



Influence of environmental factors on the attachment of *Pseudomonas putida* on Devonian clay porous ceramic granules

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Introduction

Nowadays, the study and application of adhesion have taken great importance for biotechnology as one of the methods of cell immobilization for practical needs. Investigations show that porous ceramic carriers can be used in wastewater treatment [1], in environmental bioremediation [2] and in other biotechnological applications. The aim of studies was to detect factors affecting adhesion of bacteria *Pseudomonas putida* on porous ceramic granules.

Materials & Methods

Ceramic granules were prepared and characterized at the Institute of Silicate Materials, Riga Technical University. The main raw material was clay obtained from Latvian clay deposits. Adhesion of *P. putida* MSCL 650 was carried out in the controlled batch experiments. The number of colony-forming units (CFU) of *P. putida* on the Devonian clay granules sintered at temperature of 1100 °C after 1 & 4 h long incubation was estimated.

Results & Discussion

The optimum pH for bacterial adhesion was about 6.0.

Temperature of 30 °C was more appropriate for the adhesion than temperature of 20 °C.

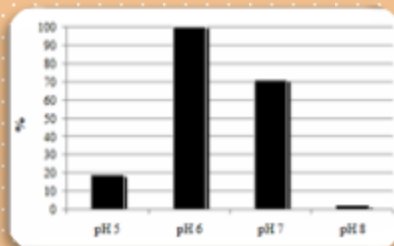
Negative correlation was observed between the number of adhered bacteria and ionic strength ($r = -0.84$) in the medium and between the number of bacterial CFU in the suspension and ionic strength ($r = -0.77$) in the medium over the range from 0 to 200 mM NaCl.

Investigated concentrations of bacterial suspension up to 11 log CFU mL⁻¹ did not reach a saturation of bacteria on the surface of granules.

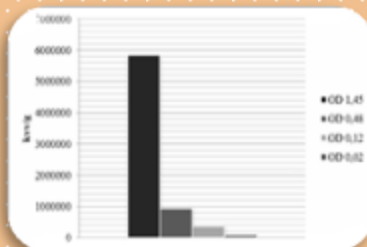
It could be suggested that the adhesion intensity is sufficient for subsequent development of bacterial colonies in adequate environmental conditions.

The characteristic of expanded clay granules

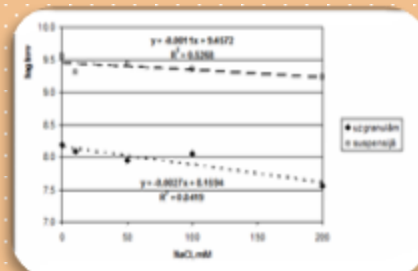
Granulas	Diametr s, cm	Masa, g	Tilpums masa, g/cm ³
Liepa 1150	1.3	1.5	1.30
Liepa 1200	1.4	1.5	1.05
Liepa 1175	1.2	1.2	1.57
Prometajs 1100	1.2	1.2	1.44
Prometajs 1150	1.2	0.5	0.45
Lode 1100	0.6	0.2	1.55



Amount of *P. putida* (%) on „Lode 1100” granules in dependence of medium pH (100 mM Na phosphate buffer).



The efficiency of adhesion according to bacteria concentration.



Concentration of *P. putida* in the suspension and on the granules in dependence of the concentration of NaCl in the medium.

Conclusion

It was detected that the level of bacterial adhesion on ceramic granules significantly ($P < 0.05$) depended on temperature, pH value and ionic strength of the medium as well on the initial bacterial concentration.



References

- [1] Kariminiaae-Hamedani H.R., Kanda K., Kato F., 2003, *Journal of Bioscience and Bioengineering* 95, 128-32.
- [2] Grundmann S., Fuß R., Schmid M., Laschinger M., Ruth B., Schulin R., Munch J.C., Schroll E., 2007, *Chemosphere* 68, 511-7.

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