Insulin-Delivery from Glucose-Responsive Polyamine-Salt Aggregates: Smart "Sense-and-Treat" Nanocarriers Made Easy

Santiago E. Herrera 1, Maximiliano L. Agazzi 1, M. Lorena Cortez 1, Waldemar A. Marmisollé 1, Mario Tagliazucchi 2, Omar Azzaroni 1*

1Instituto de Investigaciones Fisicoquímicas Teóricas y Aplicadas Facultad de Ciencias Exactas, Universidad Nacional de La Plata–CONICET Sucursal 4, Casilla de Correo 16, 1900 La Plata, Argentina; azzaroni@inifta.unlp.edu.ar
2Departamento de Química Inorgánica, Analítica y Química Física, INQUIMAE–CONICET Facultad de Ciencias Exactas y Naturales, Ciudad Universitaria, Pabellón 2, Buenos Aires C1428EH, Argentina

Polyamine-salt aggregates (PSA) are biomimetic soft-materials that have attracted great attention due to their straightforward fabrication methods, high drug-loading efficiencies and attractive properties for pH-triggered release [1,2]. In this work, we constructed poly(allylamine hydrochloride)/phosphate PSAs through one-pot ionic gelation [3] containing glucose oxidase as a glucose-responsive element, and human recombinant insulin as therapeutic drug for diabetes mellitus treatment (GI-PSA). The self-assembly process is depicted in Figure 1 (left side).

The addition of increasing glucose concentrations promotes the release of insulin due to the disassembly of GI-PSA, triggered by catalytic in-situ formation of gluconic acid (Figure 1, right side). While under normoglycemia, the carrier integrity remained intact for at least 24 h without losing Insulin, hyperglycemic conditions produced a 100% of cargo releasing after 4 h of glucose addition. This entirely supramolecular strategy presents great potential for the construction of smart glucose-responsive delivery nanocarriers.