Specification and classification of pelletised dried sewage sludge: Identifying its key properties as a renewable material for enabling environmentally non-harmful energy utilisation

Supplementary Materials: Wastewater treatment efficiency at the CWWTPL, pellets preparation, and their assessment as non-hazardous waste.

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1. Evaluation of the Wastewater treatment efficiency at the CWWTPL

1.1. Wastewater sampling and characterisation

At the CWWTPL [1], the wastewater flow at the inlet and outlet is continuously measured with a Venturimeter and an inline flow meter Prosonic S, Endress + Hauser, based on an ultrasound distance meter between the water level and the sensor, according to the accredited methods: i) DIN 19559-1:1983, Measurement of flow of wastewater in open channels and gravity conduits; General information and ii) DIN 19559-2:1983, Measurement of flow of wastewater in open channels and gravity conduits; venturi flumes. Partial wastewater samples are automatically sampled time-proportionally using the CSF48 Liquistation, Endress+Hauser. Samples are prepared, cooled, and stored by i) ISO 5667-10:1992, Water quality, Sampling, Part 10: Guidance on sampling of wastewaters, and ii) ISO 5667-3:2012, Water quality, Sampling, Part 3: Preservation and handling of water samples [2].

**Table 1:** Overview of the performed Sampling campaigns.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Sampling campaign, No | Year | Date | Inflow, m3 day-1 | Outflow, m3 day-1 |
| 1 | 2010 | The 6th July | 86,500 | 86,600 |
| 2 | The 12th October | 73,700 | 71,800 |
| 3 | 2011 | The 17th May | 86,500 | 86,600 |
| 4 | The 17th October | 73,700 | 71,800 |
| 5 | 2012 | The 27th September | 83,100 | 82,496 |
| 6 | 2013 | The 14th May | 79,700 | 79,900 |
| 7 | The 21st October | 59,600 | 58,400 |
| 8 | 2014 | The 25th May | 56,900 | 52,200 |
| 9 | The 24th September | 70,700 | 70,800 |
| 10 | 2015 | The 9th April | 62,500 | 64,500 |
| 11 | The 27th October | 58,312 | 59,566 |
| 12 | 2016\* | The 24th May | 65,148 | 64,882 |
| 13 | The 16th October | 50,194 | 51,720 |
| 14 | 2017 | The 3rd July | 66,814 | 69,950 |
| 15 | The 5th July | 55,252 | 58,690 |
| 16 | The 9th July | 43,352 | 46,730 |
| 17 | 2021 | The 12th July | 60,110 | 65,080 |
| 18 | 2022 | The 7th June | 65,000 | 68,700 |

**\*[2].**

From 2010 - 2022, additional representative samples were collected in the spring, summer and autumn (Table 1). 24-hourly, time-proportional representative sub-samples were taken at the influent and effluent to determine the removal efficiency of potential toxic metals (PTMs) (As, Cd, Cr, Cu, Hg, Mo, Ni, Pb and Zn), and metals Sb, Co, Mn, Tl and V from the raw wastewater (from Table 2 to Table 8).

The content of the heavy metals (HMs) in the raw wastewater and treated effluent is monitored by standardised physicochemical measurements: i) digestion of the wastewater sample is made according to EN ISO 15587-2:2003, Water quality — Digestion for the determination of selected elements in water — Part 2: Nitric acid digestion, ii) determination of heavy metals (except mercury) is performed with ISO 17294-2 (relevant edition), Water quality — Application of inductively coupled plasma mass spectrometry (ICP-MS) — Part 2: Determination of selected elements including uranium isotopes and iii) mercury is determined with EN ISO 12846:2012, Water quality — Determination of mercury — Method using atomic absorption spectrometry (AAS) with and without enrichment.

Most of the used methods are accredited according to the Technical Standard EN ISO/IEC 17025 (relevant edition), General requirements for the competence of testing and calibration laboratories and performed by authorised contractors.

1.2. The treatment efficiency for heavy metals evaluation/ calculation

Treatment efficiency, % m/m = [(Qinlet\* cinlet -Qoutlet\* coutlet)/ (Qinlet\* cinlet)]\*100 (1)

Qinlet,Qoutlet – the inflow of the raw wastewater/ the outflow of the treated wastewater in   
m3 day-1

cinlet, coutlet - the concentration of heavy metal in the raw wastewater/ the treated wastewater

Heavy metal concentration for results with values <LOQ or <LOD [3, 4]:

cinlet,coutlet = LOQ/2 or LOD/2 (2)

1.3. The Heavy metals concentration in wastewater and their biological treatment efficiency with the active sludge

Tables 2 to 8 show results with values lower than LOQ and higher than LOD as <…. Results with a value lower than the LOD are given by […]. The treatment efficiency could not be assessed in the case of equally low inlet and outlet concentrations.

**Table 2.** Overview of the removal efficiency for arsenic and cadmium.

| Sampling campaign, No | As | | | Cd | | |
| --- | --- | --- | --- | --- | --- | --- |
| Inlet concentration, mg L-1 | Outlet concentration, mg L-1 | Treatment efficiency, % m/m | Inlet concentration, mg L-1 | Outlet concentration, mg L-1 | Treatment efficiency, % m/m |
| 1 | [0.007] | [0.007] | n. e. | [0.0003] | [0.0003] | n. e. |
| 2 | [0.007] | [0.007] | [0.0003] | [0.0003] |
| 3 | [0.007] | [0.007] | <0.0010 | [0.0003] | 70.0 |
| 4 | [0.007] | [0.007] | [0.003] | [0.0003] | n. e. |
| 6 | [0.007] | [0.007] | [0.0003] | [0.0003] |
| 7 | [0.007] | <0.010 | 0 | [0.0003] | [0.0003] |
| 8 | 0.0005 | [0.0003] | 72.5 | [0.0003] | [0.0003] |
| 9 | 0.00076 | 0.00048 | 36.8 | [0.0003] | [0.0003] |
| 10 | 0.0010 | 0.0037 | 0 | [0.0003] | [0.0003] |
| 11 | 0.00080 | 0.00043 | 45.1 | [0.0003] | [0.0003] |
| 12\* | 0.00093 | 0.00046 | 50.7 | [0.0003] | [0.0003] |
| 13\* | 0.0018 | 0.00043 | 75.4 | 0.00068 | [0.0003] | 77.3 |
| 17 | 0.0011 | 0.00077 | 24.2 | [0.0003] | [0.0003] | n. e. |
| 18 | 0.00093 | 0.00061 | 30.7 | 0.00019 | [0.0003] | 16.6 |

**\* [2].**

In general, the content of heavy metals in municipal wastewater is low, most often at the limit of quantification. The methods for sample decomposition and determination of the heavy metals and mercury improve all the time. That resulted in the results' quality and lowered the LOQ and LOD. After 2014 (since campaign 8), the quality of results has improved, and fewer results are as <LOQ or [LOD]. The latter is especially true for As, Sb, Co, and Mn. The Cd, Sb, and Tl concentrations are mostly [LOD]. Mercury concentration at the outlet of the CWWTPL is on the level of ng L-1 or as [LOD].

**Table 3.** Overview of the removal efficiency for antimony and cobalt.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Sampling campaign, No | Sb | | | Co | | |
| Inlet concentration, mg L-1 | Outlet concentration, mg L-1 | Treatment efficiency, % m/m | Inlet concentration, mg L-1 | Outlet concentration, mg L-1 | Treatment efficiency, % m/m |
| 6 | [0.005] | [0.005] | n. e. | [0.003] | [0.003] | n. e. |
| 7 | [0.005] | [0.005] | n. e. | [0.003] | [0.003] | n. e. |
| 8 | [0.001] | [0.001] | n. e. | 0.00096 | 0.00071 | 32.2 |
| 9 | [0.001] | [0.001] | n. e. | 0.0016 | 0.00073 | 54.3 |
| 10 | [0.001] | [0.001] | n. e. | 0.0022 | 0.0040 | 0 |
| 11 | [0.001] | [0.001] | n. e. | 0.0015 | 0.00033 | 77.5 |
| 12\* | [0.001] | [0.001] | n. e. | 0.0024 | 0.00059 | 75.5 |
| 13\* | 0.0021 | [0.001] | 75.5 | 0.0048 | 0.00053 | 88.6 |
| 14 | no a. | | | 0.0015 | <0.0005 | 82.6 |
| 15 | 0.0014 | <0.0005 | 81.0 |
| 16 | 0.00094 | <0.0005 | 71.3 |
| 17 | [0.001] | [0.001] | n. e. | 0.00085 | 0.00033 | 58.0 |
| 18 | <LOD=0.00035 | <LOD=0.00037 | 0 | 0.0029 | 0.0005 | 81.8 |

**\* [2].**

**Table 4.** Overview of the removal efficiency for chromium and copper.

| Sampling campaign, No | Cr | | | Cu | | |
| --- | --- | --- | --- | --- | --- | --- |
| Inlet concentration, mg L-1 | Outlet concentration, mg L-1 | Treatment efficiency, % m/m | Inlet concentration, mg L-1 | Outlet concentration, mg L-1 | Treatment efficiency, % m/m |
| 1 | 0.014 | 0.012 | 14.2 | 0.009 | <0.005 | 72.2 |
| 2 | <0.010 | <0.010 | n. e. | 0.026 | <0.005 | 90.4 |
| 3 | 0.014 | 0.011 | 21.3 | 0.034 | <0.0050 | 92.8 |
| 4 | 0.032 | [0.003] | 95.4 | 0.039 | 0.0065 | 83.7 |
| 5 | 0.027 | 0.027 | 0.73 | 0.041 | <0.0050 | 87.8 |
| 6 | 0.016 | <0.010 | 68.7 | 0.029 | 0.0052 | 82.5 |
| 7 | 0.011 | [0.003] | 86.6 | 0.033 | <0.0050 | 92.4 |
| 8 | 0.011 | 0.0056 | 53.3 | 0.065 | 0.0091 | 86.4 |
| 9 | 0.039 | 0.0088 | 96.1 | 0.022 | <0.0050 | 88.7 |
| 10 | 0.041 | [0.005] | 93.7 | 0.041 | 0.0069 | 83.1 |
| 11 | 0.021 | [0.005] | 87.8 | 0.30 | 0.024 | 92.2 |
| 12\* | 0.026 | [0.005] | 90.4 | 0.012 | [0.01] | 61.8 |
| 13\* | 0.049 | [0.005] | 94.7 | 0.061 | [0.01] | 91.8 |
| 17 | 0.0068 | 0.0015 | 76.1 | 0.068 | [0.01] | 92.4 |
| 18 | 0.019 | [0.005] | 86.1 | 0.015 | [0.01] | 64.8 |

**\* [2].**

**Table 5.** Overview of the removal efficiency for thallium and vanadium.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Sampling campaign, No | Tl | | | V | | |
| Inlet concentration, mg L-1 | Outlet concentration, mg L-1 | Treatment efficiency, % m/m | Inlet concentration, mg L-1 | Outlet concentration, mg L-1 | Treatment efficiency, % m/m |
| 6 | [0.00025] | [0.00025] | n. e. | [0.030] | [0.030] | n. e. |
| 7 | [0.00025] | [0.00025] | [0.030] | [0.030] |
| 8 | <0.01 | <0.001 | 90.8 | 0.0014 | 0.00081 | 46.9 |
| 9 | [0.005] | [0.005] | n. e. | 0.0016 | 0.00056 | 65.0 |
| 10 | [0.005] | [0.005] | 0.0075 | 0.00034 | 95.3 |
| 11 | [0.005] | [0.005] | 0.0025 | 0.00043 | 82.4 |
| 12\* | [0.005] | [0.005] | 0.0030 | 0.00055 | 81.7 |
| 13\* | [0.005] | [0.005] | 0.0075 | 0.00032 | 95.6 |
| 17 | [0.005] | [0.005] | 0.0028 | 0.00066 | 74.5 |
| 18 | [0.005] | [0.005] | 0.0031 | 0.00059 | 79.9 |

**\* [2].**

**Table 6.** Overview of the removal efficiency for mercury and zinc.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Sampling campaign, No | Hg | | | Zn | | |
| Inlet concentration, mg L-1 | Outlet concentration, mg L-1 | Treatment efficiency, % m/m | Inlet concentration, mg L-1 | Outlet concentration, mg L-1 | Treatment efficiency, % m/m |
| 1 | [0.00015] | [0.00015] | n. e. | 0.29 | <0.10 | 65.5 |
| 2 | <0.00020 | [0.00015] | 26.9 | 0.20 | <0.10 | 75.6 |
| 3 | <0.00020 | [0.00015] | 24.9 | 0.26 | <0.10 | 80.7 |
| 4 | 0.00065 | [0.00015] | 88.8 | 0.31 | <0.10 | 84.3 |
| 5 | [0.00015] | [0.00015] | n. e. | 0.14 | <0.10 | 64.5 |
| 6 | 0.00025 | [0.00015] | 69.9 | 0.19 | <0.10 | 73.6 |
| 7 | 0.00079 | [0.00015] | 90.7 | 0.35 | <0.10 | 86.0 |
| 8 | 0.00032 | [0.00003] | 95.7 | 0.21 | 0.098 | 57.2 |
| 9 | 0.00014 | [0.00003] | 89.3 | 0.18 | [0.05] | 86.1 |
| 10 | 0.00019 | 0.000093 | 49.5 | 0.25 | 0.087 | 64.1 |
| 11\* | 0.00013 | [0.000007] | 97.2 | 0.20 | 0.074 | 62.2 |
| 12\* | 0.00011 | 0.000016 | 85.5 | 0.24 | 0.10 | 58.5 |
| 13 | 0.0080 | 0.000042 | 99.5 | 0.61 | 0.065 | 89.0 |
| 17 | no a. | [0.000007] | n. e. | 0.12 | 0.047 | 57.6 |
| 18 | 0.00019 | 0.000039 | 78.3 | 0.28 | 0.065 | 75.5 |

**\* [2].**

**Table 7.** Overview of the removal efficiency for nickel and lead.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Sampling campaign, No | Ni | | | Pb | | |
| Inlet concentration, mg L-1 | Outlet concentration, mg L-1 | Treatment efficiency, % | Inlet concentration, mg L-1 | Outlet concentration, mg L-1 | Treatment efficiency, % |
| 1 | 0.011 | <0.010 | 54.5 | 0.031 | [0.0030] | 95.2 |
| 2 | <0.010 | <0.010 | n. e. | 0.010 | [0.0030] | 85.4 |
| 3 | 0.015 | <0.010 | 66.6 | 0.0097 | [0.0030] | 84.5 |
| 4 | 0.028 | 0.017 | 40.9 | 0.016 | [0.0030] | 90.9 |
| 5 | 0.049 | 0.014 | 71.6 | 0.0078 | [0.0030] | 80.9 |
| 6 | 0.015 | 0.010 | 33.2 | 0.015 | [0.0030] | 90.0 |
| 7 | 0.063 | <0.010 | 92.2 | 0.029 | [0.0030] | 94.9 |
| 8 | 0.0073 | 0.0079 | 0.72 | 0.010 | [0.003] | 86.2 |
| 9 | 0.018 | 0.0075 | 58.3 | 0.018 | [0.003] | 91.7 |
| 10 | 0.044 | 0.027 | 36.7 | 0.016 | [0.003] | 90.3 |
| 11 | 0.011 | 0.0058 | 46.1 | 0.010 | <0.005 | 74.5 |
| 12\* | 0.021 | 0.0056 | 73.4 | 0.018 | [0.003] | 91.7 |
| 13\* | 0.033 | 0.0067 | 79.1 | 0.060 | [0.003] | 97.4 |
| 17 | 0.01 | 0.0066 | 28.5 | 0.006 | [0.003] | 70.5 |
| 18 | 0.017 | 0.0074 | 54.0 | 0.024 | [0.003] | 93.4 |

**\* [2].**

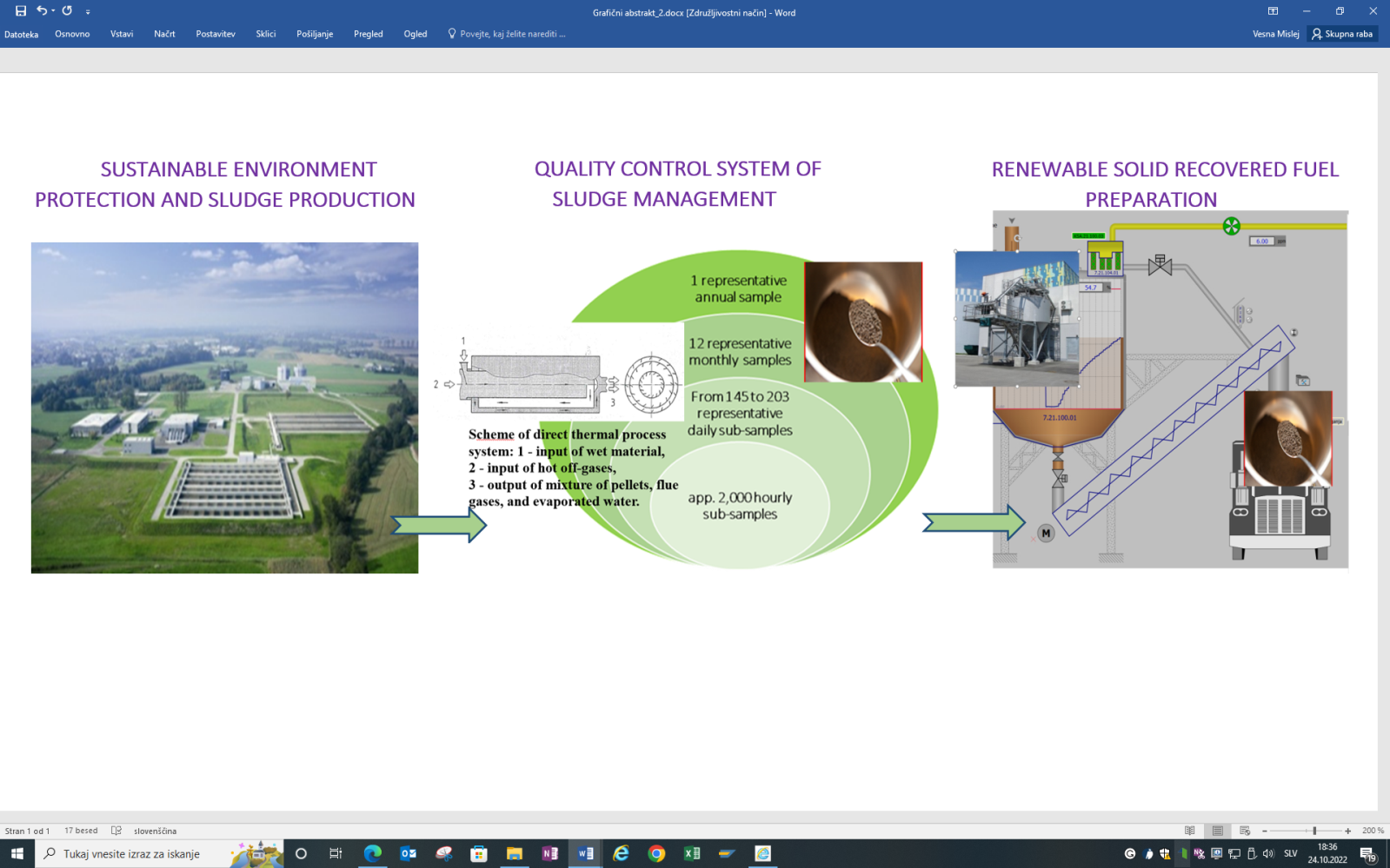
**Table 8.** Overview of the removal efficiency for manganese and molybdenum.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Sampling campaign, No | Mn | | | Mo | | |
| Inlet concentration, mg L-1 | Outlet concentration, mg L-1 | Treatment efficiency, % | Inlet concentration, mg L-1 | Outlet concentration, mg L-1 | Treatment efficiency, % |
| 6 | <0.10 | [0.025] | 74.9 | no a. | | |
| 7 | <0.10 | [0.025] | 75.5 |
| 8 | 0.043 | 0.017 | 63.7 |
| 9 | 0.054 | 0.017 | 68.5 |
| 10 | 0.064 | 0.029 | 53.2 |
| 11 | 0.058 | 0.0069 | 87.8 |
| 12\* | 0.057 | 0.015 | 73.8 |
| 13\* | 0.11 | 0.011 | 89.7 |
| 17 | 0.041 | 0.0083 | 78.1 | 0.0018 | 0.00091 | 45.3 |
| 18 | 0.25 | 0.029 | 87.7 | 0.00054 | 0.00024 | 53.0 |

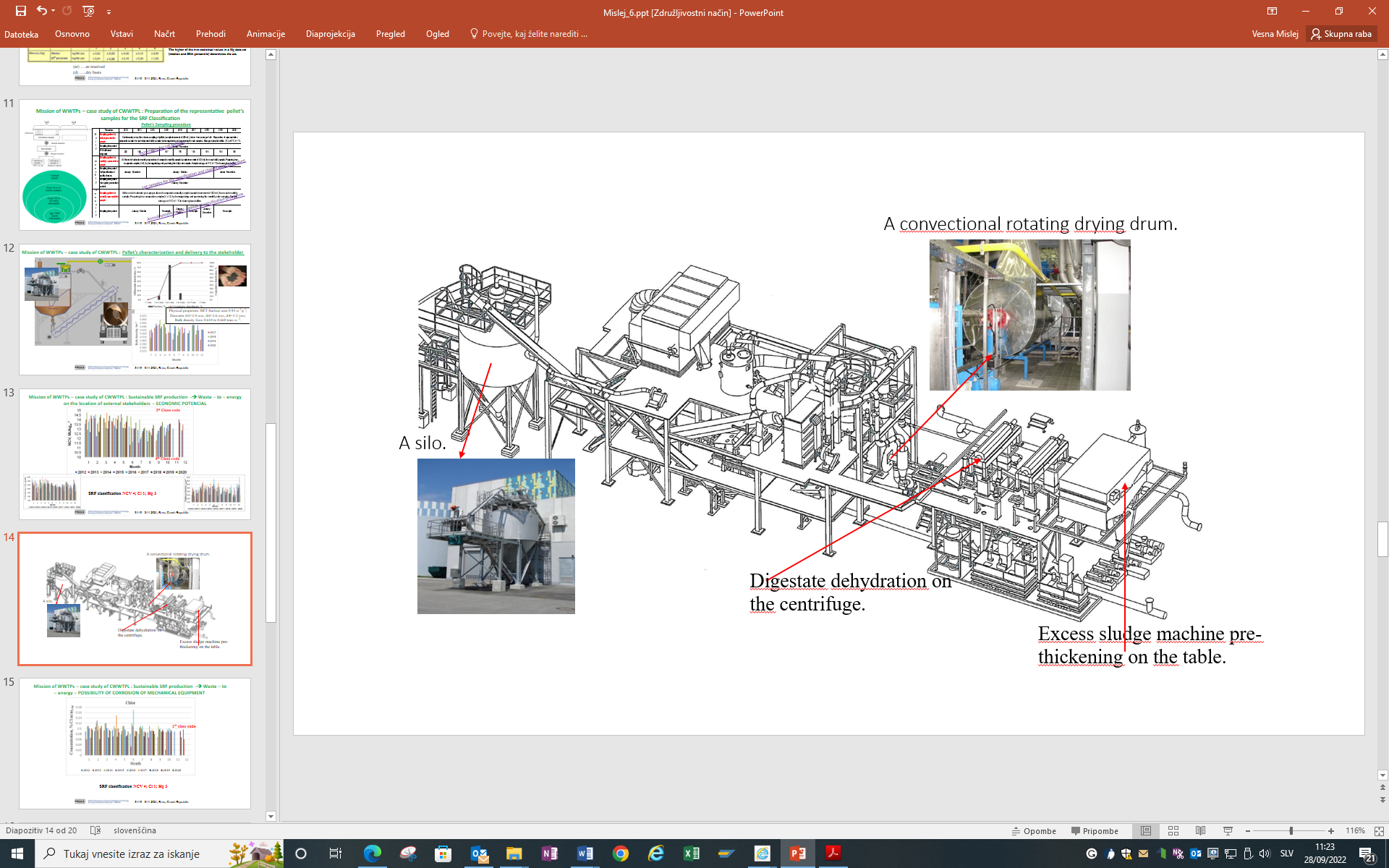
**\* [2].**

2. Pellets production at the CWWTPL [1]

The entire CWWTPL quality control system has been set up according to ISO 9001:2015 - Quality management systems, Requirements [5]. To achieve the objectives of the special national demands on solid recovered fuel (SRF) production, the existing quality management system must be upgraded with specific demands for the operation of facilities for the production and trade of SRF [6, 7], covering operations from the point of acceptance of surplus sludge destined for recovery to the point of delivery of the SRF shipment to the final stakeholder in accordance with the contract (Figure 1). Raw surplus sludge is discharged daily from the biological system. After gravitational and mechanical pre-thickening with the addition of flocculants, the excess sludge contains 5.5 to 6.5 % of dry matter. It is then alternately taken to one of two identical parallel digesters capable of holding a total volume of 14,800 m3 and processed through anaerobic mesophilic digestion. The digested sludge contains 3.0 - 3.5 % dry matter. It is collected into a 1,850 m3 secondary thickening tank. When the tank is full, the digestate dehydration process starts. Afterwards, it is transported to the mixer, where dry granulates are added. This mixture reaches a moisture content of 55 – 65 % dry matter. In this rheological form, it is suitable to be exposed to thermal treatment in a convectional rotating drying drum (Figure 2). The latter process is not continual but is in batch mode connected with the running of the centrifuge. Drum performs mixture drying up to 92 % m/m of dry matter, pelleting, and hygienisation simultaneously. Final pellets have 2 mm to 4 mm in diameter. Until taken over by the stakeholder, pellets are temporarily stored in a silo (Figure 2) with a volume of 50 m3.



**Figure 1.** Sewage sludge management at the CWWTPL [1, 2, 5 - 7].



**Figure 2.** Schematic representation of mechanical pre-treatment of excess sludge and digestate at the CWWTPL [8 - 11].

3. The pellets assessment according to hazardous waste characteristics

»Hazardous waste« means waste which displays one or more of the hazardous properties listed in Annex III of Directive 2008/98/EC [12]. Based on the review of pellets generation technology at the Central wastewater treatment plant, the review of input raw materials, pellets composition, and assessment of analysis results on the annual representative samples, the report was prepared regarding the content of hazardous matter. Official reports NLZOH [13] and NLZOH [14] state that the waste in question does not contain substances that could be classified under one of the hazard statements [15], and designated as additional hazardous items related to HP 15 [12, 15, 16]. ‘Hazard statement’ means a phrase assigned to a hazard class and category that describes the nature of the hazards of a hazardous substance or mixture, including, where appropriate, the degree of risk. By the EU Commission Regulation [11], the hazardous properties H 1 to H 15 defined in Annex III to Directive 2008/98/EC [12] are renamed to HP 1 to HP 15 to avoid potential confusion with the hazard statement codes defined in EC Regulation [15] (Table 1). Directive 2008/98/EC [12] states that the classification of waste as hazardous should be based, among other things, on the EU Union legislation on chemicals, in particular concerning the type of preparations as hazardous, including concentration limit values used for that purpose.

**Table 9.** The evaluation of pellets according to hazardous waste characteristics [12 - 14].

|  |  |  |
| --- | --- | --- |
| **Properties of waste which render it hazardous** | **Description** | **Assessment report (Yes/No)** |
| HP 1 | “Explosive”: waste is capable of chemical reaction of producing gas at such a temperature and pressure and at such a speed as to cause damage to the surroundings. | No |
| HP 2 | “Oxidising”: waste, which may, generally by providing oxygen, cause or contribute to the combustion of other materials. | No |
| HP 3 | “Flammable”: flammable solid waste, which is readily combustible or may cause or contribute to fire through friction. | No |
| HP 4 | “Irritant — skin irritation and eye damage” waste on the application can cause skin irritation or damage to the eye. | No |
| HP 5 | “Specific Target Organ Toxicity (STOT)/Aspiration Toxicity” can cause specific target organ toxicity either from a single or repeated exposure or cause acute toxic effects following aspiration. | No |
| HP 6 | “Acute Toxicity” can cause acute toxic effects following oral or dermal contact or inhalation exposure. | No |
| HP 7 | “Carcinogenic”: waste, which induces cancer or increases its incidence. | No |
| HP 8 | “Corrosive”: waste, which on the application can cause skin corrosion. | No |
| HP 9 | “Infectious”: waste containing viable micro-organisms or toxins reliably believed to cause disease in man or other living organisms. | No |
| HP 10 | “Toxic for reproduction”: waste affects sexual function and fertility in adult males and females, as well as developmental toxicity in the offspring. | No |
| HP 11 | “Mutagenic”: waste may cause a mutation, a permanent change in the amount or structure of the genetic material in a cell. | No |
| HP 12 | “Release of an acute toxic gas”: waste releases acute toxic gases in contact with water or acid. | No |
| HP 13 | “Sensitising”: waste contains one or more substances known to cause sensitising effects to the skin or the respiratory organs. | No |
| HP 14 | “Ecotoxic”: waste presents or may present immediate or delayed risks for one or more sectors of the environment. | No |
| HP 15 | “Waste capable of exhibiting a hazardous property listed above not directly displayed by the original waste”. | No |

4. The SRF classification into Quality classes

The Technical Report [17] summarises a classification system, classes, and specification procedure to evaluate the treated waste as an SRF by the decision of CEN/TC 343 Working Group 2, Fuel Specification and Classes.Technical Report [17] introduced a list of three operational parameters essential for the successful operation of a combustion facility: i) economics aspects (NCV), ii) corrosion (Cl) and emission indicators(Hg and Cd). Cadmium is added as a proposal to supplement the classification system, which can be used if needed. The classification system presents five classes (Table 10). At least ten representative samples of treated waste, sampled evenly over a calendar year, must be analysed to specify the Class code. The highest class (the worst SRF Quality class) is reserved for the SRF derived from, e.g. sewage sludge and filter cakes. Technical Standard [6], superseded with Technical Standard [7] in May 2021, determines the quality classes based only on NCV, Cl, and Hg. Both documents determine the method of evaluating the energy and environmental suitability of treated waste for use as SRF and set the statistical procedures for generated analytical results.

**Table 10.** Classification of SRFs [17].

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Classification**  **characteristic** | | **Statistical measure** | **Unit** | ***Classesa*** | | | | |
| ***1*** | **2** | **3** | **4** | **5** |
| NCV | Arithmetic mean | | MJkg-1ar | *≥ 25* | ≥ 20 | ≥ 15 | ≥ 10 | ≥ 3 |
| Chlorine (Cl) | % m/mDM | *≤ 0.2* | ≤ 0.6 | ≤ 1.0 | ≤ 1.5 | ≤ 3 |
| Mercury (Hg) | Median | | mgMJ-1ar | *≤ 0.02* | ≤ 0.03 | ≤ 0.08 | ≤ 0.15 | ≤ 0.50 |
| 80th percentile | | *≤ 0.04* | ≤ 0.06 | ≤ 0.16 | ≤ 0.30 | ≤ 1.00 |
| Cadmium*b* (Cd) | Median | | *≤ 0.1* | ≤ 0.30 | ≤ 1.0 | ≤ 5.0 | ≤ 15*c* |
| 80th percentile | | *≤ 0.2* | ≤ 0.60 | ≤ 2.0 | ≤ 10 | ≤ 30*c* |

a Values refer to a minimum of 10 analyses. bProposed classes for Cd. cFor the SRF with high ash content and therefore a higher raw material substitution in the clinker production with a maximum of 100 mg kg-1ar.

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13. 13] Report on the investigation of hazardous properties of waste for the company JP VODOVOD KANALIZACIJA SNAGA d.o.o., Waste 19 08 05 - Sludge from municipal wastewater treatment, Document N° 88-62/19-1, National Laboratory of Health, Environment and Food, Department for Waste and Soil.

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15. Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006 (Text with EEA relevance), OJ L 353, 31.12.2008, p. 1–1355.

[16] Commission Regulation (EU) No 1357/2014 of 18 December 2014 replacing Annex III to Directive 2008/98/EC of the European Parliament and of the Council on waste and repealing certain Directives Text with EEA relevance, OJ L 365, 19.12.2014, p. 89–96.

[17] Technical Report, 2006, CEN/TR 15508:2006, Key properties on solid recovered fuels to be used for establishing a classification system, ICS: 75.160.10.