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| **Date revised: 13.10.21** | Revised by: Anne K Streitlien |
| **Date Signed :** | |

**Unit:** Department of Biotechnology and Food Science. Chemical analysis, Akrinn.

Analytical lab TU1.351 and Felleslab TU1.402 with associated rooms.

**Line manager: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Participants in the identification process** (incl. funtion)**: You (Bc.sstudent/ M.student / PhD/ researcher), Supervisor (Professor)**

**Short description of main activity/main process:**

Various chemical and physical analyses, as well as the use of facilities and analytical instruments at IBT Kalvskinnet.

NB! This is a collection of example activities. Adjust your assessment of probability and consequences in accordance with the work and analyses you plan on doing. Kindly send risk assessment for work operations that are inadequate or not found in this document by e-mail to the lab coordinator: anne.k.streitlien@ntnu.no

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| **Student/ employee/ guest** | | **Responsible supervisor/ Manager** | |
|  |  |  |  |
| *Name (block letters)* | *Signature* | *Name (block letters)* | *Signature* |

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| --- | --- | --- | --- | --- | --- | --- |
| **ID nr.** | **Activity/ Process** | **Existing documentation** | **Existing safety measures** | **Allowed to work alone?**  **(Y/N)** | **Required to registrer in exposure register (E) or health examination (H)?**  **(E/H)** | **Comments, legislation, etc.** |
|  | All laboratory work | [Laboratory and workshop handbook NTNU](https://innsida.ntnu.no/wiki/-/wiki/English/Laboratory+and+workshop+handbook), Lab rules, Risk assessments, EcoOnline chemical substance index, Signed training documentation | Independent work in the laboratories is not allowed until training is given. The lab rules are to be read and signed, risk assessments are to be written in cooperation with supervisor. Observe safety rules in accordance with risk assessment. Lab coats and protective eye wear are mandatory at all times in the laboratories. |  |  |  |
| 1 | Work with chemicals | Workplace Regulations, Safety Data Sheets (SDS), EcoOnline chemical substance index, signed labrules | Lab coats and glasses are mandatory for all stays in the laboratories. The work is carried out in accordance with SDS, and if necessary, appropriate protective equipment is used. Fume hood or moveable extractor hood is used when neccesary, depending on the chemical. Nitrile gloves (blue,disposable) are available in all labs. Selfmade solutions in non-original containers are labelled according to IBT routine (see activity 2 below) | Yes | Evaluate each case | Nitrile gloves in most cases provide adequate protection, but suitability should always be assessed based on safety data sheets and working method |
| 2 | Own chemical solutions. Marking, storing and disposal. | Safety data sheets, EU Regulation on classification, labelling and packaging of substances and mixtures 1272/2008,Waste Regulations | All solutions in non-original containers are labelled with chemical names, concentration, hazard pictograms, date of making, and name of owner (see signature list) or "Felles" (shared). Storage and disposal must take place in accordance with SDS, regulations and NTNU's routines in general. Contact the lab coordinator or supervisor if uncertain. | Yes | Evaluate each case | All surplus of "own" chemicals and solutions that can be used by others is handed over to the lab coordinator. Different waste containers are used for different waste, remember to clearly label these. Avoid mixing non-compliant chemicals! |
| 3 | Fume hood, use of | User’s manual, wiki “[Working with fume cupboards](https://innsida.ntnu.no/wiki/-/wiki/English/Working+with+fume+cupboards)” on Innsida | Check that the air flow is at least 0.4 m/s and that the display lamp is green. The airflow can be increased if necessary by pressing the fan symbol with a plus sign.  Minimize opening when not in use. When using, keep opening as small as possible to avoid exposure. Clean and tidy the fume hood after use, it is not to be used for long time storage. Yearly control/ service | Yes | Evaluate each case |  |
| 4 | Pipetting | Working Environment Act | Pipetting is performed according to a dynamic work routine, with regular breaks | Yes | No |  |
| 5 | Laboratory dishwashing machine, use of | User manual | Dishwasher is used according to user manual. Avoid inhaling dust from dishwashing powder | Yes | No | No particular risk. Optional use of face mask. |
| 6 | Centrifugation | User manual, instructions for use | Centrifuge is used in accordance with the user manual and operating instructions. Ensure accurate balancing, correct rotor mounting, suitable adapter, and avoid exceeding G-force for each type of tube. Turn off after use. | Yes | No |  |
| 7 | Glass equipment, use of |  | Care is exercised when using glass equipment. Gloves are worn if necessary. Broken glass (not contaminated) is disposed of in separate container | Yes | No |  |
| 8 | pH- adjustments | User manual, Chemical Regulations | When adjusting pH with concentrated acid/base, use nitrile gloves and suitable safety equipment. Use suitable shoes or shoe bags. Moveable extraction hood/ fume hood is used if necessary. | Yes | No |  |
| 9 | Heating oven, use of | Instructions for use | If necessary, heat-protective gloves or metal tongs are used. Turn off heating oven after use. | Yes | No |  |
| 10 | Water bath, use of | Instructions for use | The water baths are equipped with a “Hot” hazard label and have an alarm for low water level and deviant temperature. Use the timer function if necessary. If the water bath is heated to temp above 70°C, mark with extra warning “Hot”. Lowering and raising equipment from water baths is carried out with caution, and with the use of heat-protective gloves, metal tongs or similar. Switch off water bath after use and pull out the plug. | Yes | No |  |
| 11 | Hotplate/ heating plate, magnetic stirrer with heating | Instructions for use | The use of hotplates and other heating devices is carried out with caution. Do not touch or move the hotplate until it has cooled down. Switch off hotplates after use and pull out the plug. Mark with warning “Hot” if left unattended prior to cooling. | Yes | No |  |
| 12 | Cryogenic gases/ liquids e.g. liquid nitrogen, work with and transport of | Laboratory and Workshop Handbook NTNU | Face protection and cold- insulating gloves, as well as easily removable shoes (not boots) are used. Avoid closing container tightly due to risk of overpressure. Ensure good ventilation. In case of transport, a separate tank with a loose-fitting cork for liquid nitrogen is used, placed on a cradle rack. No one is allowed to take an elevator together with the transport tank. | Yes | No |  |
| 13 | Spectrophotometer, use of | User manual, instructions for use | The samples are inserted and taken out with care. Avoid exposure to UV light to the greatest extent possible | Yes | No |  |
| 14 | Hydrolysis degree, (formol titration), analysis of | Chemical Regulations, safety data sheets, analytical procedure | Formol titration is carried out in fume hood using necessary protective equipment. Special care is exercised when handling formaldehyde, which is stored locked up and handled exclusively with nitrile gloves. Exposure is to be limited as much as possible. Contaminated single-use equipmet is collected and disposed of as risk waste (red box). Liquid end waste is not to be mixed with other, collect in separate container. | Yes | Yes (E) | Solo work only permitted after training and by agreement with the responsible professional. Exposure time for formaldehyde must be registered in the exposure register (ECO) |
| 15 | Lipid content (Bligh & Dyer), analysis and extraction of | Chemical Regulations, safety data sheets, analytical procedure | Bligh &Dyer is carried out in fume hood using necessary protective equipment. The addition of chloroform and methanol is carried out using dispensers. The samples are stored on ice to avoid evaporation of chloroform. Outside of the fume hood, all samples are stored in closed containers. End waste is collected and classified as 7041 "solvent with halogen" | Yes | No |  |
| 16 | Kjeldahl analysis (protein content), digestion, distillation and titration | Chemical Regulations, safety data sheets, user manual, analytical procedure | Thorough training is given before using the Kjeldahl instrument. Heat protective gloves are used if necessary. The addition of sulfuric acid is carried out in fume hood using a dispenser. Digestion heater is placed in fume hood, connected to water suction and scrubber that removes and neutralizes acid vapors. Automatic lift for sample rack. Samples are cooled in fume hood. There is no need for manual handling of tubes during distillation/ titration, due to automatic sample handling. All solutions are kept in closed containers. There are several built- in sensors to stop the run if hatches are opened during operation. | Yes | No | Pregnant women should not work with boric acid in a pure form as this may damage fertility or the unborn child (H360). 4% boric acid solution is not subject to labelling.  After analysis, the waste solution can be poured in the sink whilst using a moveable extraction hood. |
| 17 | ACE inhibitory effect (Cushman &Cheung), analysis of | Chemical Regulations, safety data sheets, analytical procedure | Analysis of ACE inhibitory effect is carried out in fume hood using necessary protective equipment. Special care is exercised when handling pyridine and benzene, and the chemicals are stored locked up. Exposure is to be limited as much as possible. In case of contact with skin or eyes, immediate measures are taken to limit injury (rinse with water). | Yes | Yes (E) | Solo work only permitted after training and by agreement with the responsible professional.  Exposure time of benzene must be registered in the exposure register (ECO) |
| 18 | HPLC, use of | Chemical Regulations, instructions for use, user manual | Analyses requiring use of HPLC are carried out only after training and in collaboration with the professional responsible for the instrument | Yes | No | Solo work only permitted after training and by agreement with the responsible professional. |
| 19 | Ultrasonic water baths, use of | User’s manual | Wear hearing protection. Pregnant women are not allowed to stay in the room during sonication. Close doors of the room whenever sonication is taking place and post the warning sign on door. | Yes | No | The equipment has a sign stating that hearing protection is required. |
| 20 | Raman spectroscope,  use of | User manual, instructions for use, Innsida, see "Radiation protection lasers" | Laser (beam source) class 3B. Located on the back of the instrument to minimize risk of eye damage. Use of instrument is only allowed after training with the responsible professional. | Yes | No |  |
| 21 | Total Phenols (TPC), analysis of | Chemical Regulations, safety data sheets, analytical procedure | Analysis is carried out in fume hood using necessary protective equipment. Special care is exercised when handling chloroform, methanol and Folin- Ciocalteu's reagent, and the chemicals are stored locked up. Exposure is to be limited as much as possible. In case of contact with skin or eyes, immediate measures are taken to limit damage (rinse with water). End waste is collected and classified as 7041 "Organisk løsemiddel med halogen". In addition, mark with "Basisk" | Yes | No | End waste consists of about 0,01% Bromine, 10% methanol, 1% Na- carbonate and 1% phosphoric acid (in addition to choloroform if previous extraction was done according to Bligh& Dyer).  pH > 10. |
| 22 | Peroxide value, analysis of | Chemical Regulations, safety data sheets, analytical procedure | Analysis is carried out in fume hood using necessary protective equipment. Waste is collected and disposed of as 7041 "Organisk løsemiddel med halogen". In addition, mark with "Surt. Inneholder cyanider" | Yes | No |  |
| 23 | Homogenising/ dispersion, use of Ultra turrax | User Instruction | Hearing protection is to be used. Work is carried out in fume hood | Yes | No |  |
| 24 | Chloride analysis (salinity), use of auto titrator | User manual | Analyses are carried out only after training. Waste is collected and classified 7097 "Uorganiske løsninger og bad" | yes | No |  |
| 25 | Bioreactor, enzymatic hydrolysis, operation of | Instruction manual from supplier + method description | Training is given before operation of the equipment. How to handle glass equipment and instruments belonging to the reactor. Sampling equipment with long shaft ensures avoidance of contact with hot liquid in reactor.  For any thermal inactivation in a microwave oven, see separate risk assessment. | Yes | Evaluated in cases where enzymes are used |  |
| 26 | Heating solutions,  in microwave oven or any other way | User manual, [IBT routine](https://studntnu.sharepoint.com/:w:/r/sites/o365_TekniskgruppeIBT/_layouts/15/guestaccess.aspx?e=V8O4jF&share=Eexovhce1TxBmGS1DUjUfy8BEQvYbc3Pw-_3UBnP-YcK8w) for handling hot solutions, danger label on equipment | Heating containers is done WITHOUT a tight lid. Heating must be controlled by periodically taking the container out for stirring/ mixing. Heat protective gloves and visor are used when temperature of liquid exceeds 50°C. | Yes | Evaluate each case |  |

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**Date: \_\_\_\_\_\_\_\_\_\_\_\_ Line Manager: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Participants in the identification process (including function): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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| ID  **Nr.** | **Activity from the identification process form** | **Potential undesirable**  **incident/ strain** | Likelihood | **Consequence:** | | | **Risk**  **Value**  **(human)** | **Comments/Status**  **Suggested measures** |
| (1-5) | Human  (A-E) | Environment  (A-E) | Economy/material  (A-E) |
| 1 | Work with chemicals | Exposure to harmful chemicals due to lack of safety measures | 3 | C | A | A | **C3** | Always read safety data sheets and work with the chemical as prescribed. Wear nitrile gloves and other protective equipment if necessary. Dispensers are available, also for organic solvents. Work in fume hood if necessary, and dispose of waste as prescribed |
| 2 | Own chemical solutions. Marking, storage and disposal | Exposure to harmful chemicals due to lack of safetymeasures, environmental emissions, undesirable chemical reactions when mixing different waste | 3 | C | C | B | **C3** | Clear labelling of solutions in non-original packaging. Different waste containers are used for different waste, remember to clearly label these. Avoid mixing non-compliant chemicals! |
| 3 | Fume hoods, use of | Exposure to harmful chemicals due to insufficient air flow | 1 | C | A | A | **C1** | Follow the rules for correct use, check air flow before use |
| 4 | Pipetting | Physical load | 3 | A | A | A | **A3** | Avoid static work and take regular breaks |
| 5 | Laboratory dishwashing machine, use of | Inhalation of dishwashing liquid | 1 | A | A | A | **A1** | Follow instructions for use and add dishwashing powder carefully. Wear face mask if desired |
| 6 | Centrifugation | Chemical spills and exposure/ damage as a result of imbalance | 1 | C | A | B | **C1** | Centrifuge is always balanced before use. Follow instructions for use |
| 7 | Glass equipment, use of | Cut injuries | 4 | A | A | A | **A4** | Take care when using, collect broken glass with sweeper and tray, throw in separate container |
| 8 | pH- adjustments | Skin and eye damage caused by corrosive acids and bases | 2 | C | A | A | **C2** | Wear nitrile gloves and mandatory protective equipment |
| 9 | Heating oven, use of | Skin burns, creating flammable situations | 3 | A | A | A | **A3** | Follow instructions for use. Make sure to switch off when not in use |
| 10 | Water bath, use of | Skin burns, electrical hazards | 3 | A | A | A | **A3** | Follow instructions for use. Make sure to switch off when not in use. Hot surfaces must be labelled with warning sign |
| 11 | Hotplate/ heating plate, magnetic stirrer with heating | Skin burns, electrical hazards, creating flammable situations | 3 | A | A | A | **A3** | Follow instructions for use. Make sure to switch off when not in use and pull out the plug. Hot surfaces must be labelled with warning sign |
| 12 | Cryogenic gases/liquids e.g. liquid nitrogen, work with and transport of | Frost bite. Eye injury.  Suffocation due to lack of oxygen | 3  1 | B-C  E | A | A | **C3**  **E1** | Requirements for training transport personnel |
| 13 | Spectrophotometer, use of | Skin and eye damage caused by exposure to UV light | 1 | B | A | A | **B1** | Follow instructions for use. Minimal risk at ordinary use of equipment, more relevant when changing light bulb |
| 14 | Hydrolysis degree, (formol titration), analysis of | Exposure to carcinogens  (Formaldehyde) | 1 | D | A | A | **D1** | Work in fume hood. Chemicals and samples are never taken out of fume hood in an open container. Exercise caution when disposing waste |
| 15 | Lipid content (Bligh &Dyer), analysis and extraction of | Exposure to chloroform (suspected carcinogenic) and methanol | 1 | D | A | A | **D1** | Work in fume hood, with chloroform on ice. Chemicals and samples are never taken out of fume hood in an open container. Exercise caution when disposing waste |
| 16 | Kjeldahl- analysis (protein content) | Burns. Exposure to concentrated acid (H2SO4, 95-97%), base (NaOH, 40%) and boric acid solution (4%),  damage to equipment | 2 | C | A | B | **C2** | Be sure to receive thorough training and follow the procedure. Work in fume hood when needed, exercise caution when making solutions and filling chemical containers. Pregnant women should not work with boric acid in pure form. |
| 17 | ACE inhibitory effect (Cushman &Cheung), analysis of | Exposure to pyridine and benzene (carcinogenic) | 1 | D | A | A | **D1** | Wear a face mask in addition to fume hood. Limit the work of pyridine and benzene. Chemicals and samples are never taken out of fume cupboards in an open container. Exercise caution when disposing waste |
| 18 | HPLC, use of | Damage to equipment,  exposure to chemicals | 1 | B | A | A | **B1** | Be sure to receive thorough training. Solo work only permitted after training and by agreement with the responsible professional. |
| 19 | Ultrasonic water baths, use of | Hearing damage (incl. foetus) | 1 | C | A | A | **C1** | Wear hearing protection, post warning sign on door during sonication. |
| 20 | Raman spectroscope, use of | Eye damage | 2 | C | A | A | **C2** | Be sure to receive thorough training. Exposure unlikely due to laser location on back of equipment |
| 21 | Total Phenol (TPC), analysis of | Exposure to chloroform (suspected carcinogenic), methanol and Folin- Ciocalteu's reagent | 1 | D | A | A | **D1** | Work in fume hood. Chemicals and samples are never taken out of fume hood in an open container. Use movable extraction hood when working on bench/ measurement on spectrophotometer. Exercise caution when disposing waste |
| 22 | Peroxide value, analysis of | Exposure to solvents | 3 | B | A | A | **B3** | Work is to the greatest extent possible performed in fume hood. Use movable extraction hood when working on bench/ measurement on spectrophotometer. Exercise caution when disposing waste |
| 23 | Homogenising/ dispersion, use of Ultra turrax | Hearing damage | 2 | C | A | A | **C2** | Wear hearing protection |
| 24 | Chloride analysis (salinity), use of auto titrator | Chemical spills, such as AgCl, HNO3 | 2 | B | B | A | **B2** | Wipe up chemical spills immediately |
| 25 | Bioreactor, enzymatic hydrolysis, operation of | Exposure to harmful chemicals (enzymes). | 3 | A | A | A | **A3** | Take care with warm liquids, wear warm gloves and visors. Check safety data sheets |
| 26 | Heating solutions,  in microwave oven or any other way | Skin burns, cuts, eye damage due to pressure changes in container | 3 | C | A | A | **C3** | Will not happen as long as IBT's routine for handling hot liquids is followed, i.e. the use of heat-protective gloves and visors at temp.> 50°C and avoid heating of tightly closed container |

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| ***Likelihood (see next pages), e.g.:*** | ***Consequence (see next pages), e.g.:*** | ***Risk value (each to be estimated separately):*** |
| *1. Minimal*  *2. Low*  *3. Medium*  *4. High*  *5. Very high* | *A. Safe*  *B. Relatively safe*  *C. Dangerous*  *D. Critical*  *E. Very critical* | ***Human = Likelihood x Human consequence***  ***Environment = Likelihood x***  ***Environmental consequence***  ***Economy/Material = Likelihood x Economical/ material consequence / material*** |

**Potential undesirable incident/strain**

Identify possible incidents and conditions that may lead to situations that pose a hazard to people, the environment and any materiel/equipment involved.

**Criteria for the assessment of likelihood and consequence in relation to fieldwork**

Each activity is assessed according to a worst-case scenario. Likelihood and consequence are to be assessed separately for each potential undesirable incident.

Before starting on the quantification, the participants should agree what they understand by the assessment criteria:

**Likelihood**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Minimal**  **1** | **Low**  **2** | **Medium**  **3** | **High**  **4** | **Very high**  **5** |
| Once every 50 years or less | Once every 10 years or less | Once a year or less | Once a month or less | Once a week |

**Consequence**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Grading** | | **Human** | **Environment** | **Economy/ Material** |
| **E** | **Very critical** | May produce fatality/ -ies | Very prolonged, non-reversible damage | Shutdown of work >1 year |
| **D** | **Critical** | Permanent injury, may produce serious health damage/ sickness | Prolonged damage.  Long recovery time | Shutdown of work 0.5- 1 year |
| **C** | **Dangerous** | Serious personal injury | Minor damage.  Long recovery time | Shutdown of work < 1 month |
| **B** | **Relatively safe** | Injury that requires medical treatment | Minor damage.  Short recovery time | Shutdown of work < 1week |
| **A** | **Safe** | Injury that requires first aid | Insignificant damage.  Short recovery time | Shutdown of work < 1day |

The unit makes its own decision as to whether opting to fill in or not consequences for economy/materiel, for example if the unit is going to use particularly valuable equipment. It is up to the individual unit to choose the assessment criteria for this column.

**Risk = Likelihood x Consequence**

Calculate the risk value for “Human”, “Environment”, and, if chosen “Economy/Material”, separately.

**About the column "Comments/status, suggested preventative and corrective measures":**

Measures can impact in both likelihood and consequence. Prioritise measures that can prevent the incident from occurring; in other words, likelihood-reducing measures are to be prioritised above greater emergency preparedness, i.e. consequence-reducing measures.

