Univerza v Mariboru

Fakulteta za naravoslovje in matematiko

| UČNI NAČRT PREDMETA / COURSE SYLLABUS | |
|---|---|
| **Predmet:** | Okoljska ocena tveganja in zastrupitve okolja |
| **Course title:** | Environmetal Risk Assessment and Environmental Intoxications |

| **Študijski program in stopnja Study programme and level** | **Študijska smer Study field** | **Letnik Academic year** | **Semester Semester** |
|---|---|---|---|
| Biologija in ekologija z naravovarstvom, 2. stopnja | | **1/2** | **Poletni/ Zimski** |
| Biology and Ecology with Nature Conservation, 2nd cycle | | **1/2** | **Summer/ Winter** |

**Vrsta predmeta / Course type** Izbirni/Optional

**Univerzitetna koda predmeta / University course code:**

| **Predavanja Lectures** | **Seminar Seminar** | **Vaje Tutorial** | **Klinične vaje work** | **Druge oblike študija** | **Samost. delo Individ. work** | **ECTS** |
|---|---|---|---|---|---|---|
| **20** | **10** | **15** | | | **135** | **180/6** |

**Nosilec predmeta / Lecturer:** Boris Kolar

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|---|---|---|
| **Jeziki / Languages:** | **Predavanja / Lectures:** | **Slovensko/Angleško Slovenian/English** |
| | **Vaje / Tutorial:** | **Slovensko/Angleško Slovenian/English** |

| **Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:** | **Prerequisites:** |
|---|---|
| Jih ni. | No prerequisites. |

| **Vsebina:** | **Content (Syllabus outline):** |
|---|---|
| 1. Okoljska ocena tveganja, kdaj, kje, zakaj. Kdaj pri kemijskih snoveh ocenjujemo nevarnost in kdaj tveganje. Okoljska ocena tveganja kemijskih snovi : definicija in pravni okvirji v EU.<br>2. Lastnosti snovi, ki se izražajo v okolju: porazdelitev snovi, obnašanje in usoda v okolju, učinki na žive organizme. | 1. Environmental risk assessment, when, where, why. Hazard and risk in the assessment of chemical substances. Environmental risk assessment of chemical substances: definition and legal frameworks in EU.<br>2. Intrinsic properties that might be expressed in the environment: |

3. Učinki snovi na organizme, združbe in ekosisteme. Testiranje intrinzičnih lastnosti snovi.
4. Koncept okoljske ocene tveganja: izpostavljenost vs učinek.
   Cilji zaščite: populacije, združbe, tla, površinske vode, podzemne vode, sediment.
5. Orodja za pripravo okoljske ocene tveganja: EUSES in EPIWIN.
6. Ocena izpostavljenosti:
   Emisije snovi in njihova porazdelitev v okolju,
7. Izračun predvidene okoljske koncentracije snovi; modeli za izračun izpostavljenosti. FOCUS modeli izpostavljenosti.
8. Ocena učinka: evaluacija relevantnih ekotoksikoloških testov.
9. Ekstrapolacija rezultatov in negotovost, razmerje tveganja, omilitveni ukrepi
   Primeri okoljske ocene tveganja: veterinarska zdravila (primer diklofenaka in tveganje za populacije nekrofagih ptic) v Evropi, kokcidiostaiki v kurjem gnoju.
10. Največji izzivi na področju okoljskih tveganj, ki ga predstavljajo kemijske snovi, v svetovnem merilu, v EU in v Sloveniji.
    Primer preiskave bioakumulacije : PCB v Krupi v jugovzhodni Sloveniji
11. Primer okoljske ocene tveganja z uporabo »*in silico*« orodij: QSAR v oceni tveganja za snovmi s pomanjkljivim naborom podatkov.
12. Okoljski standardi kakovosti za površinske vode – določitev mejnih vrednosti v EU in Sloveniji.
13. Določitev mejne vrednosti za nitrate v podzemni vodi kot habitatu človeške ribice.
14. Okoljske nesreče in zastrupitve okolja
15. Terenske preiskave okoljskih nesreč in zastrupitev okolja, laboratorijske preiskave, Upravljanje s tveganji - predlog ukrepov, nadzor ukrepov.

distribution, fate and behaviour, effects on biota.

3. Effects of substances on the organisms, communities and ecosystems. Testing of intrinsic properties of substances.
4. The concept of the environmental risk assessment: exposure vs effect.
   Goals of protection: populations, communities, environmental compartments
5. Tools used in the environmental risk assessment: QSAR; EUSES; EPIWIN.
6. Exposure assessment: Emission of substances and environmental distribution.
7. Predicted environmental concentration calculation; models used in the exposure calculation. FOCUS exposure models
8. Effect assessment: evaluation of relevant ecotoxicological testing.
9. Extrapolation of results and uncertainty; risk characterization ratio, risk mitigation measures. Case study: Environmental risk assessment of veterinary medicines-diclofenac in necrophagous birds in EU, coccidiostats in chicken manure.
10. Challenges in environmental risk assessment for chemical substances on the planetarian scale, in EU and in Slovenia.
    Case study: bioaccumulation of PCBs in Krupa in the SE Slovenia.
11. Case study: an example of environmental risk assessment using the »*in silico*« tools. QSAR in the risk assessment with an insufficient data set.
12. Environmental quality standards for surface waters – setting the risk limits in EU and Slovenia.
13. Case study: setting the groundwater risk limits for the *Proteus anguinus*
14. Environmental accidents and intoxication of the environmental compartments.
15. Field investigation and indoor survey; Risk management- proposal of risk

16. Okoljske nesreče: zastrupitev vodnega okolja: zastrupitev Slivniškega jezera z endrinom
17. Okoljske nesreče: zastrupitev ptic na Dravskem polju, zastrupitev čebel.
18. Zastrupitve vodnega okolja zaradi biogenih vzrokov(cijanobakterijsko cvetenje in aviarni butulizem).

mitigation measures, surveillance over the measures.
16. Case study: endrin intoxication of the lake Slivniško jezero
17. Case study: intoxication of birds on Dravsko polje, intoxication of bees.
18. Environmental intoxication due to the cyanobacterial bloom and avian botulism.

**Temeljni literatura in viri / Readings:**

Temeljna literatura / Basic:

C.J. van Leeuwen, and T.G. Vermeire. 2007. Risk Assessment of Chemicals: An Introduction. Second Edi. eds. C.J. van Leeuwen and T.G. Vermeire. Springer.

Priporočena literatura / Recommended:

ECHA. 2008. Guidance on Information Requirements and Chemical Safety Assessment Chapter R . 10 : Characterisation of Dose [ Concentration ] -Response for Environment May 2008.

European Commission. 2011. Technical Guidance For Deriving Environmental Quality Standards.

Študentje bodo ob predavanjih in med vajami uporabljali še prosto dostopna računalniška orodja:

EUSES (The European Union System for the Evaluation of Substances)
https://ec.europa.eu/jrc/en/scientific-tool/european-union-system-evaluation-substances

EPI Suite™ - Estimation Program Interface v 4.11
https://www.epa.gov/tsca-screening-tools/download-epi-suitetm-estimation-program-interface-v411

ETX 2.0. A Program to Calculate Hazardous Concentrations and Fraction Affected, Based on Normally Distributed Toxicity Data
https://rvs.rivm.nl/risicobeoordeling/modellen-voor-risicobeoordeling/ETX

**Cilji in kompetence:**

Cilj slušateljev je znanje in razumevanje:

1. Razumevanje osnov okoljske ocene tveganja za kemijske snovi skladno z metodologijami v EU,
2. Poznavanje osnov okoljskega modeliranja izpostavljenosti
3. Vrednotenje rezultatov ekotoksikoloških preiskav in podatkov iz literature.
4. Poznavanje metodologije za pripravo predloga okoljskega standarda kakovosti za površinske vode v EU.

**Objectives and competences:**

General objectives and competence of students is knowledge and understanding of

1. Understanding of basic principles of environmental risk assessment for substances in EU.
2. Basic knowledge of modelling of exposure of substances.
3. Knowledge on evaluation of ecotoxicological results and public literature data.
4. Acquaintance with the methodology for deriving environmental quality standards for surface waters in EU.

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|---|---|
| 5. Poznavanje in seznanjenost z računalniškimi orodij za pripravo okoljske ocene tveganja.<br>6. Poznavanje mehanizmov delovanja najpomembnejših onesnaževal v okolju<br>7. Seznanjenost s principi ukrepanja v primerih zastrupitev okolja | 5. Familiarity with »In silico« tools in environmental risk assessment.<br>6. Knowledge on the fate, behaviour and the effects of most relevant environmental contaminants.<br>7. Acquaintance with the procedures and principles of interventions in the case of intoxication of environmental compartment. |

| **Predvideni študijski rezultati:** | **Intended learning outcomes:** |
|---|---|
| Po uspešno opravljeni učni enoti bodo študenti zmožni:<br>1. Izdelati okoljsko oceno tveganja za kemijske snovi v EU<br>2. Izračunati okoljsko izpostavljenost.<br>3. Zbrati in ovrednotiti potrebne rezultate ekotoksikoloških preiskav in podatkov iz literature, na osnovi podatkov določiti toksični učinek kemijske snovi.<br>4. Izdelati predlog okoljskega standarda kakovosti za kemijsko snov v površinskih vodah, članicah EU.<br>5. Pojasniti delovanje najpomembnejših okoljskih onesnaževal .<br>6. Pripraviti načrt za preiskavo vzrokov za zastrupitve okolja<br>7. Predlagati ukrepe med intervencijo v primeru zastrupitve okolja<br>8. Predlagati ukrepe po intervenciji v primeru zastrupitve okolja. | By the end of this course students would be able to:<br>1. Prepare the assessment of the environmental risks for chemical substance in EU.<br>2. Calculate the environmental exposure.<br>3. Select and validate results of the ecotoxicological tests and literature data, assess the toxicological effect based on the selected data.<br>4. Prepare the proposal for the environmental quality standard for chemical substance in surface water within EU member states.<br>5. Explain the mode of action of the relevant contaminants.<br>6. Prepare the plan for the investigation in the case of intoxication of the environmental compartment.<br>7. Propose the measures during intervention.<br>8. Propose the measures after the intervention. |

| **Metode poučevanja in učenja:** | **Learning and teaching methods:** |
|---|---|
| Predavanja<br>Seminarsko delo<br>Laboratorijske vaje | Lecutres<br>Seminars<br>Laboratory exercise |

| Načini ocenjevanja: | Delež (v %) / Weight (in %) | Assessment: |
|---|---|---|
| Znanje študenta se izkazuje na osnovi izdelka ob zaključku laboratorijskega dela, v obliki seminarske naloge ter med ustnim zagovorom. Izpit iz predmeta se šteje kot opravljen, ko so pridobljene vse tri pozitivne ocene. Te v opisanem vrstnem redu h končni oceni prispevajo delež po naslednjem ključu: | | The student knowledge is demonstrated with the delivered product at the end of laboratory practice, with the seminar essay, and during the oral examination. The required knowledge level is proven with three positive marks. These should contribute to the final score and be obtained in the following order and pondered according to the presented key: |
| 1. Laboratorijsko delo | **10** | 1. Laboratory work |
| 2. Projektna seminarska naloga | **30** | 2. Project oriented seminar essay |
| 3. Ustni izpit | **60** | 3. Oral examination |

**Reference nosilca / Lecturer's references:**


Kolar, B., Arnuš, L., Jeretin, B., Gutmaher, A., Drobne, D. & Durjava, M. K. 2014. The toxic effect of oxytetracycline and trimethoprim in the aquatic environment. Chemosphere, 115, 75–80. http://doi.org/10.1016/j.chemosphere.2014.02.049

Kolar, B., Arnuš, L., Križanec, B., Peijnenburg, W. & Durjava, M. K. 2016. Bioaccumulation of Polybrominated Diphenyl Ethers by Tubifex Tubifex. Acta Chimicha Slovenica, 63,3:, 678–687. http://doi.org/10.17344/acsi.2016.2617

Kolar, B. & Finizio, A. 2017. Assessment of environmental risks to groundwater ecosystems related to use of veterinary medicinal products. Regulatory Toxicology and Pharmacology, 88, 303–309. http://doi.org/10.1016/j.yrtph.2017.02.009

Kolar, B., Schefferlie, J. & Holzhauser-Alberti, Michael Rubio Montejano, C. 2014. CVMP assessment report under Article 30 ( 3 ) of Regulation ( EC ) No 726 / 2004 On the risk to vultures and other necrophagous bird populations in the European Union in connection with the use of veterinary medicinal products containing the substance dic (Vol. 30).

KOLAR, Boris. The threshold concentration for nitrate in groundwater as a habitat of Proteus anguinus = Mejne koncentracijske vrednost za nitrat v podzemni vodi kot okolju močerila. *Natura Sloveniae : revija za terensko biologijo*, ISSN 1580-0814. [Tiskana izd.], 2018, letn. 20, št. 2, str. 39-42, ilustr. [COBISS.SI-ID5064783]