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Use of biologically active sol-gel precursors to form shell nanoparticles of chitosan aspartate

Xenia M. Shipenok[1], Aliya M. Mazhikenova[1], Tatiana G. Khonina[2], and Anna B. Shipovskaya[1]

[1]Institute of Chemistry, Saratov State University, 410012 Saratov, Russian Federation
[2]Postovsky Institute of Organic Synthesis, Ural Branch of the Russian Academy of Sciences, 620108 Yekaterinburg, Russian Federation

INTRODUCTION & AIM

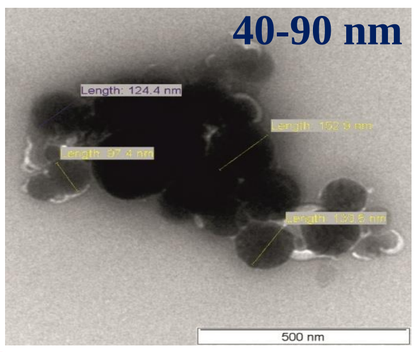
The paper examines shell nanoparticles of chitosan aspartate formed in situ in the process of counterion condensation using novel bioactive sol-gel precursors

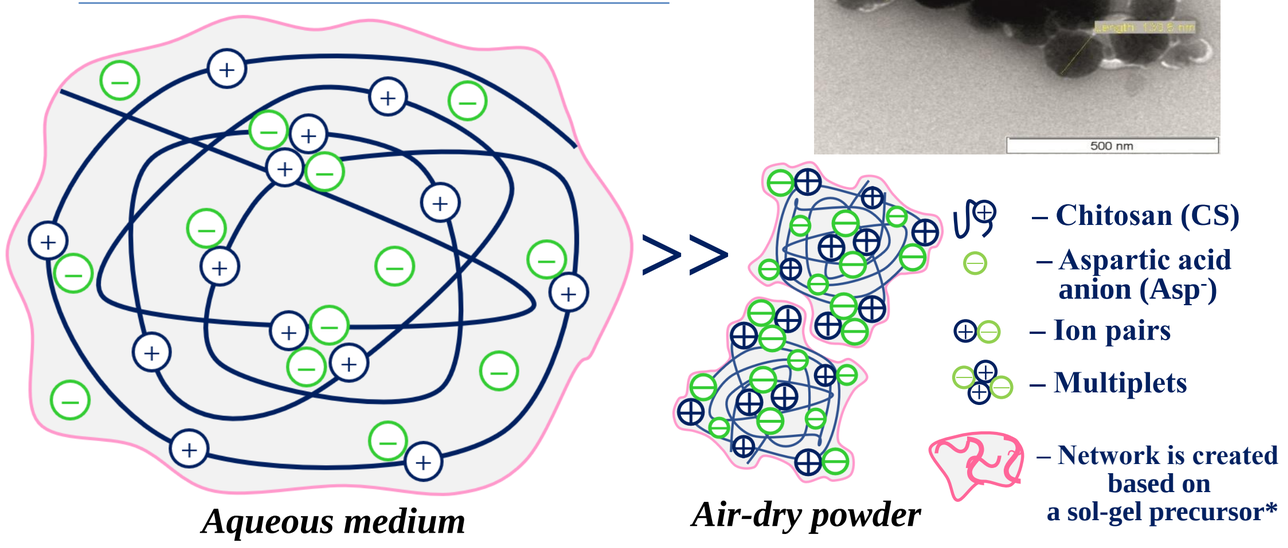
Shell Nanoparticles

DLS*

	d, nm
CS·L-AspA·Si	900-1500
CS·D-AspA·Si	800-1200

TEM**





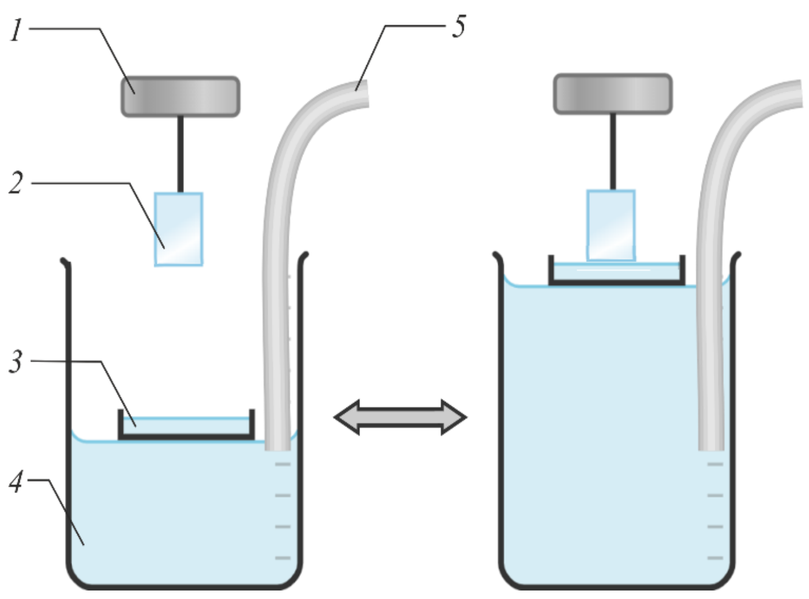
***Sol-gel precursor**

Silicon methyltriglycerolate **($MeSi(OGly)_3$)**
Silicon dimethyldiglycerolate **($Me_2Si(OGly)_2$)**
Silicon tetraglycerolate **($Si(OGly)_4$)**
Silicon tetrapolyethylene glycolate **($Si[O(C_2H_4O)_9H]$)**
Titanium tetrapolyethylene glycolate **($Ti[O(C_2H_4O)_9H]$)**

METHOD

An assessment was conducted of the impact of silicon- and titanium-containing modifiers on key colloidal properties (size, polydispersity index, zeta potential, conductivity, and surface tension) of the initial chitosan asparaginate nanodispersion, as well as during storage in ambient air.

Scheme of the modified setup for measuring surface tension



1 – Tensiometric sensor, 2 – Wilhelmy plate, 3 – laboratory vessel with the system under study, *4* – laboratory beaker with distilled water, and 5 – liquid level control system.

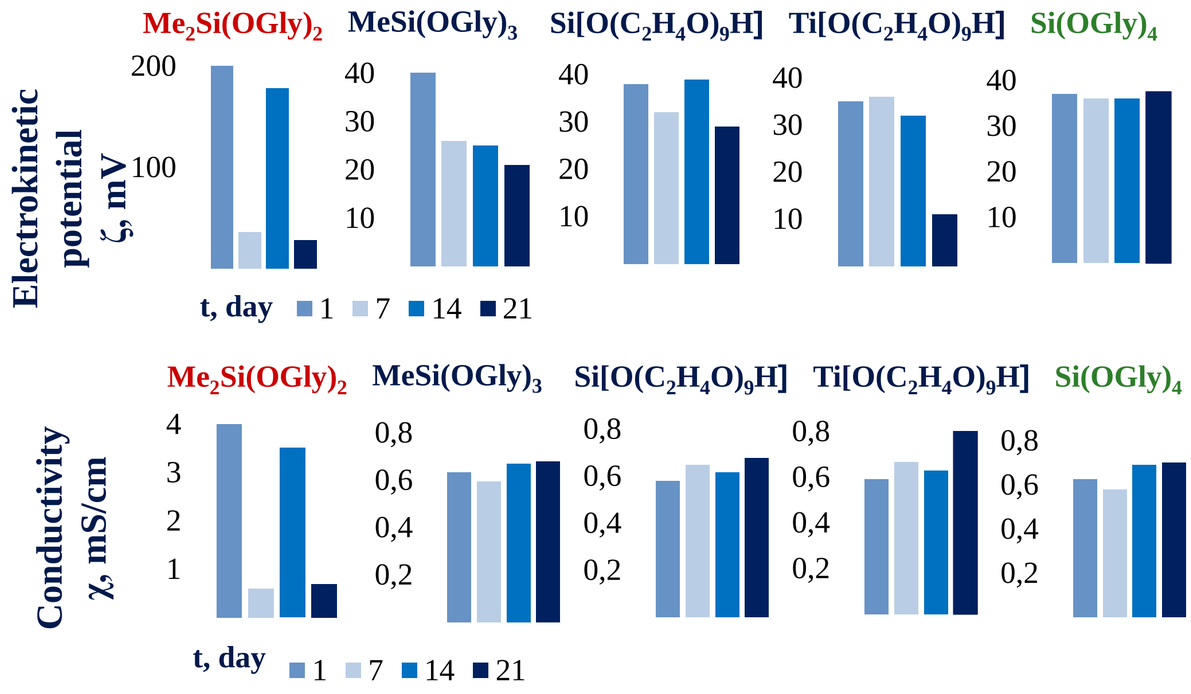
RESULTS & DISCUSSION

The diameter of nanoparticles in the freshly prepared dispersion increases in the series of sol–gel precursors

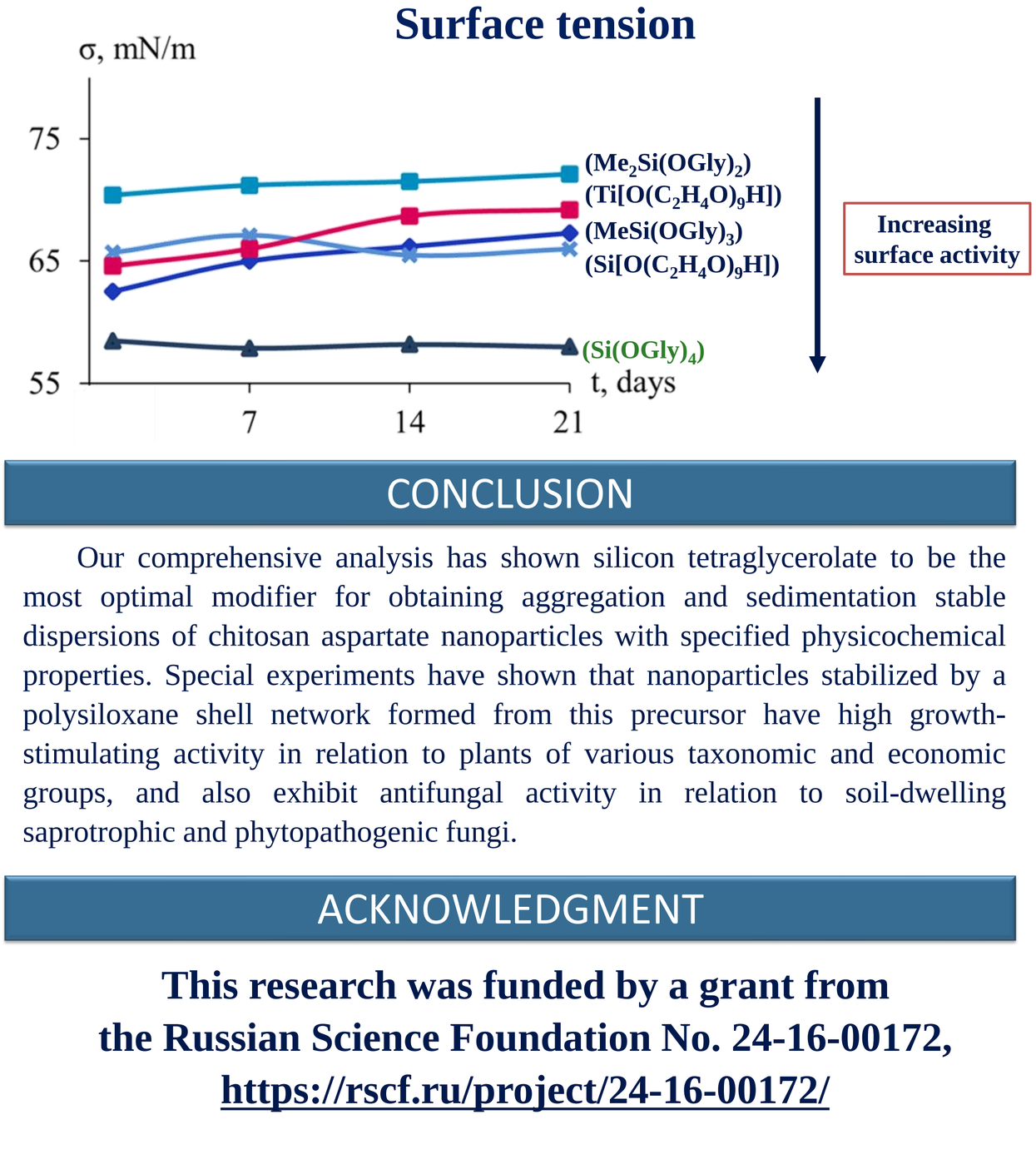
$Me_2Si(OGly)_2$ → $Si[O(C_2H_4O)_9H]$ → $MeSi(OGly)_3$ → $Si(OGly)_4$ → $Ti[O(C_2H_4O)_9H]$

In this case, the lowest and highest polydispersity was observed for the nanodispersion modified with **$Si(OGly)_4$** and **$Ti[O(C_2H_4O)_9H]$**, respectively

Ectrochemical characteristics



Surface tension



CONCLUSION

Our comprehensive analysis has shown silicon tetraglycerolate to be the most optimal modifier for obtaining aggregation and sedimentation stable dispersions of chitosan aspartate nanoparticles with specified physicochemical properties. Special experiments have shown that nanoparticles stabilized by a polysiloxane shell network formed from this precursor have high growth-stimulating activity in relation to plants of various taxonomic and economic groups, and also exhibit antifungal activity in relation to soil-dwelling saprotrophic and phytopathogenic fungi.

FUTURE WORK / REFERENCES

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