Sveučilište u Rijeci
University of Rijeka

BIOtech
Odjel za biotehnologiju
51000 Rijeka, Radmile Matejčić 2
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Detailed curriculum for the course:

Laboratory apprenticeship – Determination of microplastics in seawater

Academic year: 2020/2021

Program: Biotechnology for the Life Sciences (1st year)

Course code: EBLS107

ECTS points: 12

Language of the course: English

Teaching hours: 280 hours (all practical work)

Pre-requisites: Successful completion of BLS103 "Introduction to Laboratory Work and Safety"

Course leader and contact information:

Title and name: Doc. dr. sc. Daniela Kalafatovic
Address: Odjel za biotehnologiju, O-810
E-mail: daniela.kalafatovic@biotech.uniri.hr

Time period: 1st March - 16th April 2021
or
19th April – 4th June 2021

Teaching staff: Course leader:
Doc. dr. sc. Daniela Kalafatovic

Associates:
Patrizia Jankovic, Mag. Pharm. Inv.

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Reading:

Eubeler, J. P.; Bernhard, M.; Knepper, T. P., *Environmental biodegradation of synthetic polymers II. Biodegradation of different polymer groups.* Trac-Trend Anal Chem 2010, 29, (1), 84-100.
Andrady, A. L., *Microplastics in the marine environment*. Mar Pollut Bull 2011, 62, (8), 1596-605.
Duwez, A. S.; Nysten, B., *Mapping Aging Effects on Polymer Surfaces: Specific Detection of Additives by Chemical Force Microscopy*. Langmuir : the ACS journal of surfaces and colloids 2001, 17, (26), 8287-8292.
Gu, J.-D., *Microbiological deterioration and degradation of synthetic polymeric materials: recent research advances*. Int Biodeter Biodegr 2003, 52, (2), 69-91
Fendall, L. S.; Sewell, M. A., *Contributing to marine pollution by washing your face: microplastics in facial cleansers.* Mar Pollut Bull 2009, 58, (8), 1225-8.
Darija Vukić Lušić, D.; Kranjčević, L.; Maćešić, S.; Lušić, D.; Jozić, S.; Linšak, Ž.; Bilajac, L.; *Grbčić, L.; Bilajac, N. Temporal variations analyses and predictive modeling of microbiological seawater quality.* Water Research, 2017, *119, 160-170*

Additional articles, specific to each student's research, may be assigned by the course leader.

Course description:

Synthetic polymers in the form of plastic debris are one of the most significant pollutants in the aquatic environment. Extremely durable, lightweight, and mostly buoyant, plastic particles spread in the aquatic environment and last for several decades. For this reason, it is not surprising that plastic particles are reported in different sizes and shapes in all marine compartments all over the world. In recent years, small plastic particles, so-called microplastics, came into the focus of scientists. The elevated abundance compared to larger particles in marine systems underlines the serious concerns about microplastic particles. These anthropogenic microparticles possibly interfere in natural systems and might be harmful after ingestion by organisms.

The term microplastics was first defined by the scientific community as particles smaller than 5 mm in size at a workshop on the "Occurrence, Effects, and Fate of Microplastic Marine Introduction 7 Debris" in 2009.

The small size of microplastics complicates their determination in environmental samples compared to macroplastics and demands for higher requirements regarding the analytical approaches. Depending on the sampling compartment of the aquatic environment, the application of different sampling methods and sample treatments is necessary. Microplastic particles are generally too small to differentiate them with the naked eye from sediments or floating natural debris.

In this project we will work on identification and determination of microplastic particles in environmental seawater samples and on determining the suitable sampling and spectroscopic methods for their characterisation. This will be part of a major project where the collected experimental data will be used for database creation that will result in prediction model development for estimating the impact of climatic changes on sea pollution.

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During this course, students will spend 8 weeks conducting laboratory work in Dr. Kalafatović's research group. This will begin with basic training in microplastics identification and characterization. This teaching will occur in a "mentorship" situation, with two students being taught at a time. As the skills of the students develop, they will then begin to perform research experiments, using these techniques, to gain novel insight into the research field of synthetic polymers and their identification.

After completion of the course, students will then have the option of continuing their research as a **Research Project** under the mentorship of Dr. Kalafatović or in a different research group of choice.

Learning outcomes:

Students will gain an in-depth theoretical knowledge of the study of peptide nanotechnology through peptide synthesis and characterization. In addition, the students will receive an insight into the application of machine learning methods to peptide design with the aim of searching for function (i.e. catalytic activity). This will come through reading on the subject, discussion with the course leader/mentor and other members of the research group, as well as first-hand experience in the laboratory.

Practically, students will gain significant practical experience at synthesizing peptides, analysing their quality and purity using chromatography techniques, often coupled to mass spectrometry for identification purposes. Options for performing AFM imaging, participation in database building and learning basic machine learning methods will also be available. This will be obtained through guided training, and reinforced through using the techniques to perform genuine research experiments. In this way, the skills learned should become relevant to the students in a research context.

Through work in a research environment, students will also have an opportunity to hone their soft research skills, including searching the academic literature, critical review of papers, experimental design and analysis, and writing of scientific reports.

Requirements, methods of assessment and evaluation:

Students are required to perform work in the laboratory for the duration of the course, as indicated in "Schedule of Classes" below. They will engage fully in the day-to-day activities of the work group, including observing the work of others, engaging in research work of their own, and performing other tasks required for running the laboratory. They are required to keep a laboratory book/journal of their work, written in English, in a manner that is understandable to their supervisor. They will also engage in scientific discussions, lab meetings and/or presentations of their work to the same degree as other members of the research group. They will work at all times in a safe manner, as defined in the course "Introduction to Laboratory Work & Safety" plus any additional safety measures that apply to members of this laboratory.

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Students will receive continuous assessment from the mentor/course leader who will meet with and teach the students on a regular basis. In this way, the student will both be assessed, and receive continuous feedback concerning their work. At the end of the course, the mentor will submit a report on their work and progress at the end of the course. The mentor's report, and accompanying grade, will account for 50% of the student's grade for the course.

Additionally, at the end of the course, the student will submit a short report (approximately 3 pages), detailing the area that they worked in, the experiments they performed, any results they obtained, and skills that they learned and used. This report will then be assessed by the mentor and one other member of faculty, who will together agree on a grade for the remaining 50% of the course.

Qualification and grades (according to the *University of Rijeka Study Regulations*):

The following grades will be awarded based on the final score:

Percentage score	ECTS grade	Numerical grade
90% to 100%	A	Excellent (5)
75% to 89.9%	B	Very good (4)
60% to 74.9%	C	Good (3)
50% to 59.9%	D	Satisfactory (2)
0% to 49.9%	F	Unsatisfactory (1)

The final grade is based on the sum of percentage points accumulated during the course. Passing grades are excellent (5), very good (4), good (3) and satisfactory (2).

Schedule of classes:

Daily, from 9:00-12:00 and 13:00-17:00, every weekday, either from 01.03.2021 to 16.04.2021, or from 19.04.2021 to 31.05.2021 (excluding national and University holidays). All work will be performed in laboratories O-149 and O-276, unless otherwise indicated by the course leader/supervisor. Variations in exactly which hours are worked can be made with the agreement of the course leader/supervisor. Some laboratory time may be replaced with private study and background reading, subject to the requirements of the research performed, and with the agreement of the course leader/supervisor.

Additional information:

Academic integrity

Students are required to respect the principles of academic integrity, and refer to the documents: *Ethics Guidelines of the University of Rijeka* and the *Ethics Guidelines for Students*.