The existence of cross-talk and noise from narrowly located and simultaneously active muscles is exaggerated when the level of muscle contraction is very low. Due to this the current applications of surface electromyogram (sEMG) are infeasible and unreliable in pattern classification of sEMG. This research reports a new classification technique for sEMG using Blind Source Separation Techniques (BSS) such as Independent Component Analysis (ICA). The technique uses BSS methods to classify the patterns of Myo-electrical signals during different Maximum Voluntary Contraction (MVCs) at different low level finger movements. The results of the experiments indicate that patterns using ICA of sEMG is a reliable ($p<0.001$) measure of strength of muscle contraction even when muscle activity is only 20% MVC. The authors propose that BSS methods are useful indicator of muscle properties and are a useful indicator of the level of muscle activity.