



UČNI NAČRT PREDMETA / SUBJECT SPECIFICATION	
Predmet:	Biofizikalni aspekti obvladovanja tvorbe biofilmov na dentalnih površinah
Subject Title:	Biophysical Aspects of Biofilm Formation Management on Dental Surfaces

Študijski program in stopnja Study programme and cycle	Študijska smer Study option	Letnik Year of study	Semester Semester
Dentalna medicina/Dental Medicine 2. stopnja/2nd cycle		2	4

Vrsta predmeta / Course type

Izbirni/Elective

Univerzitetna koda predmeta / University subject code:

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Clinical training	Druge oblike študija Other forms of study	Samost. delo Individual work	ECTS
5	35	5			45	3

Nosilec predmeta / Lecturer:

Doc. ddr. Klemen Bohinc

Jeziki /

Predavanja / Lecture: slovenščina/slovene

Languages:

Vaje / Tutorial: slovenščina/slovene

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Prerequisites:

Vsebina:

Content (Syllabus outline):

**Pripravljene vsebinski sklopi:**

- Karakterizacija dentalnih površin (hrapavost, hidrofobnost, naboj).
  - Karakterizacija površin anaerobnih in aerobnih bakterij (hidrofobnost, naboj).
  - Interakcija med bakterijami in dentalnimi površinami (osnove DLVO teorije, modificirane xDLVO teorije).
  - Neposredne in posredne metode dokazovanja bakterijske adhezije na dentalnih površinah (elektronska in konfokalna mikroskopija, barvanja).
  - Tvorba biofilmov (pogoji nastanka, rast in širjenje biofilmov) na dentalnih površinah.
  - Vpliv različnih dentalnih premazov in modifikacij dentalnih površin na adhezijo bakterij in tvorbo biofilmov
  - Vpliv hidrodinamike in dezinfekcijskih sredstev na odstranjevanje biofilmov z dentalnih površin
- Definirani so vsebinski sklopi predavanj. Znotraj teh sklopov si študentje izberejo posamezne tematike, ki jih preštudirajo in jih nato predstavijo ostalim študentom v okviru seminarja. Vsebino skupaj prediskutiramo. Vsebinski okvir je variabilen.

**Proposed topics:**

- Characterization of dental surfaces (roughness, hydrophobicity, charge)
- Characterization of anaerobic and aerobic bacteria (hydrophobicity, charge)
- Interaction between bacteria and dental surfaces (basics of DLVO theory, modified xDLVO theories)
- Direct and indirect methods of bacterial adhesion on dental surfaces (electronic microscopy, confocal microscopy, staining)
- Biofilm formation (conditions for formation, growth and biofilm propagation)
- Influence of different dental surface coatings on bacterial adhesion and biofilm formation
- Influence of disinfection and hydrodynamics on removal of biofilms

Different topics for the lectures are proposed. Students select particular topics, prepare the presentations for other students, and stimulate discussions.

**Temeljni literatura in viri / Textbooks:**

- Norde W, Colloids and Interfaces in Life Sciences and Bionanotechnology, CRC Press, Taylor & Francis, 2nd Edition, 2012.
- Linke D, Goldman A. Bacterial Adhesion. Chemistry, Biology and Physics. Springer, 2011.

**Cilji:**

Na osnovi fizikalnih konceptov osvojiti zakonitosti tvorbe biofilmov na dentalne površine. Opisati pomen področja adhezije. Opredelitev pomena bakterijske adhezije za zagotavljanje dentalnega zdravstva.

**Objectives:**

Based on physical concepts understand physical mechanisms of biofilm formation on dental surfaces. Knowledge of basics in the field of bacterial adhesion. Describing of bacterial adhesion to ensure the dental health.

**Predvideni študijski rezultati:****Intended learning outcomes:**Znanje in razumevanje:

- študent opredeli osnove adhezije in tvorbe biofilmov.
- študent opredeli pomen pogojev, ki opredeljujejo adhezijo.
- študent poveže adhezijo bakterij z mikrobiološkimi vsebinami, fizikalnimi principi in higienskimi pogoji.

Prenesljive/ključne spretnosti in drugi atributi:

Študentje opišejo uporabo biofizikalnih modelov za študij adhezije in tvorbe biofilmov.

Knowledge and Understanding:

- Is able to define the bacterial adhesion and biofilm formation.
- Define the conditions for bacterial adhesion.
- Link the bacterial adhesion with microbiology, physical principals and hygienic conditions .

Transferable/Key Skills and other attributes:

Students describe the use of biophysical models for bacterial adhesion and biofilm formation.

**Metode poučevanja in učenja:****Learning and teaching methods:**

Predavanja  
Seminar  
Vaje (seminarske)

Lectures  
Seminars  
Tutorial (seminar)

**Načini ocenjevanja:****Delež (v %) / Assessment:  
weight (in %)**

Seminarska naloga in zagovor (pisna).	50%	Seminar work (written).
Ustni izpit.	50%	Oral exam.
ŠTUDIJSKE OBVEZNOSTI ŠTUDENTOV: Obvezna prisotnost na seminarjih. Izdelava pisne seminarske naloge in ustna predstavitev seminarske naloge z diskusijo.		ACADEMIC OBLIGATIONS OF STUDENTS: Compulsory participation at seminars. Seminar work written and oral presentation of the seminar work with discussions.
POGOJI ZA PRISTOP K POSAMEZNEMU PREVERJANJU ZNANJA: Pravočasno oddana pisna seminarska naloga. Pravočasno oddana priprava na ustno predstavitev seminarske naloge. Pogoj za ustni izpit je uspešno zagovorjena seminarska naloga.		REQUIREMENTS FOR ACCESS TO INDIVIDUAL KNOWLEDGE CHECKING: Written seminar work which has to be submitted to the lecturer on time. Arrangements of the oral presentation discussed with the lecturer on time. Students can take part in oral exam after successfully defended seminar.

**Reference nosilca / Lecturer's references: doc. ddr. Klemen Bohinc**

1. K. Bohinc, G. Dražič, A. Abram, M. Jevšnik, B. Jeršek, D. Nipič, M. Kurinčič, P. Raspor. Metal surface characteristics dictate bacterial adhesion capacity. *Int J Adhes Adhes* 2016; 68: 39-46.
2. D. Kovačević, R. Pratnekar, K. Godič Torkar, J. Salopek, G. Dražič, A. Abram, K. Bohinc. Influence of polyelectrolyte multilayer properties on bacterial adhesion capacity. *Polymers*, 8(10) ( 2016), 345-1-345-12.
3. E. Preedy, S. Perni, D. Nipič, K. Bohinc, P. Prokopovich, Surface roughness mediated adhesion forces between borosilicate glass and gram-positive bacteria. *Langmuir*, 30(31) (2014) 9466-9476.
4. K. Bohinc, M. Jevšnik, R. Fink, G. Dražič, P. Raspor, Surface characteristics dictate microbial adhesion ability. V: PROKOPOVICH, Polina (ur.). *Biological and pharmaceutical applications of nanomaterials*. Boca Raton: CRC Press: Taylor & Francis, 2016, 193-213.
5. L. Janovák, A. Deák, S.P. Tallosy, D. Sebok E. Csapo, K. Bohinc, A. Abram, I. Palinko, I. Dékány, Hydroxyapatite-enhanced structural, photocatalytic and antibacterial properties of photoreactive TiO<sub>2</sub>/HAp/polyacrylate hybrid thin films *Surface & coatings technology* 326 (2017), 316-326.