In the frameworks of the present master thesis, the synthesis and characterization of pegylated calcium hydroxide nanoparticles ($Ca(OH)_2$ NPs) along with their nematicidal activity is presented. The pegylated calcium hydroxide nanoparticles differ on their composition, size and percentage of coating. Various surfactants (1,2 pronanediol, tetraethylene glycol, polyethylene glycol 8000) were used for the NPs' coating as well as a variety of precursors (calcium chloride and calcium nitrate) was used for the NPs formation. Furthermore, the pegylated nanoparticles were studied for their nematicidal activity in two populations of nematodes *Meloidogyne* spp. The synthesis of NPs was carried out by the *microwave synthesis method* and the use of polyol, into special containers in which high pressures and temperatures were developed. The synthesized nanoparticles were characterized by various methods like X-ray diffraction (XRD), Fourier Transform Infrared Spectroscopy (FT-IR), Thermal Analysis (TGA), Dynamic Light Scattering (DLS), and z-potential. Additionally, the pH of the solutions from various concentrations of nanoparticles was measured for determining the concentration of hydroxyls released from each sample. The samples prepared with calcium chloride remained for some time in the laboratory and were re-characterized by TGA and FT-IR for studying their compositional changes over time. The results from the nematicidal bioassays of pegylated calcium hydroxide nanoparticles with anhydrous calcium chloride as precursor are presented. The nematicidal bioassays, *in vitro* conditions, were performed against two populations of *Meloidogyne* spp. (*Meloidogyne incognita* and *Meloidogyne javanica*). The biological experiments were for causing paralysis at second-stage larvae (J2) of nematodes, which is the infectious stage of their biological cycle.