

Technical University of Košice
Faculty of Materials, Metallurgy and Recycling
Institute of Recycling and Environmental Technologies



Institute of Recycling
and Environmental Technologies

Devices and equipment

2025



Devices and equipment
IRET

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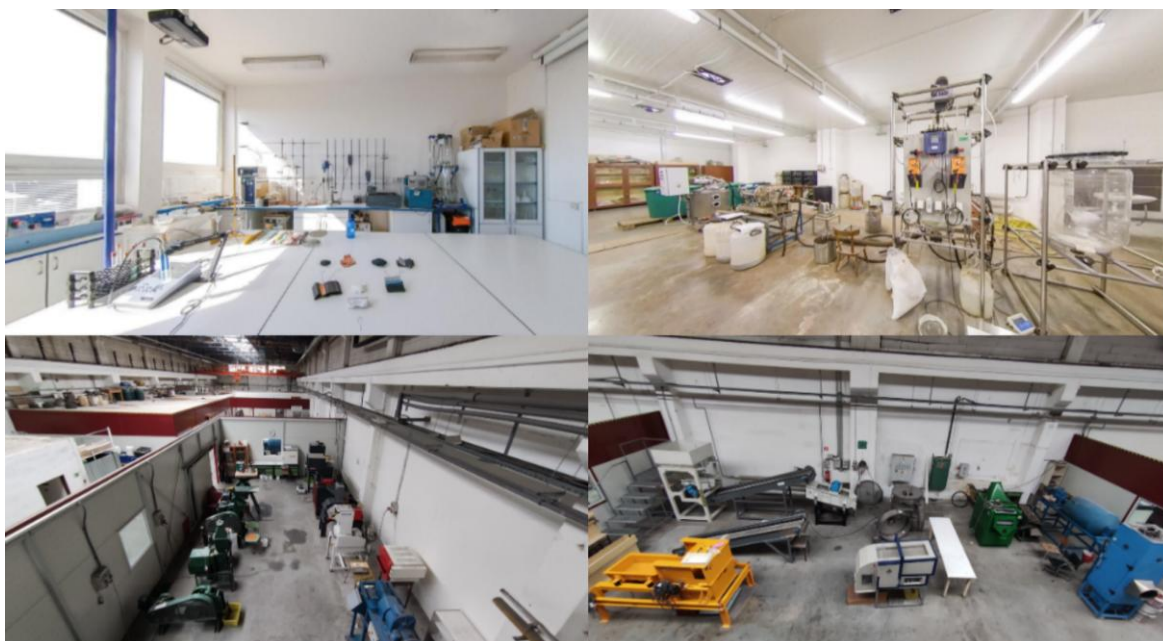
IRET Web page

About Institute

The Institute of Recycling and Environmental Technologies (IRET) is part of the Faculty of Materials, Metallurgy and Recycling (FMMR) at the Technical University of Košice (TUKE). IRET specializes in material recycling of waste through mechanical and physical pre-processing, hydrometallurgical processes and environmental technologies. The Institute has more than 20 years of experience in waste recycling through international and national projects, as well as cooperation with industry.

The Institute focuses on recycling of both municipal and industrial waste. In the area of municipal waste, it deals with the recycling of batteries (e.g. lithium batteries from cars and electronics, portable batteries), waste from electrical and electronic equipment (mobile phones, computers and others) and other types of waste. In the industrial sector, it focuses on waste containing metals, such as slag from aluminum production, waste from zinc and tin plating, slag and dust from copper, iron and steel production and other metal bearing waste.

IRET is also dedicated to the development and implementation of environmental technologies that minimize the negative impacts of industrial activities on the environment. These include processes for wastewater treatment, soil decontamination and reduction of air emissions. The aim of these technologies is not only to protect natural resources, but also to promote sustainable development and ecological production.



Institute Focus:

1. Processing and recycling of industrial waste:

- slag and dusts from iron and steel production,
- slag and dusts from copper production,
- drosses from aluminum production and recycling,
- drosses, fly ash and dusts from the hot-dip galvanizing process,
- tinning sludge.

2. Processing and recycling of municipal waste:

- batteries and accumulators based on lithium, nickel, cobalt, zinc and manganese,
- waste from electrical and electronic equipment (mobile phones, computers, printed circuit boards, contacts),
- material analysis of municipal waste.

3. Chemical analysis:

- elemental analysis of environmental samples,
- analysis of samples of various types of waste and products of their hydrometallurgical processing,
- support in the analysis of inputs and outputs in recycling processes for the processing of various types of waste,
- analysis of drinking, surface and wastewater,
- analytical control of the mobility of metals in the environment affected by metallurgical and/or mining activities.

4. Other areas:

- mechanical and physical treatment of waste and raw materials,
- experimental testing of hydrometallurgical, pyrometallurgical and combined methods of processing waste/secondary raw materials to obtain metals and other materials (compounds),
- assessment in waste matters,
- implementation of elemental and phase analyses of raw materials and overall characterization of input materials, intermediate products and processing products.

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1. Analytical equipments

1.1. Panalytical X-ray powder diffractometer

Model	XPert PRO RV-11 / 2010
Manufacturer	PANalytical
Types of samples	Solid
Analysis type	XRD (phase diffraction analysis)
Continuous / Batch / Single	Batch
Lab / Pilot / Industry	Lab
Power consumption / voltage	8,5 kW / 400 V
Portability	No
Description	RTG powder diffractometer



1.2. Shimadzu X-RAY fluorescence analyzer

Model	EDX-7000P
Manufacturer	Schimadzu
Types of samples	Solid/Liquid
Analysis type	XRF (elemental analysis)
Continuous / Batch / Single	Batch
Lab / Pilot / Industry	Lab
Power consumption / voltage	200 W / 230 V
Portability	No
Description	RTG fluorescence analyzer



1.3. Keyence EA-300 LIBS spectrometer

Model	EA-300
Manufacturer	Keyence
Types of samples	Solid
Analysis type	LIBS (elemental analysis)
Continuous / Batch / Single	Batch
Lab / Pilot / Industry	Lab
Power consumption / voltage	230 V
Portability	No
Description	Analyzer for laser-induced spectrometry.



1.4. Thermo atomic absorption spectrometer

Model	ICE 3000
Manufacturer	Thermo scientific
Types of samples	Liquid
Analysis type	AAS – elemental analysis
Continuous / Batch / Single	Single
Lab / Pilot / Industry	Lab
Power consumption / voltage	300 VA / 230 V
Portability	No
Description	Atomic absorption spectrometer



1.5. ContrAA atomic absorption spectrometer

Model	ContrAA 700
Manufacturer	Analytik Jena AG
Types of samples	Liquid
Analysis type	AAS - elemental analysis
Continuous / Batch / Single	Single
Lab / Pilot / Industry	Lab
Power consumption / voltage	2,1 kW / 230 V
Portability	No
Description	Atomic absorption spectrometer



1.6. Varian atomic absorption spectrometer

Model	SPECTR AA 20 PLUS
Manufacturer	Varian
Types of samples	Liquid
Analysis type	AAS – elemental analysis
Continuous / Batch / Single	Single
Lab / Pilot / Industry	Lab
Power consumption / voltage	1,2 kW / 230 V
Portability	No
Description	Atomic absorption spectrometer



2. Mechanical and physical pretreatment

2.1. Twin-shaft shredder

Model	DR 120
Manufacturer	Častulik, SR
Grain size (input/output)	300x350 mm chamber / ~10 mm
Treatment type	Comminution, dry
Active phys. properties	Size
Continuous / Batch / Single	Continuous, Batch
Lab / Pilot / Industry	Lab / Pilot
Power consumption / voltage	9 kW / 400 V
Portability	No
Description	Shredder for wood, rubber, plastics, steel canisters, printed circuit boards.



2.2. Four-shaft shredder

Model	ARIES 120
Manufacturer	Častulík, SR
Grain size (input/output)	400x350 mm chamber / ~10 mm
Treatment type	Comminution, dry
Active phys. properties	Size
Continuous / Batch / Single	Continuous, Batch
Lab / Pilot / Industry	Lab / Pilot
Power consumption / voltage	13,2 kW / 400 V
Portability	No
Description	Shredder for wood, rubber, plastics, steel canisters, printed circuit boards.



2.3. Jaw CRUSHER

Manufacturer	Vítkovice, ČR
Grain size (input/output)	>20 mm / <10 mm
Treatment type	Comminution, dry
Active phys. properties	Size
Continuous / Batch / Single	Batch
Lab / Pilot / Industry	Lab / Pilot
Power consumption / voltage	400 V
Portability	No



2.4. Cutting mill

Model	SM200
Manufacturer	Retsch
Grain size (input/output)	<60 mm / 0,25-20 mm
Treatment type	Comminution, dry
Active phys. properties	Size
Continuous / Batch / Single	Batch
Lab / Pilot / Industry	Lab / Pilot
Power consumption / voltage	2,2 kW / 400 V
Portability	Yes
Description	Cutting mill for soft, medium-hard, tough, elastic, fibrous materials



2.5. High speed cutting mill

Model	DP 11-240-350 / 2005
Manufacturer	Profing, Ltd. Piešťany, SR
Grain size (input/output)	200 mm / 4 – 40 mm
Treatment type	Comminution
Active phys. properties	Size
Continuous / Batch / Single	Continuous
Lab / Pilot / Industry	Lab
Power consumption / voltage	11 kW / 400 V
Portability	No
Description	Shredding plastic foil, PET bottles and other materials like rubber, wood, paper and textile.



2.6. Hammer mill

Model	MK-380
Manufacturer	BMZ Slovakia, Inc.
Grain size (input/output)	max. 50 mm / 0 – 2 mm
Treatment type	Comminution, dry
Active phys. properties	Size
Continuous / Batch / Single	Batch, Continuous
Lab / Pilot / Industry	Lab / Pilot
Power consumption / voltage	5,5 kW / 400 V
Portability	No
Description	18 pinned hammers mill on carry frame for dry milling of soft, tack-free materials.



2.7. Ball mill

Treatment type	Comminution, dry
Active phys. properties	Size
Continuous / Batch / Single	Batch
Lab / Pilot / Industry	Lab / Pilot
Power consumption / voltage	400 V
Portability	No



2.8. Friction mill

Model / manufactured	ZTR TMR 2 / 1967
Grain size (input/output)	10 mm / dust
Treatment type	Comminution, dry, wet
Active phys. properties	Size
Continuous / Batch / Single	Batch
Lab / Pilot / Industry	Lab / Pilot
Power consumption / voltage	400 V
Portability	No



2.9. Disc swing mill

Model	1982
Manufacturer	OPS Přerov
Grain size (input/output)	150 mm / dust
Treatment type	Comminution, dry
Active phys. properties	Size
Continuous / Batch / Single	Batch
Lab / Pilot / Industry	Lab
Power consumption / voltage	2kW / 400 V
Portability	No
Description	Various grinding jars and rings. Fine and micro grinding for laboratory analysis.



2.10. Hammer mill ŠK600

Model	ŠK 600/ 2005
Manufacturer	ŠT Strojné zámočníctvo, Tužka Štefan
Grain size (input/output)	20 mm / 8 mm
Treatment type	Comminution, dry
Active phys. properties	Size
Continuous / Batch / Single	Continuous / Batch
Lab / Pilot / Industry	Lab / Pilot
Power consumption / voltage	7,2 kW / 400 V
Portability	Yes
Description	Knife mill with fast rotating hammer head. Primary function: agriculture



2.11. Hammer mill ŠK300

Model	ŠK 300
Manufacturer	ŠT Strojné zámočníctvo, Tužka Štefan
Grain size (input/output)	15 mm / 5 mm
Treatment type	Comminution, dry
Active phys. properties	Size
Continuous / Batch / Single	Continuous / Batch
Lab / Pilot / Industry	Lab
Power consumption / voltage	4 kW / 400 V
Portability	Yes
Description	Knife mill with fast rotating hammer head. Primary function: agriculture and food industry. Materials: Bone, corn, cereals, waste printed circuit boards, wood, automotive scrap materials etc.



2.12. Small hammer mill

Model	22-5s3964
Manufacturer	WEBER
Grain size (input/output)	8-10 mm / 1-2 mm
Treatment type	Comminution
Active phys. properties	Size
Continuous / Batch / Single	Batch / Single
Lab / Pilot / Industry	Lab
Power consumption / voltage	230 V
Portability	Yes
Description	Laboratory scale mill for materials such as waste electrical and electronic equipment, hard plastics, wood etc.



2.13. Laboratory grinder

Model	MF 10 micro
Manufacturer	IKA
Grain size (input/output)	10 mm / 0,25-5 mm
Treatment type	Comminution
Active phys. properties	Size
Continuous / Batch / Single	Batch / Single
Lab / Pilot / Industry	Lab
Power consumption / voltage	1 kW / 230 V
Portability	Yes
Description	Laboratory-scale grinder with 2 different knives for materials with max feed hardness 6 Mohs.



2.14. Sample divider

Model / manufactured	RV-01 / 2007
Manufacturer	Spišcol, Ltd.
Grain size (input/output)	<10 mm/ <10 mm
Treatment type	Separation
Active phys. properties	Sample size
Continuous / Batch / Single	Batch
Lab / Pilot / Industry	Lab
Power consumption / voltage	0,12 kW / 230 V
Portability	Yes
Description	Division of one dry sample to smaller representative samples (up to 10)



2.15. Homogenizer HKR-100

Model	HKR-100
Manufacturer	SlovSETRA s.r.o
Grain size (input/output)	1,5 – 6 mm
Treatment type	Homogenization
Continuous / Batch / Single	Batch
Lab / Pilot / Industry	Pilot
Power consumption / voltage	3 kW / 400 V
Portability	No
Description	Homogenization of granular material



2.16. Cone crusher

Model	DKR-100
Manufacturer	SlovSETRA s.r.o
Grain size (input/output)	10 cm / 2 – 6 mm
Treatment type	Crushing
Active phys. properties	Size
Continuous / Batch / Single	Batch
Lab / Pilot / Industry	Industry
Power consumption / voltage	3 kW / 400 V
Portability	No
Description	Cone crusher for continuous crushing.
Capacity	100 kg/h



3. Physical pretreatment

3.1. Vibrating feeder hopper

Model	VZP 040.009 Z
Manufacturer	Techkon, Ltd.
Weight	144 kg
Power consumption / voltage	2x0,37 kW / 400 V
Working surface width	400 mm
Working surface length	900 mm
Portability	No
Description	Freely oscillating, resonant vibrating feeder with a conveyor chute. Driven by a pair of vibrators operating in autosynchronous operation.
Function	Transport and feeding of powder or lump materials.



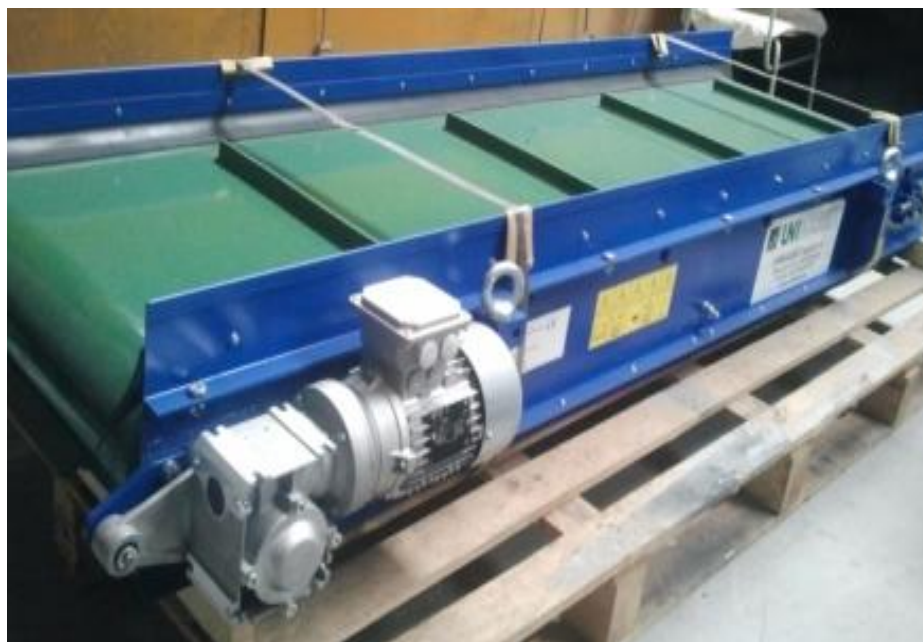
3.2. Conveyor belt

Model	B-400-3000
Manufacturer	Spišcol, Ltd.
Weight	250 kg
Power consumption / voltage	1,1 kW / 400 V
Working surface width	400 mm
Working surface length	3000 mm
Portability	No
Description	Conveyor belt
Function	Continuous or intermittent transport of materials.



3.3. Conveyor belt for magnetic separator

Model	UDPP 837/ 2014
Manufacturer	UNIKASSET, Ltd. Ostrava, Czech Republic
Continuous / Batch / Single	Continuous
Lab / Pilot / Industry	Lab / Pilot
Power consumption / voltage	0,43 kW / 400 V
Portability	No
Description	Rubber conveyor belt for magnetic separator.



3.4. Lab sieving tower

Model	AS 200
Manufacturer	RETSCH
Grain size (input/output)	< 510 mm
Treatment type	Separation, dry
Active phys. properties	Size
Continuous / Batch / Single	Batch
Lab / Pilot / Industry	Lab
Power consumption / voltage	430 VA / 230 V
Portability	Yes



3.5. Eco separator gyratory sifter

Model	No.31940/ 2015
Manufacturer	Russel
Grain size (input/output)	0 - 20 mm / 0 - 10 mm
Treatment type	Separation, wet, dry
Active phys. properties	Size, shape
Continuous / Batch / Single	Batch
Lab / Pilot / Industry	Lab / Pilot / Industry
Power consumption / voltage	400 V
Portability	Yes, on wheels
Description	Spring-mounted grading sieve for use in almost any processing industry. Ability to separate wet or dry materials on up to five fractions, made fully stainless.



3.6. Band vibrating separator

Model	TAJFUN B 045.010
Manufacturer	Spišcol, Ltd., SR
Weight	217 kg
Power consumption / voltage	0,75 kW / 400 V
Working surface width	450 mm
Working surface length	1000 mm
Portability	Nie
Description	Freely oscillating over-resonant vibrating separator, elliptic oscillation.
Function	Powdery or piece material separation on wire sieve.



3.7. Eddy-current separator

Model	SKR-240N
Manufacturer	EPA Prague, inc., Czech Republic
Treatment type	Separation
Active phys. properties	Magnetism, conductivity
Continuous / Batch / Single	Batch, continuous
Lab / Pilot / Industry	Lab / Pilot
Power consumption / voltage	1,7 kW / 400 V
Portability	No
Description	Selective separation of non-ferrous metals via magnetic fields induced by eddy currents. Infeed via vibrating table.



3.8. Air table separator

Model / manufactured	TTS 300 - 100 - 1KV/ 2015
Manufacturer	TRENNSO TECHNIK
Treatment type	Separation, dry
Active phys. properties	Density
Continuous / Batch / Single	Batch
Lab / Pilot / Industry	Lab / Pilot
Power consumption / voltage	1 kW / 400 V
Weight	600 kg
Portability	No
Description	Fluid separator with adjustable screen angle. The machine separates varying bulk materials according to their specific weight and shape.



3.9. Wet shaking table

Model	800 Laboratory
Manufacturer	Holman-Wilfley
Weight	220 kg
Power consumption / voltage	0,37 - 3 kW / 230 V
Capacity	Max 75 kg/h
Total size (W x L x H)	810 x 2315 x 1430 mm
Table decks size	640 x 1280 mm
Description	Two decks laboratory shaking table unit with self-lubricating head motion on adjustable frame feet.
Function	Recovery of precious metals (gold...), characterization of heavy minerals, quality control etc.



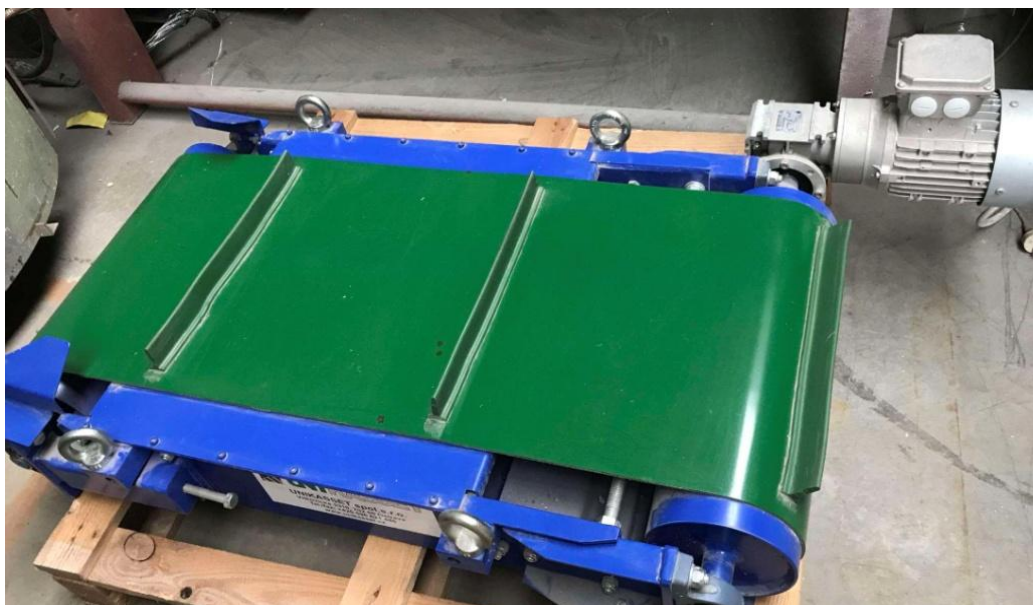
3.10. Drum magnetic separator

Model / manufactured	MOR 45131 MT 30A / 2015
Manufacturer	Steinert
Treatment type	Separation, dry
Active phys. properties	Magnetism
Continuous / Batch / Single	Continuous
Lab / Pilot / Industry	Pilot
Power consumption / voltage	1 kW
Weight	700 kg
Size	(300 v 500 mm)
Portability	No
Description	Separation of fine and coarse iron particles



3.11. Belt ferrite magnetic separator

Model / manufactured	SPUC 450/ 2014
Manufacturer	UNIKASSET, Ltd. Ostrava, Czech Republic
Treatment type	Separation, dry
Active phys. properties	Magnetism
Continuous / Batch / Single	Continuous
Lab / Pilot / Industry	Lab / Pilot
Power consumption / voltage	0,55 kW / 400 V
Weight	230 kg
Portability	No
Description	Rubber conveyor belt with permanent ferrite magnet.



3.12. Belt neodyme magnetic separator

Model	B-400-3000 MGS
Manufacturer	Techkon, Ltd.
Weight	250 kg
Power consumption / voltage	1,1 kW / 400 V
Working surface width	400 mm
Working surface length	3000 mm
Description	All metal plate construction on rotating rollers. Moving roller powered by electromotor with electric gear unit. Roller is equipped by magnets for magnetic fraction separation.
Function	Powdery or piece material continual or broken transport with permanent neodyme magnet.



4. Hydrometallurgy

4.1. Leaching reactor 3l

Manufacturer	KGW ISOTHERM
Treatment type	Wet
Active phys. properties	Chemical reactivity
Continuous / Batch / Single	Batch
Lab / Pilot / Industry	Lab
Power consumption / voltage	230 V
Portability	No
Description	Double wall glass leaching kettle with thermoregulation and stirring mechanism.



4.2. Leaching reactor 16l

Manufacturer	IRET
Treatment type	Wet
Active phys. properties	Chemical reactivity
Continuous / Batch / Single	Batch
Lab / Pilot / Industry	Pilot
Power consumption / voltage	400 V – stirring
Portability	No
Description	Double wall glass leaching kettle with thermoregulation, stirring mechanism and automatic pH regulation.



4.3. Leaching reactor 100l

Manufacturer	IRET
Treatment type	Wet
Active phys. properties	Chemical reactivity
Continuous / Batch / Single	Batch
Lab / Pilot / Industry	Pilot
Power consumption / voltage	400 V – stirring
Portability	No
Description	Double wall glass leaching kettle with thermoregulation, stirring mechanism and automatic pH regulation.



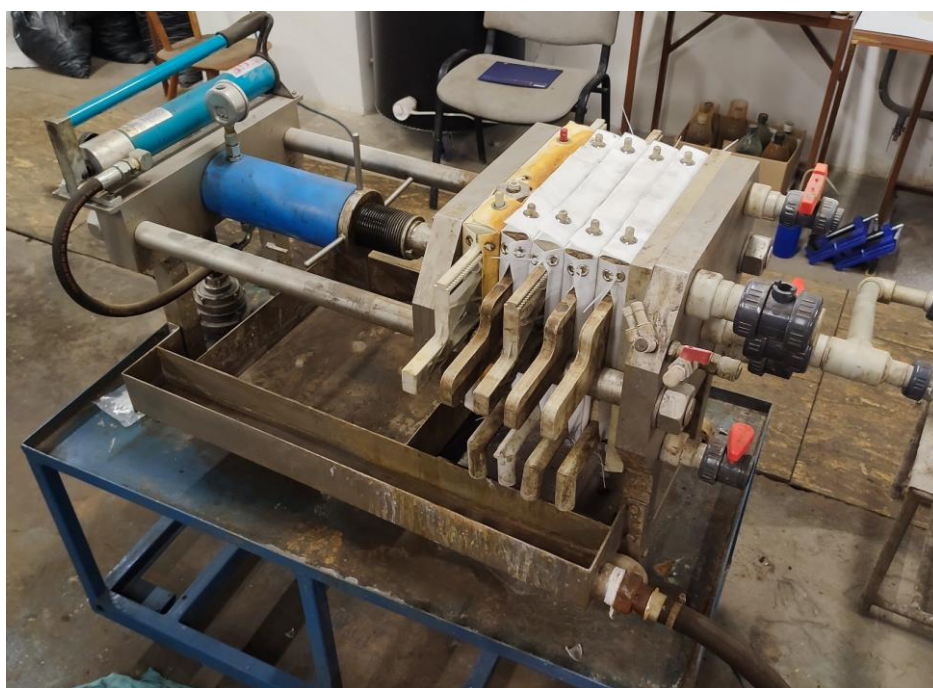
4.4. Filter press small

Model / manufactured	300/3-00-20/ 2015
Manufacturer	ANTARES Přerov, Czech Republic
Treatment type	Wet
Active phys. properties	Moisture
Continuous / Batch / Single	Batch
Lab / Pilot / Industry	Pilot
Power consumption / voltage	165 kg
Portability	Yes
Description	Filter press used with leaching kettles (16l and 100l). Suitable for thick sludges and mud.



4.5. Filter press medium

Model / manufactured	AXHR 300 LÁB/ 2013
Manufacturer	ANTARES Přerov, Czech Republic
Treatment type	Wet
Active phys. properties	Moisture
Continuous / Batch / Single	Batch
Lab / Pilot / Industry	Pilot
Power consumption / voltage	200 kg
Portability	Yes
Description	Filter press used with leaching kettles (16l and 100l). Suitable for thick sludges and mud.



4.6. Vacuum evaporator

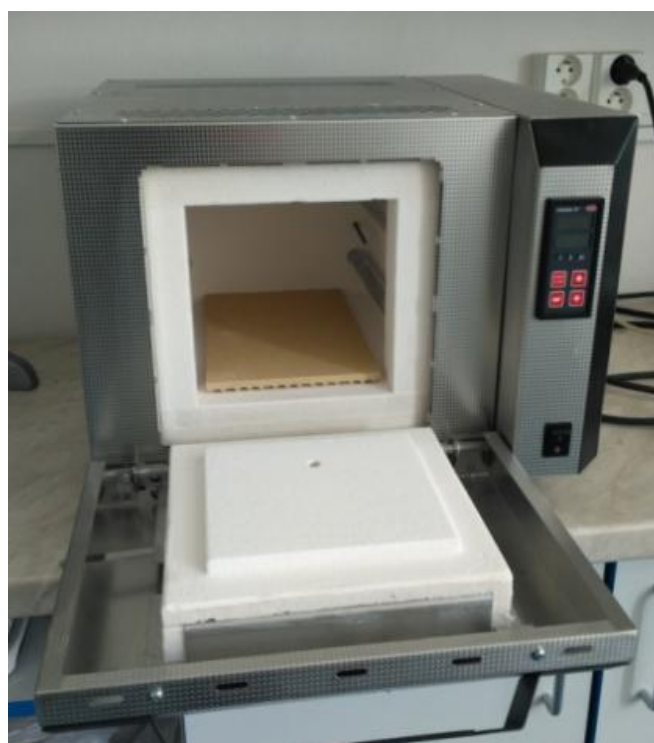
Model / manufactured	Normi Vacuum / 2017
Manufacturer	Normit
Volume	100 l
Continuous / Batch / Single	Batch
Lab / Pilot / Industry	Lab / Pilot
Power consumption / voltage	9,12 kW / 400 V
Portability	No
Description	Closed cylindric tank composed of inner pot and outer cover with electric heating and stirring.



5. Thermal treatment

5.1. Muffle laboratory furnace – small

Model	HT40 P
Manufacturer	LAC, Ltd. BRNO, Czech Republic
Continuous / Batch / Single	Batch
Lab / Pilot / Industry	Lab
Power consumption / voltage	2,3 kW / 230 V
Portability	Yes
Description	Manually controlled furnace for temperatures up to 800 °C.



5.2. Muffle laboratory furnace

Model	LH 30/13 HT40AL
Manufacturer	LAC, Ltd. BRNO, Czech Republic
Continuous / Batch / Single	Batch
Lab / Pilot / Industry	Lab
Power consumption / voltage	3,2 kW / 230 V
Portability	No
Description	Manually controlled furnace for temperatures up to 1340 °C.



5.3. High temperature vacuum furnace

Model	HT VAC 1600
Manufacturer	LINN
Continuous / Batch / Single	Batch
Lab / Pilot / Industry	Lab / Pilot
Power consumption / voltage	400 V
Portability	No
Description	Vacuum/inert atmosphere up to 1600 °C.



5.4. Muffle laboratory furnace

Continuous / Batch / Single	Batch
Lab / Pilot / Industry	Lab
Portability	No
Description	Manually controlled furnace for temperatures up to 800 °C.



5.5. Silt electric furnace

Continuous / Batch / Single	Batch
Lab / Pilot / Industry	Lab / Pilot
Power consumption / voltage	400 V
Portability	No
Description	Top feed furnace for temperatures up to 1200 °C.



5.6. Laboratory tube furnace

Temperature	Max. 1000 °C
Continuous / Batch / Single	Batch
Lab / Pilot / Industry	Lab
Power consumption / voltage	400 V
Portability	No
Description	Tube furnace suitable for sintering and pyrolysis.



5.7. Laboratory drying oven 256 l

Model	ULE 600
Manufacturer	Memmert
Volume	256 l
Continuous / Batch / Single	Batch
Lab / Pilot / Industry	Lab
Power consumption / voltage	1,6 kW / 230 V
Portability	No
Description	Laboratory hot air-drying oven.



6. Filtration

6.1. Mobile filtration equipment

Model	EKOVENT PF 1.0 v01.2017
Manufacturer	Elektrotechnika Filter, Ltd.
Weight	160 kg
Power consumption / voltage	0,75 kW / 400 V
Filtration surface	10 m ²
Total size (W x L x H)	900 x 700 x 1950 mm
Description	Industrial filtration equipment constructed as modular unit installed in all-steel frame.
Function	Exhaustion and filtration of dusts or aerosols polluted air in basic inexplusive environment.



6.2. Mobile filtration equipment

Model	DC350CF
Manufacturer	Bernardo GmbH, Austria
Capacity	2800 m ³ /h
Waste bag volume	200 l
Continuous / Batch / Single	Continuous / Batch
Lab / Pilot / Industry	Lab / Pilot
Weight	47 kg
Power consumption / voltage	2,1 kW / 400 V





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