EVALUATION OF THE GROWTH KINETICS OF E. COLI ON COTTON FABRIC

Nina Čuk[1], Rok Fink[2] and Brigita Tomšič[1]

[1] *University of Ljubljana, Faculty of Natural Sciences and Engineering, Aškerčeva cesta 12, 1000 Ljubljana (Slovenia),* brigita.tomsic@ntf.uni-lj.si
[2] *University of Ljubljana, Faculty of Health Sciences, Zdravstvena pot 5, 1000 Ljubljana (Slovenia),* rok.fink@zf.uni-lj.si

Abstract: The aim of this study was to analyze the suitability of two commonly used fluorescent dyes for staining bacteria for evaluation of their growth intensity on the surface of the cotton fabric over a certain period of time. Fluorescein Diacetate (FDA) and Green Fluorescent Nucleic Acid Stain (SYTO9) were used to stain *Escherichia coli* ATCC 35218 adhered to bleached and mercerized cotton fabric. The results of inverse phase-contrast microscopy with fluorescence showed that the more appropriate dye was FDA. Image analysis using the cell fluorescence method (CTFC) made it possible to assess a bacterial growth curve with different time intervals within 24 hours.

Keywords: *bacterial adhesion, fluorescent dyes, cotton fabric*

Textiles provide suitable conditions for the growth of bacteria [1]. Their presence can be problematic from the point of view of the deterioration of aesthetic and functional properties as well as their possible negative impact on the user's health [2]-[3]. *Escherichia coli* is a type of bacteria, which has gained prominence due to its public health risk leading to nosocomial infections and increasing antibiotic resistance [4]-[5]. One of the methods to detect the presence of bacteria on textiles is the use of inverse phase-contrast microscopy. However, not all dyes are suitable for this purpose, as they can, for example, stain the cotton fibers, as well as the bacterial cells, such as crystal violet dye [6]. On the other hand, some fluorescent dyes can emit fluorescence through bacteria-specific reactions and interactions and overcome the limitations of conventional detection methods [7]. The advantage of this approach is a fast and reliable method, that allows quantification of the bacteria on the surface.

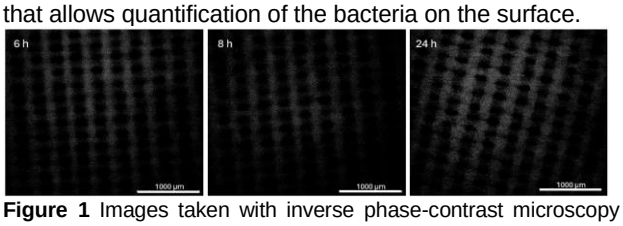

Figure 1 Images taken with inverse phase-contrast microscopy with FDA fluorescent dye.

In our study, the SYTO9 dye did not showed to be appropriate as the background fluorescence blurred the bacterial signal at low bacterial cell load, thus enabling *E. coli* growth kinetic evaluation at the initial time intervals. Contrary, introducing the FDA dye enabled images with good contrast between the background and bacterial cells even at their low concentrations (Figure 1). Accordingly, the CTFC values were used to create the bacterial growth curve within time intervals of 1, 4, 6, 8 and 24 hours, showing that the FDA dye was sufficiently utilized regardless of the age/number of the bacterial cells (Figure 2).

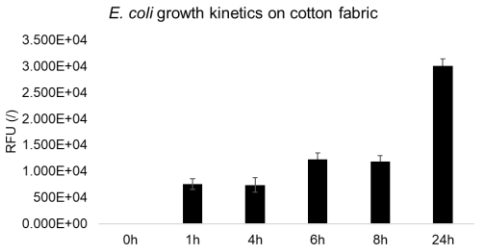

Figure 2 *E. coli* growth kinetics on cotton fabric (in RFU – relative fluorescence units).

This leads to the conclusion that the fluorescent dye FDA is more suitable than SYTO9 for determining the growth kinetics on the cotton fabric.

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