

Accepted Manuscript

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PII: S0142-9612(18)30169-8

DOI: [10.1016/j.biomaterials.2018.03.010](https://doi.org/10.1016/j.biomaterials.2018.03.010)

Reference: JBMT 18536

To appear in: *Biomaterials*

Received Date: 19 January 2018

Revised Date: 5 March 2018

Accepted Date: 6 March 2018

Please cite this article as: Yang B, Lin H, Dai C, Chen Y, Shi J, “Stepwise extraction” strategy-based injectable bioresponsive composite implant for cancer theranostics, *Biomaterials* (2018), doi: 10.1016/j.biomaterials.2018.03.010.

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“Stepwise Extraction” Strategy-based Injectable Bioresponsive Composite Implant for Cancer Theranostics

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Abstract: “Smart” bioresponsive materials, which are sensitive to biological signals or pathological abnormalities, are appealing therapeutic platforms for the development of next-generation cancer theranostics. In this work, a novel “stepwise extraction” strategy has been proposed and demonstrated in constructing injectable bioresponsive composite implant, which features unique theranostic responsivenesses to exogenous and external triggers. The as-designed implant exhibits theranostic functions and biodegradability for cancer treatment based on the change of intratumoral microenvironment and the needs of therapeutic process. This “stepwise extraction” process, that is, “solvent extraction”, “manganese extraction” and “phosphorus extraction”, significantly promoted the biodegradation and disintegration of the bioresponsive implant step by step, accompanied by the corresponding component releases from the PLGA framework and furthermore, accomplished different specific theranostic functions needed at different treatment stages. This is the first demonstration of bioresponsive organic-inorganic hybrid implant with marked theranostic functions and excellent biodegradability by a “stepwise extraction” approach, paving the way to the solutions of unsatisfactory therapeutic efficacy and strong side effects in current cancer therapeutic modalities.

Keywords: “stepwise extraction” strategy, bioresponsive, implants, theranostics

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