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DISCRIMINATION OF PATHOGENIC YEAST AND BACTERIA BY MEANS OF ATR IR SPECTROSCOPY

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Pathogenic microorganisms such as bacteria and fungi can cause infectious diseases. Antibiotics are used for the treatment of bacterial infections and antifungals for yeast caused infections. Discrimination between bacterial and fungal infection is important because of the different treatment strategies which can be applied while treating patients. For example, the prescription of antibiotics to patients with fungal infection can complicate the course of the disease by eliminating the bacterial members of the skin microbiota. Methods which are used nowadays for pathogenic microorganisms' identification require sample preparation and/or cultivation and takes a long time until the identification results are obtained, especially in the case of eukaryotic microorganisms. ATR IR spectroscopy is a non-destructive method and often does not require sample preparation. The collection of the ATR IR absorption spectrum takes several minutes therefore the identification of pathogenic microorganisms can be accomplished faster [1-3].

In this work, the method of an attenuated total reflection of infrared radiation (ATR IR) spectroscopy was applied for the analysis.A total of 177 ATR IR absorption spectra were collected which includes two types of yeast (*Candida guilliermondii*, *Candida parapsilosis*), three types of bacteria (*Staphylococcus aureus*, *Streptococcus pyogenes*, *Escherichia coli*) and mixtures between pathogenic yeast and bacteria.

ATR IR absorption spectra of mixtures of *C. guilliermondi-S. aureus*, *C. parapsilosis-E. coli* and *C. parapsilosis-S. Pyogenes* at the ratios 1:1, 1:2, 1:3, 2:1, 3:1, 2:3, 3:2 were measured to test the ATR IR suitability to discriminate microorganisms in mixtures. The main spectral difference was observed in 1360 cm^{-1} – 1280 cm^{-1} region. As the ratio of the mixture changes, the position of the polysaccharides δ (CH), Amide III spectral bands changes (Fig. 1. (a)). In order to assess the applicability of the FTIR ATR spectral method in clinical diagnostics, k-means statistical analysis was performed. In Fig. 1. (b) most of ATR IR absorption spectra of pure bacteria are located in the part of the diagram marked with red ellipse, while most the pure yeast spectra are located in the part of the diagram marked with blue ellipse. The spectra of the mixtures are located between the mentioned parts of the diagram, depending on the dominant microorganism in the sample.

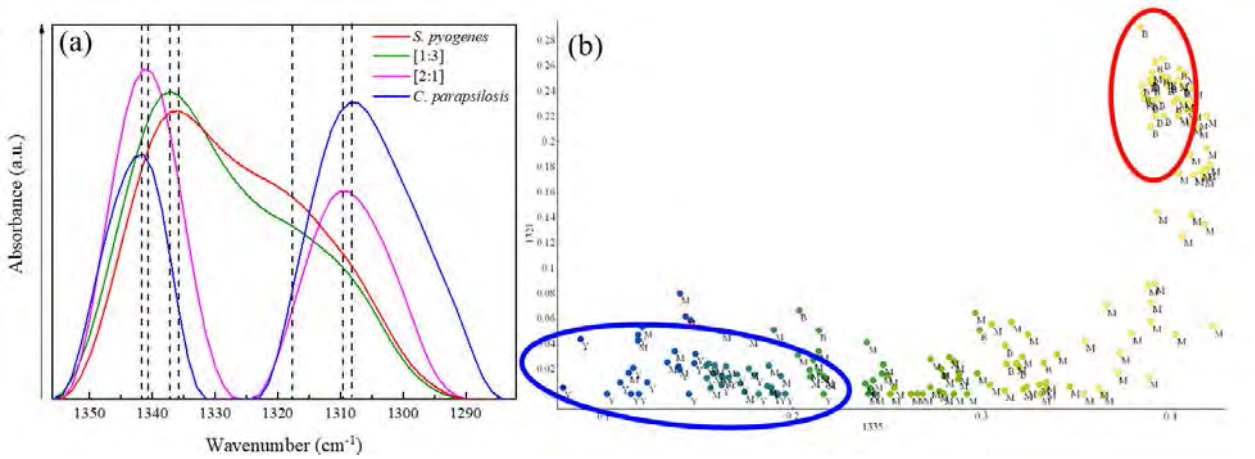

Fig. 1. (a) ATR IR absorption spectra of pure yeast, pure bacteria, and mixture, (b) k-means plot of ATR IR absorption spectra of bacteria, yeast, and their mixtures.

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