# Abstract

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Title of Thesis: Development of material for agar-based ultrasound brain phantom

This thesis is concerned with the development of a material for an agar-based ultrasound phantom that would provide skill acquisition and experience in a manner approximating real surgery. The aim is to formulate and optimize the agar hydrogel preparation procedure, evaluate its acoustic properties and water loss during storage.

A dependence was found between the amount of water evaporated during storage (4 weeks at 37 °C) and the glycerol content, which slows down the water loss from the samples in direct proportion. Based on the results, an agar gel (AG) formulation with 1% agar and 60% glycerol was selected for the acoustic properties measurements. During this experiment the microbial stability of AG was confirmed.

The results of acoustic parameters measurements were evaluated, namely, speed of the ultrasound, attenuation coefficient and echogenicity of the samples as a function of content of scattering particles $Al_2O_3$ and SiC. It was shown that each type of particles affects grayscale value and attenuation coefficient in a different way and by choosing the amount of particles the acoustic properties of AG can be controlled. Therefore, the phantom can consist of regions with different particle content, allowing the different structures of the brain and tumor to be distinguished from each other on the ultrasonogram. It has also been found that the propagation speed of ultrasound shows a linear dependence on the amount of glycerol contained.