Nanotechnology is a novel scientific branch for the treatment of matter with dimension size smaller than 100 nm. The nanostructures are an intermediate structure between atomic structures and bulk materials. Among nanostructures, nanoparticles are very interesting due to their large applications. For example, titanium dioxide is one of the important semiconductors due to its morphology and a crystalline phase. The disadvantage of TiO$_2$ is that its gap band is activated only under ultraviolet radiation which presents a reliable percentage of the sunlight so we have to solve this problem. Doping titanium dioxide remains the best solution for increasing its photocatalytic activities by using metals or non-metals. Different methods have been used for the elaboration of metal-doped titanium dioxide, including chemical precipitation methods, microemulsion methods, hydrothermal methods and sol-gel processes using a variety of precursors such as titanium alkoxides, titanium tetrachloride, titanium tetraisopropoxide…. But these methods are costly, toxic and high energy requirement. Among these methods, the sol-gel method is a simple method to synthesis TiO$_2$ nanoparticles. In this study, we have prepared Nickel doped TiO$_2$ via sol-gel method. The obtained nanoparticles were characterized by several analytical techniques like Diffuse reflectance spectroscopy (DRS), Fourier Transform Infrared Spectroscopy, X-ray diffraction (XRD), Raman Spectroscopy and Transmission Electron Microscopy (TEM). The DRS results show that the dopant Nickel accords a red shift to light absorbing nature of TiO$_2$ and reduces its band gap energy significantly so that, it can absorb energy from a major portion of visible light. The DRS of Nickel doped TiO$_2$ powders annealed at 500°C presents a single broad intense absorption at around 400nm. The DRS spectra of Ni-doped TiO$_2$ at Ni = 2.5% powders and calcined at 700°C show two wide absorption bands in the wavelength ranges of 400–500nm and 650–850nm and the doped at 5/7.5/10% of Nickel present three large absorption bands in ranges of 400nm, 400-500nm, and 650-1000nm. The degree of absorbance of these latter peaks increased with the increase of Ni-doping concentration in TiO$_2$. 

**Keywords:** Nickel doped TiO$_2$ nanoparticles, X-ray diffraction, Diffuse reflectance spectroscopy

**Presenting author's email:** halim.wafae@gmail.com