

## Author's Accepted Manuscript

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PII: S0039-9140(18)30976-7  
DOI: <https://doi.org/10.1016/j.talanta.2018.09.067>  
Reference: TAL19081

To appear in: *Talanta*

Received date: 26 July 2018  
Revised date: 11 September 2018  
Accepted date: 18 September 2018

Cite this article as: Yi Yang, Chao Li, Hai Shi, Tianshu Chen, Zhaoxia Wang and Genxi Li, A pH-responsive bioassay for paper-based diagnosis of exosomes via mussel-inspired surface chemistry, *Talanta*, <https://doi.org/10.1016/j.talanta.2018.09.067>

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# A pH-responsive bioassay for paper-based diagnosis of exosomes via mussel-inspired surface chemistry

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## Abstract:

The analysis of exosomes, which shows an increasing potential as prognostic biomarkers for non-invasive cancer diagnosis, can reveal their biological functions and disease associations. Nevertheless, the development of a convenient and quantitative method for determination of exosomes is still challenging. Herein, a novel approach for exosome quantification using pH test paper is developed via HRP-mediated promotion of mussel-inspired surface engineering and reagent-free functionalization of urease molecules. Urease can hydrolyse urea into ammonia and carbon dioxide, and simultaneously raise the pH value of the solution. By establishing the relationship between exosome recognition and the change of pH value of the sensing solution, we can directly employ the low-cost, widely used and commercially available pH test paper to quantitatively analyse exosomes. The pH-responsive bioassay enables sensitive detection of exosomes with a detection of limit down to  $4.46 \times 10^3$  particles/ $\mu\text{L}$  and can be successfully applied for determination of exosomes in clinical specimens. The

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