ABSTRACT

As the tendency towards safety in workplaces has increased, a warning system is needed to minimize fatal work injuries. However, the methods that are currently using acoustical or auditory warning signals have several drawbacks. The reliability of the current methods might get lost under dusty or loud working conditions. Thus, the development of a wearable electrical warning system is purposed. Electrocutaneous stimulation has been acknowledged as one of the viable techniques for producing nerve activity as it is non-invasive and capable of inducing sensations. In a previous study, 80 participants were investigated regarding the sensation thresholds, qualitative, and spatial perception with TENS. Comparisons between TENS and textile electrode cuffs were carried out with 30 participants, indicating a too high impedance of the textile electrode cuffs. This thesis was established to investigate the impedance characteristics of a textile electrode cuff in comparison to the characteristics of TENS electrodes as the reference. For that purpose, experiments with an agar phantom as artificial skin have been carried out in a Faraday cage. The 5 textile electrode cuffs (6 electrodes each) and the 6 TENS electrodes were attached to the phantom. Impedance spectroscopy has been performed for frequencies between 1 Hz and 106 Hz by GAMRY 600+ with the impedance magnitude $|Z|$ and the impedance phase φ. The TENS electrodes consistently showed stable behavior for both magnitude and phase. This condition is caused by the adhesive characteristic and structure of hydrogel in TENS. The impedance magnitude of the cuffs was mostly higher than TENS. In contrast to TENS, the results of the cuff electrodes show fluctuating magnitude and phase. Fluctuations may occur due to manual manufacturing, as the sizes of the carbon-filled coatings on the cuff were not the same. For future studies, it is recommended to use other coating materials to improve the attachment between the electrode and the skin.