Magnetic nanoparticles conjugated to Amylovis® as contrast agents

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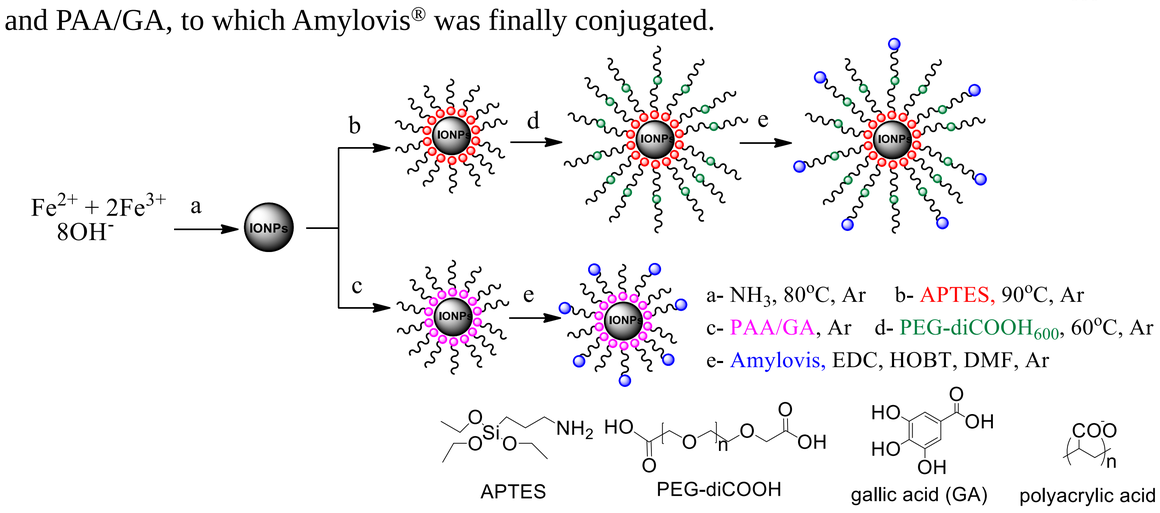
Introduction

An early aggregation of amyloid plaques (βA) in the brain, principally composed of beta amyloid peptides, characterizes Alzheimer's disease (AD). Magnetic Resonance Imaging (MRI) helps visualize these structures with greater sensitivity and sharpness (resolutions). Still, it is necessary to contrast agents functionalized with compounds related to βA. The Cuban Neuroscience Center has developed a new family of naphthalene derivatives compounds called Amylovis®, to be used to diagnose AD through MRI. The use of contrast agents allows obtaining images with greater clarity. The most used contrast agents today in the clinic are based on metal oxide nanoparticles. The goal of this work is to synthesize, by coprecipitation method, iron oxide nanoparticles (IONPs) with different coatings, to be conjugated to Amylovis®. The obtained nanoparticles were characterized by FT-IR, Electrophoretic Light Scattering (ELS) and Dynamic Light Scattering (DLS).

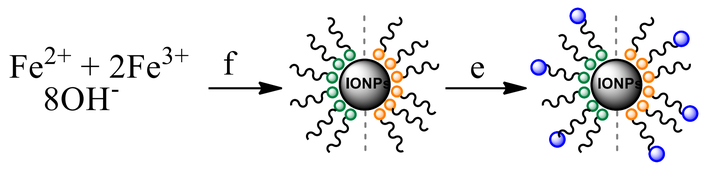
Experimental Section

Two synthesis methodologies were used, in which the coating of the IONPs was performed post-synthesis or *in situ*.

Using the **post-synthesis** coating methodology, IONPs were obtained by the coprecipitation method and later they were functionalized with: APTES-PEG-diCOOH$_{600}$ and PAA/GA, to which Amylovis® was finally conjugated.

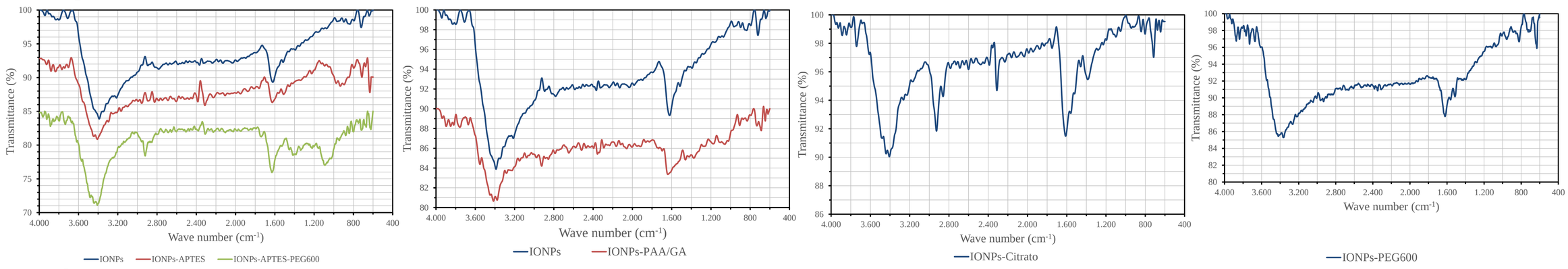


Using the ***in situ*** coating methodology, functionalized IONPs were obtained with: PEG$_{600}$ and citrate, using the coprecipitation method, to which Amylovis® was subsequently conjugated.

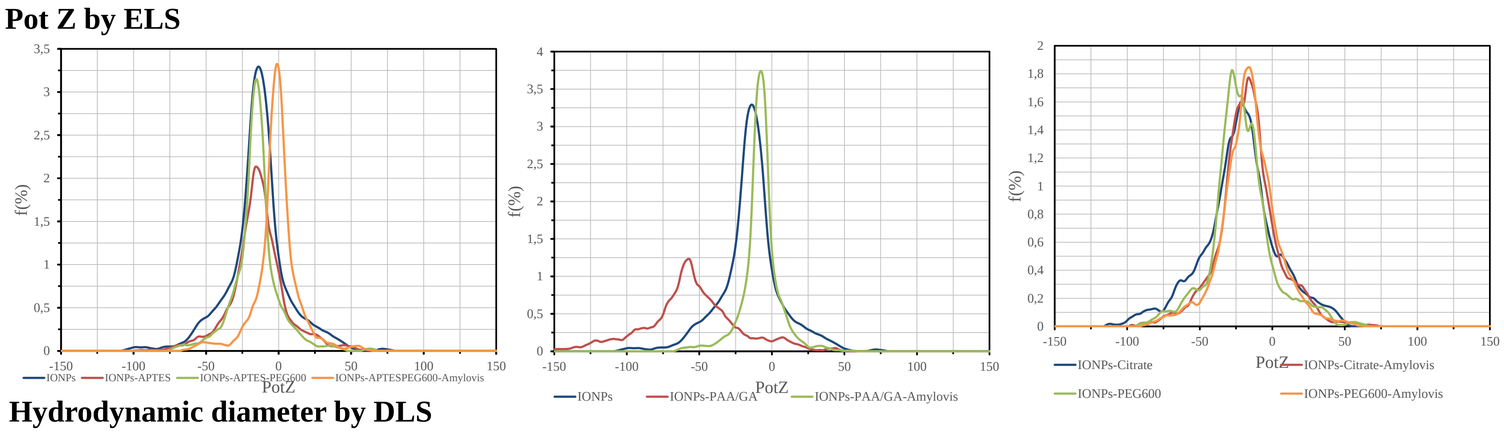


Results and Discussion

FT-IR spectra

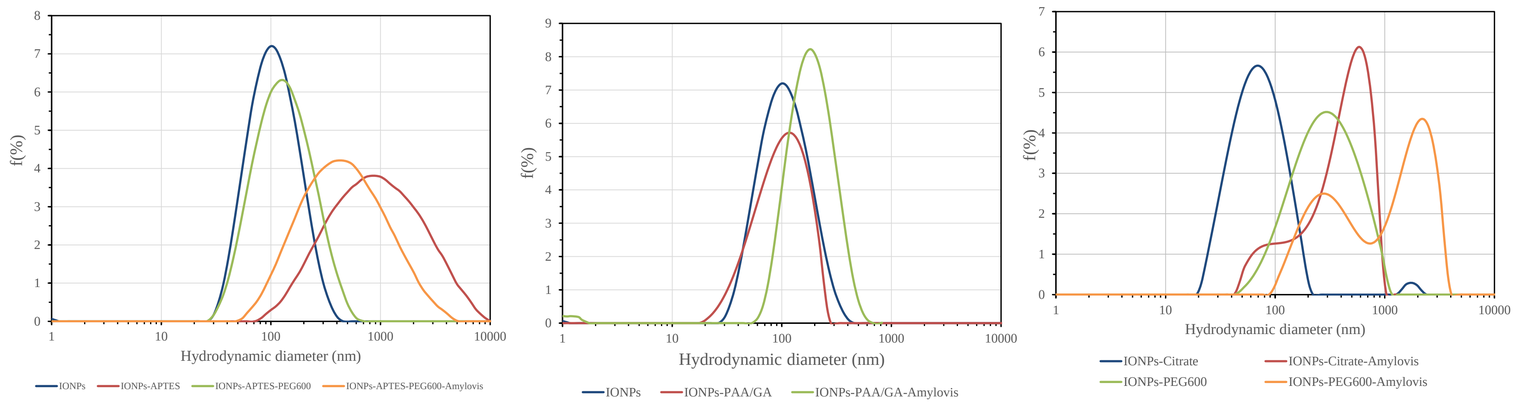


Pot Z by ELS



NPs	PotZ (mV)	SD	NPs	PotZ (mV)	SD
IONPs	-14,6	1,4	IONPs@PAA/GA-Amylovis®	-7,4	0,6
IONPs@APTES	-12,4	0,8	IONPs@Citrate	-26,8	1,9
IONPs@APTES-PEG-diCOOH$_{600}$	-15,8	0,8	IONPs@Citrate-Amylovis®	-14,3	1,0
IONPs@APTES-PEG-diCOOH$_{600}$-Amylovis®	-0,9	0,3	IONPs@PEG-diCOOH$_{600}$	-25,2	2,4
IONPs@PAA/GA	-53,6	2,4	IONPs@PEG-diCOOH$_{600}$-Amylovis®	-17,9	2,0

Hydrodynamic diameter by DLS



NPs	HD (nm)	PI (%)	NPs	HD (nm)	PI (%)
IONPs	93,6	18,7	IONPs@PAA/GA-Amylovis®	170.2	13.1
IONPs@APTES	780,3	35,0	IONPs@Citrate	74,5	23,6
IONPs@APTES-PEG-diCOOH$_{600}$	112,0	22,7	IONPs@Citrate-Amylovis®	421,2	29,2
IONPs@APTES-PEG-diCOOH$_{600}$-Amylovis®	351,7	32,0	IONPs@PEG-diCOOH$_{600}$	261,5	25,7
IONPs@PAA/GA	90,3	23,9	IONPs@PEG-diCOOH$_{600}$-Amylovis®	1774,0	24,1

Conclusions

Using the coprecipitation method, it was possible to obtain IONPs with different coatings, both **post-synthesis** and ***in situ***, and they were subsequently conjugated to Amylovis®. Through FT-IR, the formation of the different nanostructured systems was verified. The zeta potentials and hydrodynamic diameters of the obtained Amylovis® conjugated nanoparticle systems suggest several of them as potential candidates for MRI contrast agents.

References

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