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# The Dependence of Raman Signal Enhancements on Chain-lengths of Alkanethiols functionalized on gold nanoparticles

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Surface-enhanced Raman spectroscopy (SERS) has been widely studied for decades and has attracted many researchers in various fields due to its advantageous characteristics such as a low limit of detection, easy sample preparation, non-destructive nature and high sensitivity. Recent studies have focused more on enhancing the Raman signal by manipulating various parameters of SERS. SERS signals are heavily dependent on the substrates and molecules (Raman reporters) adsorbed on a substrate. Recently the focus has been on trying to develop materials with different and enhanced properties to be employed as SERS substrate. As such, gold nanoparticles (AuNPs) are a type of material that has received much attention. Unlike most transition metals, AuNPs are biocompatible, stable in the harsh environment and most importantly they can provide extremely strong electromagnetic field around the hot spots due to the excitation of surface plasmons. However, the effect of chain-length of Raman reporter molecules functionalized on SERS substrates has not been investigated in a wide range. Herein we investigate the effect of the chain-lengths of 1-alkanethiols (1-pentanethiol, 1-decanethiol, and 1-pentadacanethiol) functionalized AuNPs on the Raman signal enhancement. AuNPs were synthesized using chloroauric acid (HAuCl<sub>4</sub>) as a precursor and trisodium citrate as a capping and reducing agent. The nanoparticles were then functionalized with 1-pentanethiol, 1-decanethiol, and 1-pentadecanethiol, thus resulting in the formation of self-assembled monolayers. UV-Vis spectroscopy confirmed the plasmon resonance of gold nanoparticles at 520 nm; HR-TEM illustrated monodispersed spherical nanoparticles with an average diameter of 14 nm. The SERS experiments revealed the increase in Raman signal as the chain-length of alkanethiol decreases.

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