PREPARATION AND CHARACTERIZATION OF CHITOSAN-ALIGINATE-PEGILATED CAIX[4]ARENES NANOPARTICLES FOR DELIVERY OF CURCUMIN

Elena Drakalska [1,3] *, Denitsa Momekova [1] , Stanislav Rangelov [2] , Nikolay Lambov [1]

[1] – Medical University of Sofia, Faculty of Pharmacy, Sofia, Bulgaria

[2] – Bulgarian Academy of Sciences, Institute of Polymers, Sofia, Bulgaria

[3] – University of medical sciences – Goce Delchev – Shtip, Faculty of pharmacy, Macedonia

* - dmomekova@yahoo.com

INTRODUCTION

Curcumin, the constituent of Curcuma longa, is considered a very promising anticancer agent due to its potent and pleiotropic antineoplastic activity and low nonspecific toxicity to normal cells. A major hurdle towards clinical realization of curcumin potential has been limited due to its poor aqueous solubility (11ng/ml) and very low systemic bioavailability. A possible aproach to overcome these limitations is the design of nanosized drug delivery systems. In this study we report the preparation, characterization and evaluation of drug release profiles of curcumin loaded Chitosan – Alginate –pegilated calix[4]arenes nanoparticles (CS-ALG-PEGCX NPs).

EXPERIMENTAL

Preparation of curcumin loaded Chitosan – Alginate – pegilated calix[4]arenes nanoparticles (CS-ALG-PEGCX NPs)

Nanoparticles were prepared by ionotropic - pregelation of an alginate core, followed by chitosan polyelectrolyte complexation. In order to increase the entrapment efficiency of curcumin into the CH-ALG nanopartcles and to avoid the use of organic solvent we first disolve the drug in an aqueous solution of polyoxiethylated tert-butyl calix[4]aren which proved to drastically increase the aqueous solubility of curcumin by formation of the inclusion complexes.

Quantitative analysis of curcumin encapsulation

For quantitative determination of loaded curcumin a validated UV-VIS spectroscopic method was used . The absorbance of curcumin was measured at λ=427 nm.

Dynamic light scattering

The size and size distribution patterns of curcumin loaded chitosan – alginate –pegilated calix[4]arenes nanoparticles were investigated by ZetaSizer NanoZS (Malvern Instruments)The parameters were evaluated from measurements at scattering angle of 173°, at 25°C.

In vitro drug release studies

The in vitro drug release profiles were studied under simulated physiological conditions (pH 7, 37°C) for different incubation periods of 2, 4, 6, 8, 10, 24, 48 and 96 hours.
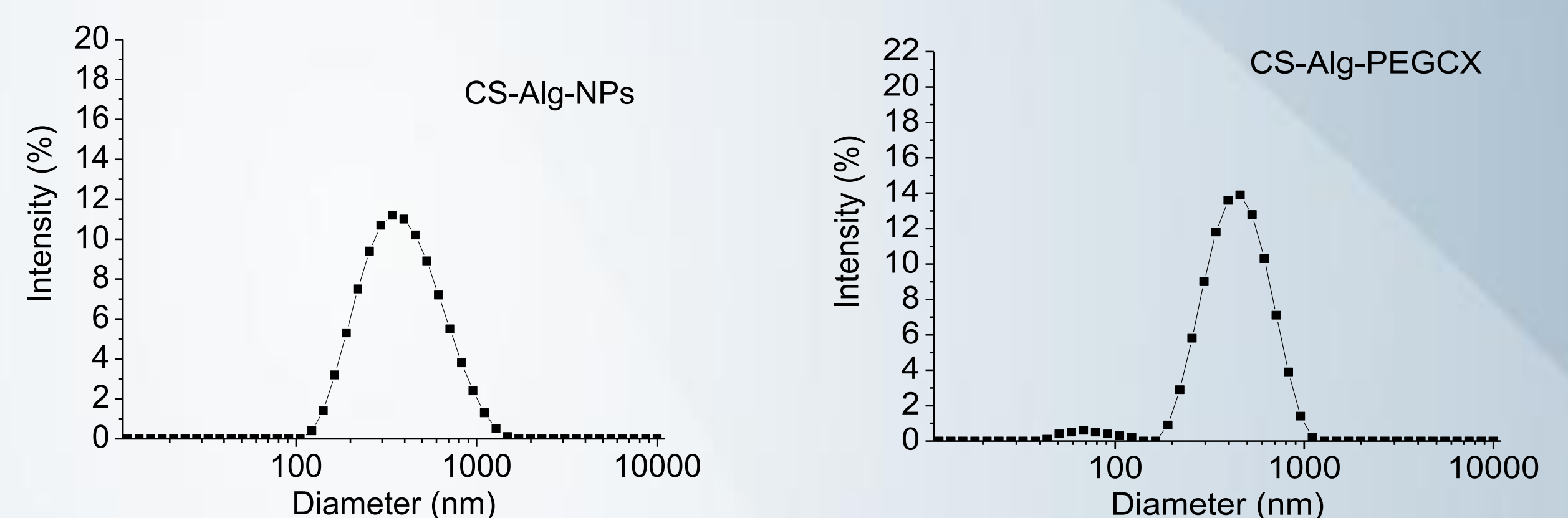

Figure 1 Size distribution of curcumin loaded CH-AlG and CH-ALG-PEGCX nanoparticles

In vitro drug release profiles of both tested formulation showed prolonged curcumin release. Chitosan – Alginate – pegilated calix[4] arene nanoparticles showed higher drug release - 66% of the loaded curcumin was released at 96 hour of incubation compared with less than 52 % released drug from CS– Alg nanoparticles without PEG-CX. (Figure 2). This could be attibuted to the hydrophilicity of the PEG-CX –curcumin inclusion complexes .
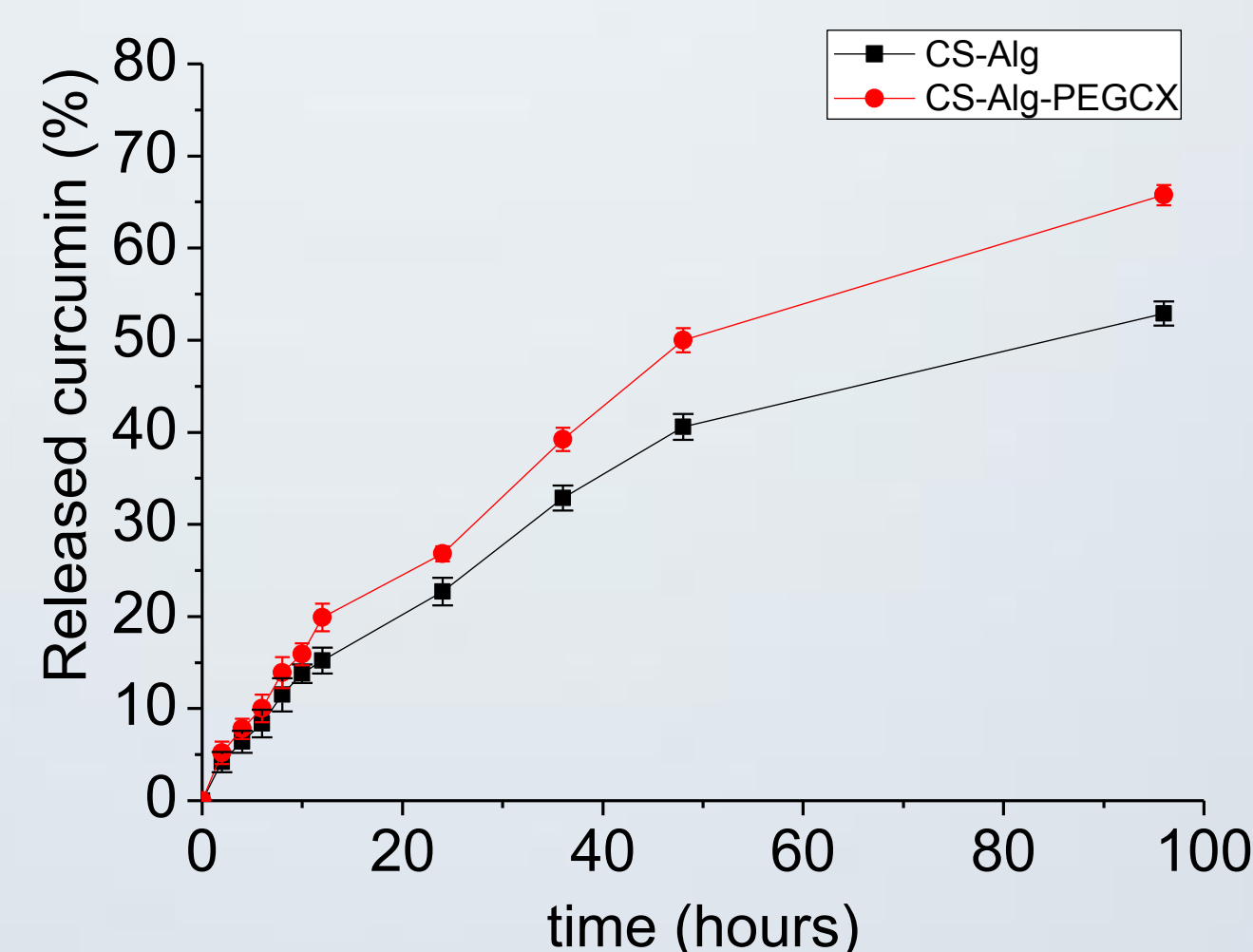

Figure 2. In vitro curcumin release profile of CH – ALG NPs and CH-ALG – PEGCX NPs

RESULTS

Representative examples of nanoparticles size distribution measured at 25 are shown in Fig. 1. The distributions are monomodal with PDI below 0,3. The apparent hydrodynamic diameters of the tested formulation range between 200 and 270 nm. The encapsulation efficiency of curcumin in calixarene containing NPs was over 70% and was found to be two times higher conpared with particles without PEGCX (see Table 1).

Formulation	Size (nm)	PDI	Zeta-potential (mV)	Encapsulation efficacy (%)
CS – ALG NPs	213.1 ± 4, 3	0,2	- 43,1	35%
CS – ALG – PEGCX NPs	268 ± 5.6	0,3	- 37, 4	75%

Conclusion

On the ground of the exellent phisico-chemical and technological properties of the tested nanoparticles we could consider CS-ALG-PEGCX NPs as promising drug delivery platform for curcumin.

fppt.com