DETECTION OF BREAST CANCER BY ATR-FTIR SPECTROSCOPY

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Breast cancer is the most common type of cancer among women, and one of the most common worldwide [1]. Many factors such as sex, advancing age, early menarche, late menopause, late age at first birth and family history of breast cancer have a significant role in the initiation or development of breast cancer [2]. There were found some changes in the hair structure of women with breast cancer. The human hair is typically 50-100 μ, consisting of core, or medulla, typically 5-10 μ in diameter, that is surrounded by the cortex, making up the bulk of the hair, and of an outer layer or cuticle, typically less, than 5 μ in thickness [3]. When investigated the levels of trace elements in breast cancer patients in comparison with healthy controls by X-ray emission (PIXE), the concentrations of Fe and Cu ($p < 0.05$) were found to be higher compared to those of healthy controls, while the concentration of Zn ($p < 0.05$) was found to be lower [2]. But no significant difference was observed for S, K, Ca, Ti as well as ratios of Cu/Zn and Cu/Fe in the hair of the two groups ($p< 0.05$). Other found cancer detection test is when strands of hair bombarded with X-rays from a synchrotron particle accelerator and in hair from healthy people, the pattern produced by the X-rays is a series of arcs, while in people with breast cancer - a distinctive ring is superimposed on top of the arcs [4]. It is suggested, that proteins released by cancer cells alter the hair follicle to produce hair with a different structure.

Our interest was attracted the most by attenuated total reflectance Fourier transform infrared (ATR-FTIR) spectra as the cheapest and easiest method, that obtain signals based on electromagnetic disturbances called evanescent waves, which can penetrate 1–2 mm of the sample adhering tightly to the crystal surface. This principle determines ATR application to biological samples [3-8]. According to the recent investigation shift of the CH bending absorption from 1446-1456 cm^{-1} to 1448-1458 cm^{-1} was considered to be affected by the procancer lipids formation [9].

Thus, it was decided to predict breast cancer of 124 second year students of the Pharmacy faculty of Zaporizhzya State Medical University. The students' strands of hair at the 3-5 cm from the sculp were used to obtain IR spectra (4000-600 cm^{-1}) by a Bruker ALPHA FT-IR spectrometer using a module for measuring ATR. The spectra were carefully studied, and, fortunately, no students were found to have changes in the positions of the peaks.

The interesting continuation of presented material would be measurement of the ATR-FTIR spectra of the women with breast cancer in the women's consultation before and after treatment to statistically prove this low cost and short measurement time method of breast cancer detection.

References

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