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Stable fluorescent silicon nanoclusters, reversible interaction with solvents and applications in drug delivery

Hanieh Yazdanfar and **Klaus Von Haeften**
University of Leicester, UK

Fluorescent silicon nanoclusters are of considerable interest, both as means of studying the fundamental properties of silicon, the most important technological material of our age, but also for their many possible applications. Luminescent clusters of silicon have applications in Drug delivery, biological labels and sensors as well as in optoelectronic devices and lasers; also its low toxicity giving it an advantage over other light emitting materials. Fluorescent silicon nanocluster solutions have been produced in our lab with a novel method using liquid jet passes through the source of atomized silicon in the vacuum (10^{-2}) and makes the solution of silicon clusters deposit on the cold trap. In this method several ml of sample with cluster size of 1 nm will be produced in few minutes. Aging experiment proves these fluorescent particles are stable in solution after several years; their fluorescence intensity did not change during 3 years. Samples can produce in different solvents such as water, ethanol, and isopropanol. Clusters show a solvent sensitive fluorescence band at 350-420 nm and the results show peak shifts with changing the solvent, this process is reversible. The solvent exchange suggests that fluorescence originates from the solvent/cluster-surface interface. Stern-Volmer plot describes a linear relation between fluorescent yield and concentration. The silicon nanoparticles produced in water have quantum yield between 8% and 10% which is very promising for medical applications. Chemical analysis of particles using XPS and FTIR/ATR revealed that practically all the silicon was oxidized and the silicon is present in a high oxidation state. Infrared absorption bands were attributed to SiOH, SiH, SiO, SiO_2 and SiO_3 investigations suggest the fluorescence emerges from these oxygen rich surface states.

hy114@le.ac.uk

Molecular study of cytomegalovirus infection among children with end stage renal diseases undergoing dialysis: Pilot study

Sameh Salama[1] and **Maysaa EL Sayed Zaki**[2]
[1]ALazhar University, Egypt
[2]Mansoura University, Egypt

Cytomegalovirus is considered as an opportunistic infection affecting immunocompromised patients. Children with end stage renal diseases requiring dialysis is among affected population by this virus. The aim of the present study was to detect and compare the seroprevalence of CMV and CMV antigen pp65 with real time polymerase chain reaction (PCR) among children with end stage renal diseases undergoing dialysis. The study is a prospective case-control study. The 41 patients included in the studied are registered in the hospital for regular dialysis waiting for renal transplantation. The study included 41 healthy controls with same age and gender distribution. Blood samples were obtained from studied children and subjected for determination of specific immunoglobulin M and G for CMV (IgM-CMV, IgG-CMV) by Elecys system and CMV-DNA determination by real time polymerase chain reaction (PCR) and for PP65 antigenemia test by light diagnostic CMVpp65. CMV-IgM was significantly detected frequently (P=0.0001) in 12.2% of the patients and in 2.4% of the control children. Moreover, IgG-CMV was significantly more frequently detected in patients (P=0.0001) than in control (90.2% and 31.7%, respectively). CMV-DNA was significantly (P=0.0001) detected in 12 patients (29.3%) compared to the control (2.4%), while CMVpp65 was detected among 4 children (9.8%) compared to one child in the control group. The comparison between IgM-CMV and real time PCR revealed that 30.7% of positive samples by PCR had positive IgM-CMV, while IgG-CMV was associated with 84.6% of positive PCR. CMVpp65 correctly identified all negative samples compared to PCR, while the majority of negative PCR was also negative for IgM-CMV (98.6%). Moreover, all negative children for CMVpp65 was also negative by PCR (100%) For the validity of different CMV markers, IgG-CMV was the most sensitive test (84.7%), CMVpp65 was the most specific test 100%. From this study we concluded that CMV is a common viral infection among children with end stage renal diseases requiring dialysis. The diagnostic performance of real time PCR is the gold standard technique in diagnosis of this infection. CMVpp65 antigenemia is a specific accurate test for laboratory diagnosis however, it lacks sensitivity. Specific IgG for CMV is good screening diagnostic test.

samehsalama2003@hotmail.com