA has been used for the synthesis of biodegradable polymers developed specifically for implantable drug delivery matrices. However, RA when it is exposed to air, it reacts with the oxygen of the air and decomposes into short-chain aldehydes and ketones. Usually this hydrolysis process happens through what is called a microbial rancidity which refers to a process in which microorganisms, such as bacteria, use their enzymes such as lipases to break down fat. In this work, ricinoleic acid is extracted from commercial oils, purified, and characterized by spectral analysis. New matrix of encapsulation was made of phospholipid liposomes and gelatin. Spectral and morphology analysis are used to characterize the produced mat. The cytotoxicity test is considered to examine the final product biocompatibility. The encapsulation efficiency was investigated by UV- Visible spectroscopy.

Methods: Preparation of Ricinoleic acid (RA): Pure RA can be obtained by using alkali treatment of commercial castor oil (cold processed) in the presence of alcohol and followed by an acidification step to liberate free RA. Preparation of RA was carried out using the method described elsewhere [1]. The preparation of RA impregnated beads: Lecithin (2 gm) was placed to 1.5 gm RA oil dissolved in 50 ml of chloroform in a 1L round-bottomed flask. The dissolved mixture was stirred for 30 min at room temperature before 50 mL of 5 % gelatin solution added to the mixture and stirring was continued for more 30 min at 1500 rpm. Chemical structure were confirmed by spectral analysis, UV spectroscopy was used to measure the release profile and the encapsulation efficiency.

Results The FT-IR spectra of lecithin (a), gelatin (b), ricinoleic acid (c), and gelatin-liposomal RA matrix (d) are shown in Fig (3). FT-IR spectrum of gelatin (Fig. 3b) displayed characteristic absorption bands of amide A at 3277 cm^{-1}, (due to the N-H stretching vibration and very sensitive to the strength of a hydrogen bond); amide I at 1626 cm^{-1} (stretching vibrations of the C=O and C-N groups); amide II at 1525 cm^{-1} (in-plane N-H bending, and C-N and the C-C stretching vibrations); amide III at 1235 cm^{-1} (dependent on the nature of side chains and hydrogen bonding).

The IR spectrum of lecithin (Fig. 3a) shows absorption bands at 1734 cm^{-1} (C=O), 1059 cm^{-1} (P-O-C), 1231 cm^{-1} (PO_4 stretching), 1463 cm^{-1} and 1377 cm^{-1} (CH_2 bending), which assigned to standard phospholipid compounds (Fig. 4).The Fig.3c shows the typical IR spectrum of ricinoleic acid as fully described above. In the RA loaded gelatin and lecithin matrix (Fig 3d), it can be obviously seen that the absorption bands of both gelatin and lecithin were observed and there is no significant changes which is implying that very low amounts of RA are included inside microspheres. However, at 3277 $cm^{-1}$and 3273 cm^{-1} corresponding to the N-H stretching shows slight changes in both gelatin and lecithin respectively, which narrowed, and shifted to higher wavenumber 3298 cm^{-1} according to changing of the hydrogen bonding state of the pure compounds. For the same reason, the absorption band of C=O groups of gelatin and lecithin shows slight shifting to 1646 cm^{-1}.

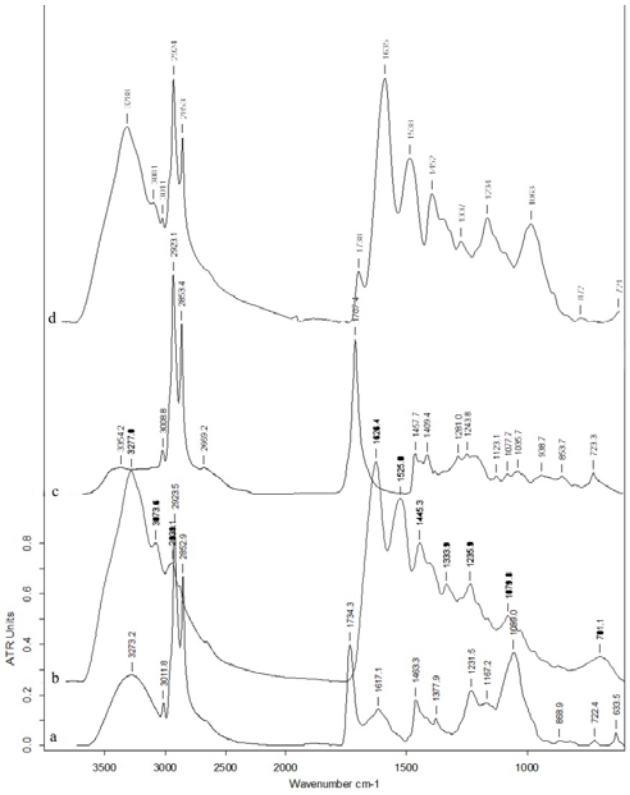

Figure 1 IR spectra of lecithin (a), gelatin (b), ricinoleic acid (c), and G/L-RA matrix (d)

Conclusions: RA was encapsulated successfully into gelatin/liposome microspheres with high encapsulation efficiency. Microspheres with and without RA show no significant cytotoxisity to normal fibroblast cell line.

References: [1] Vaisman B, Shikanov A, Domb AJ. J Am Oil Chem Soc 2007;85:169–84.