# Umweltbiotechnologische Verfahren
*(Air, Water & Soil Purification Processes)*

<table>
<thead>
<tr>
<th>Relevance for ResEngin curriculum</th>
<th>compulsory elective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration</td>
<td>Administration</td>
</tr>
<tr>
<td>Contact</td>
<td>Contact</td>
</tr>
<tr>
<td>Inst. f. Ing. biologie &amp; Biotechn. d. Abwassers</td>
<td><a href="mailto:josef.winter@kit.edu">josef.winter@kit.edu</a></td>
</tr>
</tbody>
</table>

### Term(s) offered
2nd (Summer Apr–Sept)

### Duration | Cycle
1 term; every year

### Language of instruction
German

### Prerequisites
Bachelor, German language proficiency at DSH level

### Module coordinator
**Winter, Dr.rer.nat. habil. Josef, Ord.; IBA**

### Learning outcomes
Description see p. 2.

### Literature / Course materials
Reference list see p. 3.

### Basis for module(s)
not applicable

### Intersection with module(s)
M 2 Waste & Waste Water Technologies

<table>
<thead>
<tr>
<th>Lecture courses</th>
<th>Duration (CP)</th>
<th>Workload specification (ECTS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>19251 Abluftreinigung (lecture)</td>
<td>1.5 CP</td>
<td>5 x 30 h 150 h</td>
</tr>
<tr>
<td>19xxx Bodensanierung (lecture)</td>
<td>1.5 CP</td>
<td></td>
</tr>
<tr>
<td>19244 Industrieabwasserreinigung (lecture)</td>
<td>2.0 CP</td>
<td></td>
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</tbody>
</table>

**SUM 5.0 CP 4 WCH**

### Workload specification
(30 work hours→1 CP acc. to ECTS) 5 x 30 h 150 h

<table>
<thead>
<tr>
<th>Lecture Phase</th>
<th>Contact hours</th>
<th>42.0 h</th>
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</thead>
<tbody>
<tr>
<td>Self instruction</td>
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<td>63.0 h</td>
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<table>
<thead>
<tr>
<th>Exam Phase</th>
<th>Self instruction</th>
<th>45.0 h</th>
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</thead>
</table>

### Module examination(s)
(mode | scope | weighting)

<table>
<thead>
<tr>
<th>“Abluftreinigung”</th>
<th>oral</th>
<th>15 min</th>
<th>1.5/5.0 CP</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Bodensanierung”</td>
<td>oral</td>
<td>15 min</td>
<td>1.5/5.0 CP</td>
</tr>
<tr>
<td>“Industrieabwasserreinigung”</td>
<td>oral</td>
<td>30 min</td>
<td>2.0/5.0 CP</td>
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</tbody>
</table>

### Lecturers
(in alphabetic order)
- Gallert, PD Dr.rer.nat. Claudia; IBA
- Winter, Dr.rer.nat. habil. Josef, Ord.; IBA

### Individual lecture courses
Descriptions + Recommended background knowledge see pp. 4.
Module T2a: “Air, Water & Soil Purification Processes” (cont.)

Module topic

An appropriate choice of (a) off-gas purification processes for specific types of pollution and industry; (b) remediation processes and a choice of suitable processes for specific types of pollution. Problems of industrial wastewater treatment.

Learning outcomes

Disciplinary knowledge

- concepts, theories & definitions
  Off-gas characterization and measurement, legal aspects, different treatment options and examples from different industries. Characterization of the main pollutants (PAK, BTEX, hydrocarbons, pesticides, heavy metals), soil characteristics and treatment options for different types of contaminated soils. Differences between domestic and industrial wastewater treatment, characterization of wastewater from food and paper industries, process concepts for industrial wastewater purification.

- subject matter (factual data, examples)
  Established methods for cleaning waste air or off-gas from different fields using physical/thermal, chemical or biological processes. Established methods to remediate polluted soil in-situ or ex-situ with thermal, physico-chemical or biological processes according to the legal requirements. Modern reactors for industrial wastewater purification.

- methods & procedures
  Technically applied methods and processes to purify air with filters, washers, etc. Incineration, soil washing/extraction, land farming, reactor technologies, natural attenuation, phytoremediation. UASB/EGSB reactors, anaerobic filters, fixed-bed reactors and applicability for different types of wastewaters, problems and solutions.

Professional skills

- Understanding of the different processes and decision making.
- Planning remediation processes.
- To define process solutions for different industries. To learn how to proceed with basic engineering to design an industrial plant.

Personal competence

- Critical evaluation of process applicability and treatment costs
- Knowledge of technologies to improve environmental quality
Module T2a: “Air, Water & Soil Purification Processes” (cont.)

Literature/ Course material


Lecture notes
- “Abluftreinigung”
- “Bodensanierung”
- “Industrieabwasserreinigung”
**Course**

### Module T2a

<table>
<thead>
<tr>
<th>Course topic</th>
<th>Abluftreinigung (Off-Gas Purification)</th>
</tr>
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</table>

<table>
<thead>
<tr>
<th>KIT lecture ID</th>
<th>19251</th>
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<tr>
<td>Relevance</td>
<td>compulsory elective</td>
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<td>Prerequisites</td>
<td>Bachelor, German proficiency (DSH level)</td>
</tr>
<tr>
<td>Term(s)</td>
<td>2&lt;sup&gt;nd&lt;/sup&gt; term (summer)</td>
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<tr>
<td>Language</td>
<td>German</td>
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<tr>
<td>Training mode</td>
<td>Lecture, 1 WCH</td>
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<tr>
<td>Workload</td>
<td>1.5 CP ⇒ 45.0 h</td>
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#### Workload specification

<table>
<thead>
<tr>
<th><strong>LECTURE PHASE</strong></th>
<th><strong>EXAM PHASE</strong></th>
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<tbody>
<tr>
<td>Contact (based on 1 WCH)</td>
<td>Self-instruction</td>
</tr>
<tr>
<td>10.5 h</td>
<td>21.0 h</td>
</tr>
<tr>
<td>Self-instruction</td>
<td>13.5 h</td>
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**Contact**

**GALLERT, PD Dr.rer.nat. Claudia; IBA**

- Appropriate choice of an off-gas purification process for a specific type of pollution and industry.
- Recommended background knowledge
  - Fundamentals of biology, chemistry, process engineering.

#### Disciplinary knowledge

- **concepts, theories & definitions**
  - off-gas characterization and measurement, legal aspects, different treatment options and examples from different industries.
- **subject matter (factual data, examples)**
  - established methods for cleaning waste air or off-gas from different fields using physical/thermal, chemical or biological processes.
- **methods & procedures**
  - technically applied methods and processes to purify air with filters, washers, etc.

#### Professional skills

- Understanding of the different processes and decision making.

#### Personal competence

- Critical evaluation of process applicability.

**Assessment specification**

- **written** ---
- **oral** 15 min = partial module exam "Abluftreinigung"
- **other** ---

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*WCH = Weekly Contact Hours*
**Module T2a**

**Umweltbiotechnologische Verfahren**  
(Air, Water & Soil Purification Processes)

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**Course**

**Bodensanierung**  
(Soil Remediation)

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<table>
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<th>xxxxx</th>
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**Workload specification**

<table>
<thead>
<tr>
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<td></td>
<td>Self instruction</td>
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<tr>
<td><strong>EXAM PHASE</strong></td>
<td>Self-instruction</td>
<td>13.5 h</td>
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**Contact**

claudia.gallert@kit.edu

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**Lecturer(s)**

GALLERT, PD Dr.rer.nat. Claudia; IBA

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**Course topic**

Remediation processes and a choice of a suitable process for a specific type of pollution.

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**Recommended background knowledge**

Fundamentals of biology, chemistry, process engineering and ecology

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**Learning outcomes**

**Disciplinary knowledge**

- **concepts, theories & definitions**
  characterization of the main pollutants (PAK, BTEX, hydrocarbons, pesticides, heavy metals), soil characteristics and treatment options for different types of contaminated soils.

- **subject matter (factual data, examples)**
  established methods to remediate polluted soil in-situ or ex-situ with thermal, physico-chemical or biological processes according to the legal requirements.

- **methods & procedures**
  incineration, soil washing/extraction, land farming, reactor technologies, natural attenuation, phytoremediation.

**Professional skills**

Planning remediation processes.

**Personal competence**

Critical evaluation of process applicability and treatment costs.

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**Assessment specification**

written ---
oral 15 min = partial module exam “Bodensanierung”
other ---

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* WCH = Weekly Contact Hours
Module T2a
Umweltbiotechnologische Verfahren
(Air, Water & Soil Purification Processes)

Course
Industrieabwasserreinigung
(Treatment of Industrial Wastewater)

<table>
<thead>
<tr>
<th>KIT lecture ID</th>
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**Workload specification**

<table>
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<th>LECTURE PHASE</th>
<th>EXAM PHASE</th>
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</thead>
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</tr>
<tr>
<td>Self instruction</td>
<td>21.0 h</td>
<td>18.0 h</td>
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**Contact**

josef.winter@kit.edu

**Lecturer(s)**

WINTER, Dr. rer. nat. habil. Josef, Ord.; IBA

**Course topic**

Problems of industrial wastewater treatment; relevant for various branches of industry such as milk-/cheese industry, starch, cellulose or paper industry.

**Recommended background knowledge**

Fundamentals of biology, inorganic and organic chemistry and process engineering

**Learning outcomes**

**Disciplinary knowledge**

- concepts, theories & definitions
  Differences between domestic and industrial wastewater treatment, characterization of wastewater from food and paper industries, process concepts for industrial wastewater purification.

- subject matter (factual data, examples)
  modern reactors for industrial wastewater purification.

- methods & procedures
  UASB/EGSB reactors, anaerobic filters, fixed-bed reactors and applicability for different types of wastewaters, problems and solutions.

**Professional skills**

To define process solutions for different industries. To learn how to proceed with basic engineering to design an industrial plant.

**Personal competence**

Knowledge of technologies to improve environmental quality.

**Assessment specification**

written ---
oral 30 min = partial module exam "Industrieabwasserreinigung"
other ---