IMPACT OF ALBUMIN SORPTION ON THE MORPHOLOGY OF THE DISPERSED PHASE OF AQUEOUS DISPERSIONS OF PHOSPHORUS-CONTAINING POLYESTERS

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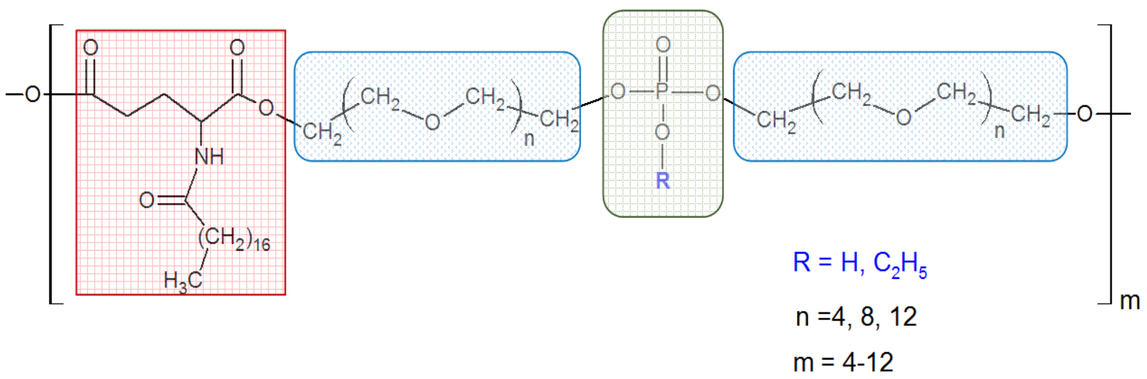
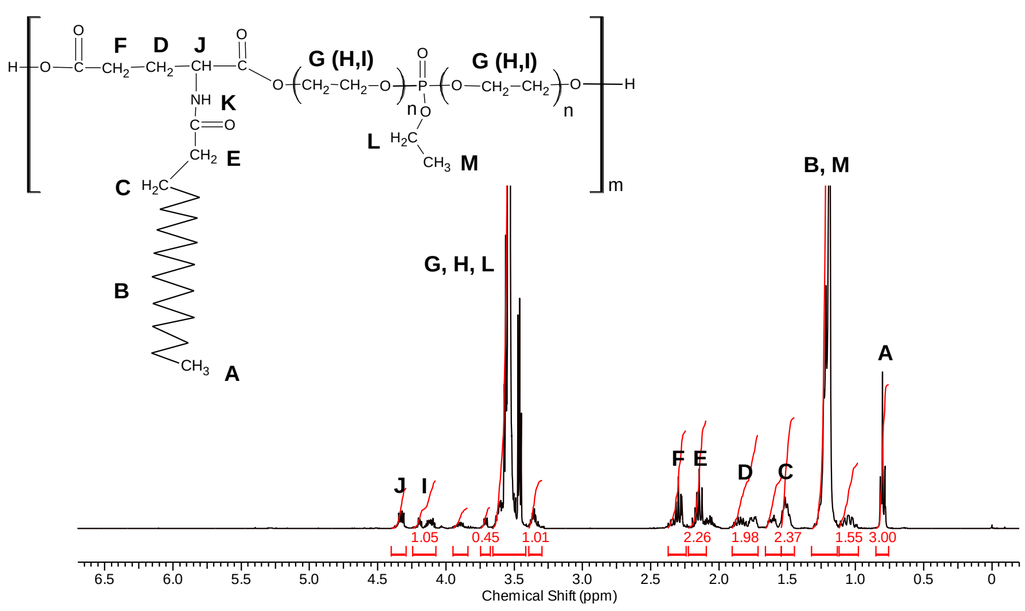
INTRODUCTION

The introduction of phosphate groups into the polymer chain of the polyesters are promising materials for biomedical applications. The most convenient method of obtaining phosphorus–containing polyesters (PPE) is the interaction of N–derivatives of dicarboxylic α–amino acids and diols of the polyoxyethylene series by the Steglich reaction. For this purpose, polyoxyethylene glycols with an ethyl phosphate group were previously synthesized. The phosphate group introduced into the hydrophilic chain of polyoxyethylene glycol is able to provide chemisorption of a number of biologically active compounds due to the formation of ionic bonds between them. Those phosphorus–containing polyesters have surfactant properties, are non–toxic. The aqueous dispersions of the obtained PPE are able to solubilize significant amounts of water–insoluble organic compounds.

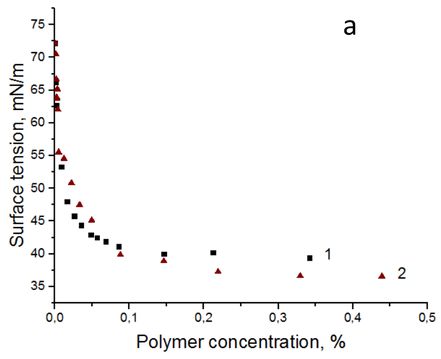
RESULTS



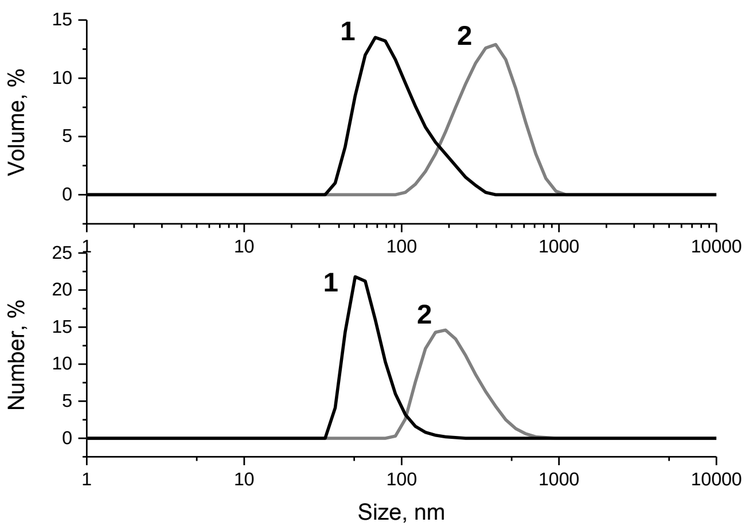
General structure of phosphorus-containing polyesters: R=C_2H_5 - PPE with ethyl phosphate group; R=H – PPE with phosphate group



^{1}H NMR spectra of a PPE based on GluSt and DEP-4 with ethyl phosphate group



a) Surface tension isotherms
b) Solubilization capacity
1 – PPE with ethyl phosphate group,
2 – PPE with phosphate group

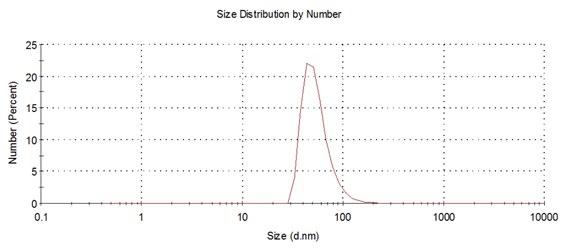


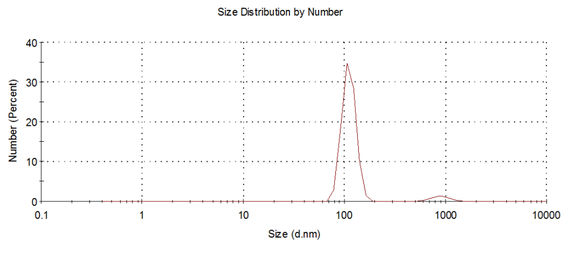
Histograms of the particle size distribution of the dispersed phase of: 1 – PPE with phosphate; 2 – ethyl phosphate group. Concentration of PPE 0.4%. Temperature 25 °C

Photographs of aqueous dispersions of PPE

Effect of content of BSA on hydrodynamic size of nanoparticles in aqueous media

Concentration of BSA,%	Concentration of PPE, %	ζ-potential	Mobili-ty, $m^2/Vs \cdot 10^{-8}$	Conductivity, mS/cm
0	0,15346	-40,9	-3,205	0,11
0,13753	0	-35,3	-2,768	0,0559
0,13898	0,05245	-38,3	-3,003	0,0585
0,13872	0,07565	-38,4	-3,012	0,0586
0,13982	0,10098	-35,3	-2,77	0,0632
0,13921	0,02247	-37,7	-2,956	0,0462
0,10665	0,1087	-31,9	-2,498	0,0561
0,05049	0,10408	-31,5	-2,466	0,0546
0,02008	0,10583	-40,6	-3,184	0,0591





CONCLUSION

The synthesis of PPE was investigated, the structure was confirmed by IR and NMR spectroscopy, and their surface properties and solubilization capacity were investigated. Based on PPE obtain stable dispersions with a particle size of the dispersed phase 60–100 nm, able to form dispersions with nanometer–sized particles at high concentrations of the dispersed phase. The influence of adsorption on the stability of the dispersion in the conditions of sorption of bovine serum albumin (BSA) on the particles of the dispersed phase of PPE was studied. It has been established that the effects associated with additional albumin stabilization of the particles of their dispersed phase, which is manifested in a decrease in the average diameter of the particles in the dispersions. Therefore, the properties of new phosphorus–containing polyesters allow us to consider them as potential systems for drug delivery.