# THE USE OF SURFACE-ACTIVE SUBSTANCES SYNTHESIZED BY *RHODOCOCCUS ERYTHROPOLIS* IMV AC-5017 ON INDUSTRIAL WASTE FOR THE DESTRUCTION OF BACTERIAL AND YEAST BIOFILMS

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**Introduction.** There is an increasing interest to microbial surfactants vs synthetic analogues due to advantages (biodegradability, lack of toxicity, stable physical and chemical properties in a wide range of temperatures and pH) [1] and unique biological properties of first [2, 3]. Thus, the possibility of using surfactants of microbial origin in the oil and mining, chemical, food industries, agriculture, and environmental technologies has already been established.

Although at present the effectiveness of biotechnology methods for obtaining surfactants is low due to the high cost of the products of microbial synthesis. A possible solution is to use industrial waste (that are available in large quantities) as substrates [4].

In our previous studies [5, 6] a possibility of synthesis of surfactants by *Rhodococcus erythropolis* IMV Ac-5017 on waste from biodiesel production and refried sunflower oil was found. However, to date, an anti-adhesive activity of surfactants synthesized on these toxic wastes has not been studied.

Therefore, the **objective of this work** is to study how surfactants, synthesized by *R. erythropolis* IMV Ac-5017 on waste from biodiesel production and refried sunflower oil, influence on biofilms destruction.

**Material and methods.** *Rhodococcus erythropolis* IMV Ac-5017 was cultivation in a liquid mineral medium. The following compounds were used as a carbon source (2 % volume fraction): refined glycerol; waste from biodiesel production (Komsomol Biofuel Plant, Poltava region, Ukraine), refined sunflower oil (TM «Oleyna», Ukraine), waste mixed sunflower oil after frying meat, potatoes, onions, cheese (from RocketPub fast food restaurants, Kyiv, Ukraine).The surfactants were extracted from the supernatant of cultural liquid by a Folch mixture. The degree of biofilms destruction were determined by spectrophotometric method.

**Results.** The ability of surfactants to destroy the biofilms, depended on the nature of the growth substrate, the concentration of surfactants and the type of test culture.

The degree of destruction of bacterial (*Escherichia coli* IEM-1, *Bacillus subtilis* BT-2, *Pseudomonas* sp. MI-2) biofilms by surfactants synthesized on both refined glycerol and waste from biodiesel production was almost the same: 48-72% and 44-73% respectively. While surfactants synthesized on waste oil destroyed such bacterial biofilms more effective (the degree of destruction was 63-73%) than those obtained on refined oil (42-60%). It should be noted that the destruction of bacterial biofilms by 42−76 % was achieved at low concentrations of surfactants (8−15 μg/ml) synthesized on all studied substrates.

Surfactants were equally effective in destroying biofilms (72–80 %) of *Candida albicans* D-6, *Candida utilis* BVS-65, *Candida tropicalis* PE-2 and not depended on the nature of carbon source in the culture medium of *R. erythropolis* IMV Ac-5017. The concentrations of surfactants were 2-4 times higher (30 µg/ml ) than bacterial biofilms. It should be noted that he destruction of yeast biofilms of the genus *Candida* is an urgent problem today, because most modern biocides, including some surfactants, are not effective enough. For example, surfactants synthesized by *Lactobacillus jensenii* P6A and *Lactobacillus gasseri* P65 at a concentration of 180 µg/ml destroyed yeast biofilms only by 25–35 %

To date, in the literature, there is no information about the destruction of biofilms under the action of surfactants synthesized on industrial waste, although there are a large number of works on the ability of microbial surface-active rhamnolipids and lipopeptides to destroy biofilms [7, 8].

**Conclusions**

It was found that surfactants synthesized by *R. erythropolis* IMV Ac-5017 on toxic industrial waste are characterized by high able to destroy bacterial and yeast biofilms. This set of biological properties makes the surfactant strain IMV Ac-5017 promising for practical use. Also, bioconversion of waste from biodiesel production and waste oil into microbial surfactants will help protect the environment from uncontrolled emissions of toxic waste.

**References:**

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