Polyelectrolyte multilayer assembly bearing ketoprofen for transdermal delivery

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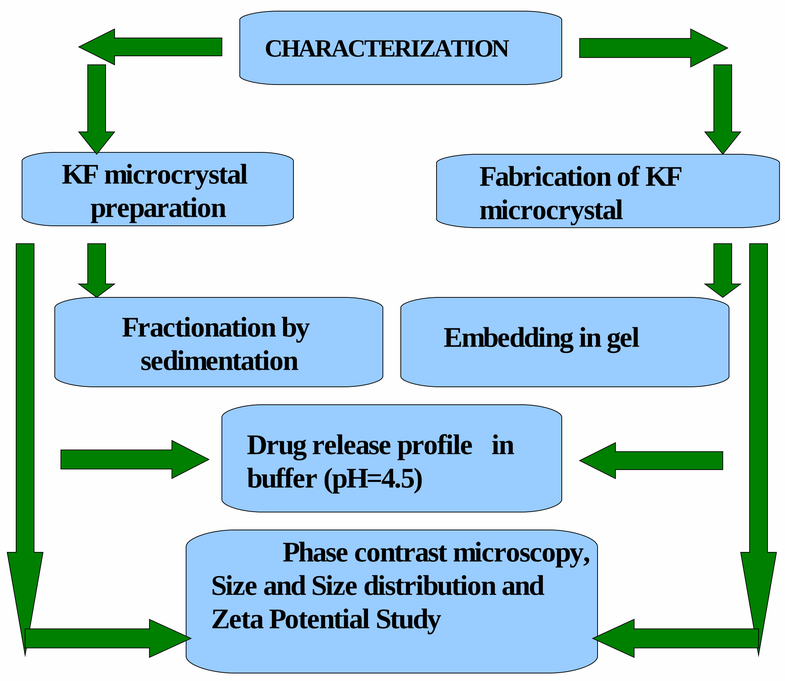
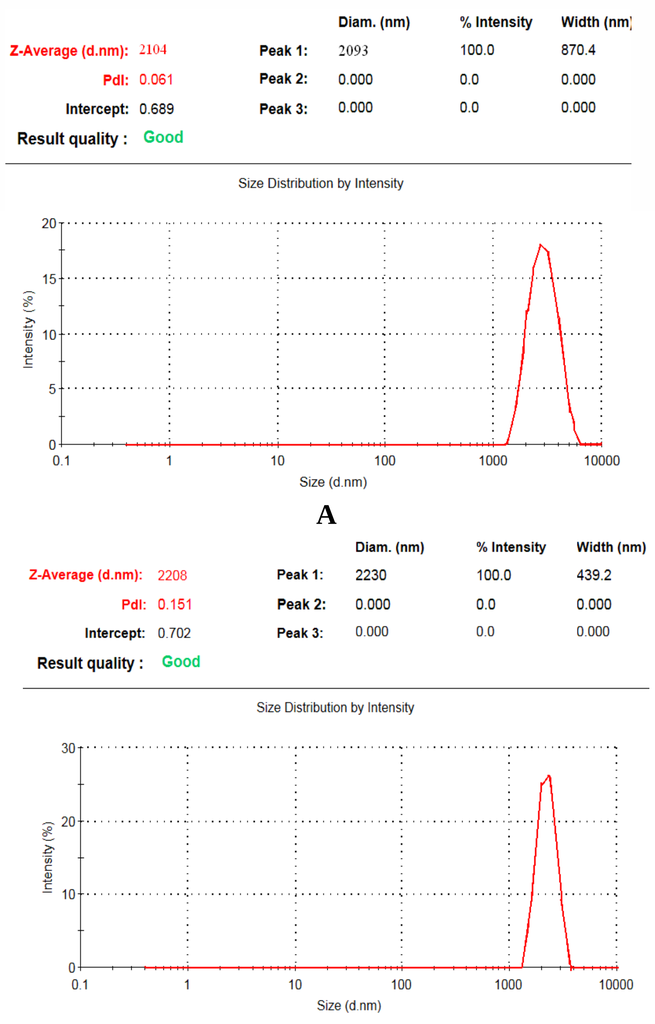
INTRODUCTION AND OBJECTIVE

A novel micro-encapsulation technology based on layer-by-layer assembly has been extensively studied and used for controlled delivery of drug microcrystal having poor aqueous solubility and low bioavailability [Qiu et al. 2001]. A non-steroidal anti-inflammatory drug (Ketoprofen, KF) was selected for encapsulation using biodegradable and biocompatible polyions and synergistically the suspension was embedded in gel matrix for topical application. Topical application of the drugs at the pathological sites offer potential advantages of delivering the drug directly to the site of action and thus producing high tissue concentrations of the drug [Jain et. al. 2005].

CHARACTERIZATION

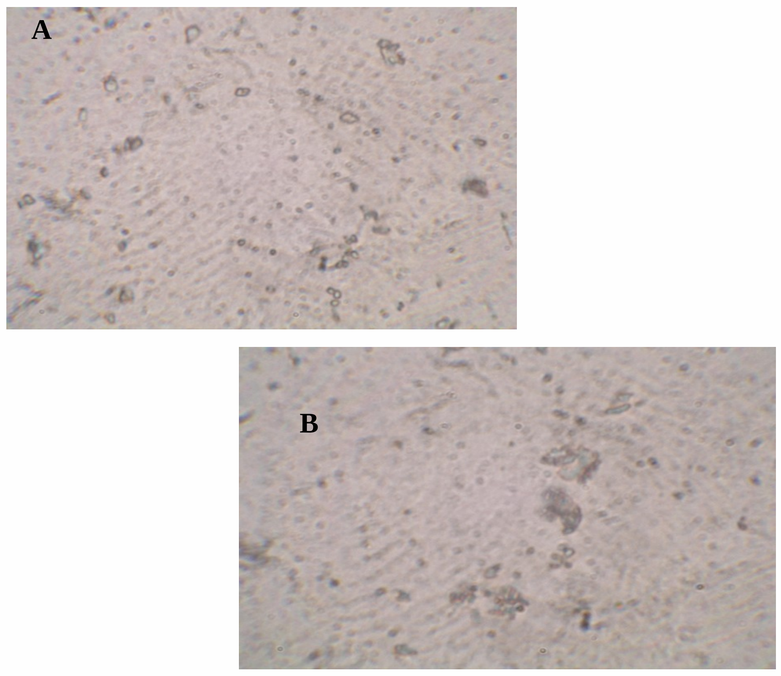


SIZE AND SIZE DISTRIBUTION STUDY



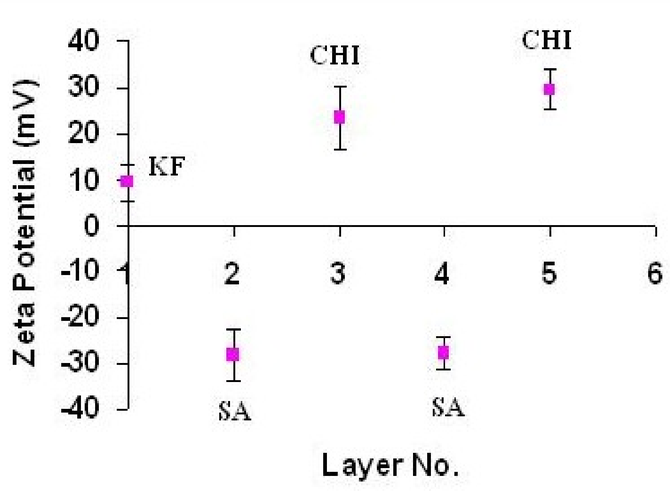
Mean particle size & size distribution of A. bared KF selected for encapsulation (2.104 µm); B. polyelectrolyte encapsulated KF(2.208 µm).

PHASE CONTRAST MICROSCOPY OF BARE AND COATED KF PARTICLES



A. Photomicrograph of bared KF at magnification (100x) showed mono-dispersity.
B. Photomicrograph of encapsulated KF at magnification 100x.

LAYER-BY-LAYER GROWTH STUDY BY ELECTROPHORETIC MOBILITY



SIZE AND POLYDISPERSITY INDEX OF FRACTIONS COLLECTED

Fractions collected (Top to bottom)	Size (µm)	Polydispersity index
1	2.104	0.061
2	2.345	0.151
3	2.88	0.328
4	3.056	0.203
5	3.924	0.28

IN-VITRO KF RELEASE PROFILE

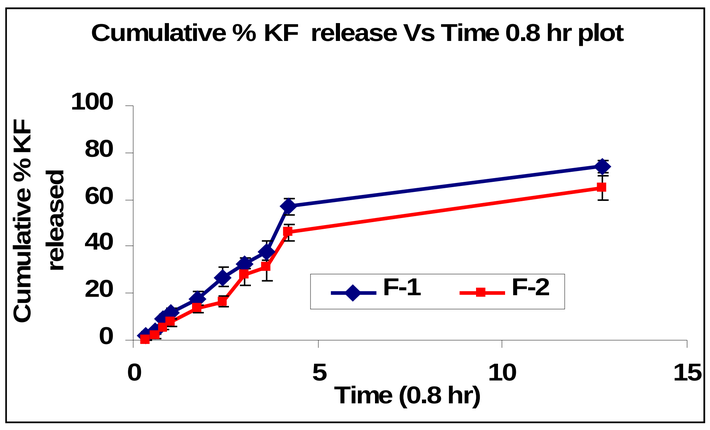


Figure shows in-vitro release profile of KF encapsulated formulations at pH=4.5.

IN-VITRO KF RELEASE PROFILE

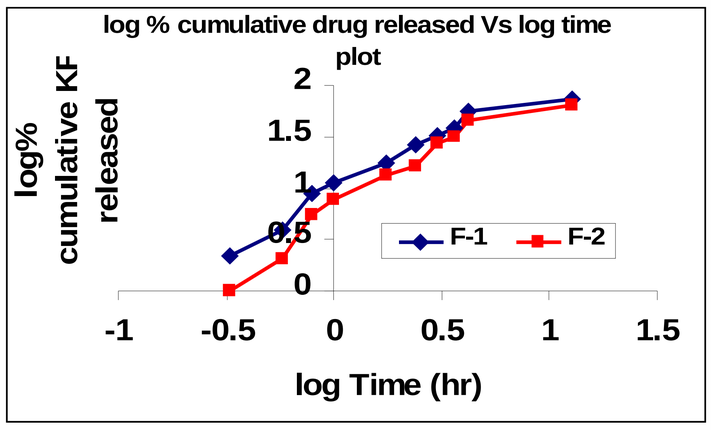


Figure shows Log% cumulative KF released Vs log time plot of KF released at pH=4.5

DISCUSSION

- Topical application of polyelectrolyte multilayered assembly bearing ketoprofen at the pathological sites offers potentials advantages of delivering the drug directly to the site of action and thus producing high tissue concentrations of the drug.
- Shape, surface morphology and narrow size distribution ranging from 2-4 µm of the KF micro-crystal and encapsulated KF presented by the particle size analyzer and Phase contract microscopy.
- The effective adsorption of the PEs was evidenced by the zeta potential measurement.
- In this novel approach we studied here, that the shell thickness of the capsule come ~100 nm, which is much smaller than the core drug crystal dimensions and gives a polymer shell to drug core thickness ratio of about 1:50.
- A different release kinetic was observed for the both the formulations. Fick's law of diffusion seems not to be applicable in each case. An initial rapid drug release was noted for F-1, whereas a lag time (~15 min) was observed with F-2 formulations which, could result from the time taken by the drug to diffuse across the gel.

CONCLUSIONS

In the present investigation, we aimed to develop polyelectrolyte assembled multilayered KF mixed with gel for transdermal delivery, which effectively would manage the pain and inflammation in osteoarthritis and rheumatoid arthritis. Thus obtained data showed better effectiveness of the novel formulation. Further investigations are still underway to gather stability studies of developed formulation and for in-vivo performance by taking suitable model.

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