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$CdS/Cd(OH)_2$ Nanocrystals as New Biophotonic Tools to Investigate the Antigens A Expression in Red Blood Cells

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Abstract – Bioconjugated $CdS/Cd(OH)_2$ quantum dots were applied as fluorescent labels of erythrocytes cells. The bioconjugation procedure was performed using glutaraldehyde as a crosslinker and antibody Anti-A as the blood membrane targeting molecule. The antigen membrane expression of type A cells was monitored using flow cytometry. Our results show that these quantum dots are a promising class of fluorescent probes that may be applied in the quantification of different sub-group blood types of the ABO system.

Semiconductor colloidal quantum dots (QDs) have become, for the past two decades, important fluorescent tools for biological imaging mostly due to their physical and chemical properties. Compared to organic fluorophores, QDs have an exceptional resistance to photodegradation, narrower photoluminescence with high quantum yield and broader absorption bands [1]. In this work we use $CdS/Cd(OH)_2$ QDs bioconjugated to antibody A to label membrane antigen A in red blood cells. Although the monoclonal antibodies anti-A recognize and agglutinate the majority of ABO sub-groups, to determine blood sub-groups types with low expression of antigens is a laborious task. Thus, innovative techniques and methodologies to improve molecular techniques are always in focus and can contribute to a better efficiency of hematological tests performed in blood banks.

The synthesis of $CdS/Cd(OH)_2$ QDs was done using sodium polyphosphate as stabilizing agent and $Cd(ClO_4)_2$ and H_2S as precursors [2]. Optical characterization of these systems demonstrate that the particles are highly luminescent in the green region (emission peak = 493 nm). The conjugation of $CdS/Cd(OH)_2$ nanocrystals to anti-A was done via a glutaraldehyde crosslinking procedure. Type A and O red blood cells were incubated with the bioconjugated QDs at 37°C for 30 min and analyzed by flow cytometry. The O type erythrocytes were used as negative control. Figures 1(a) and 1(b) show, respectively, analyses of flow cytometry for A and O erythrocytes. The results demonstrate that QDs were successfully functionalized with antibody A. The bioconjugation was confirmed by experiments performed using ELISA fluorescent microplate reader.

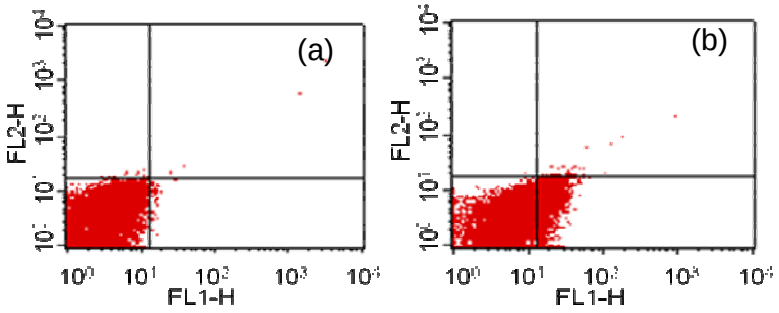

Figure 1: a) Type O erythrocytes analyzed by flow cytometry showing negative staining when labeled with $CdS/Cd(OH)_2$-antiA and **b)** type A erythrocytes showing specific pattern of green staining when labeled with $CdS/Cd(OH)_2$-antiA.

The nanostructured systems presented here show a great potential of application in the biomedical science for instance as low cost diagnostic tool for flow cytometry.

[1] B. S. Santos, P. M. A. Farias, A. Fontes in "Semiconductor quantum dots for biological applications". In: Mohamed Henini (Org.). Handbook of Self Assembled Semiconductor Nanostructures Novel Devices in Photonics and Electronics. Elsevier, 2008
[2] B. S. Santos, em "Obtenção de Nanopartículas de CdS em Sistemas Amorfos e a Investigação de suas Propriedades Ópticas Não-Lineares em Meio Aquoso". Tese de Doutorado, 2002.