This paper reports a study on the thermal stability and flame-retardant properties of microencapsulated phase change materials (PCMs) with clay nano-particles (Clay-NPs) doped gelatin/sodium alginate shell. The novel microcapsules were fabricated by the technique of complex coacervation with gelatin and sodium alginate as the shell and PCM n-eicosane as the core. Their flame retardant property as well as their practicable thermal performances when integrated into woven cotton fabrics by pad-dry-cure was investigated. Thermal storage/release properties of the prepared microcapsules were analyzed using DSC instrument. Thermal gravimetry (TG) analysis was applied to measure the thermal stability and surface morphology of the microcapsules was observed by means of optical microscopy and SEM. The DSC results indicated that the microencapsulated n-eicosane have considerable latent heat storage capacity in a range of 97-114 j/g. The microcapsules had spherical shape with particle sizes between 13.7 µm and 17 µm. The PCM microcapsules (PCMMs) and nano-composite PCM microcapsules (NCPCMMs) with clay-NPs doped gelatin/sodium alginate shell were found having good potential for developing thermal comfort in textiles. Comparing with conventional PCMMs, NCPCMMs have significantly better thermal stability. This can be attributed to nano-composite structure of the microcapsules, in which clay-NPs doped in the shell structure to increase shell thermal stability. Improved flame retardant properties of the cotton fabrics treated with NCPCMs were declared as a result of flame retardant tests. Thermo-regulating properties of the fabrics were proved by thermal history (T-History) measurements results from releasing heat from microcapsules.