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CONTENT

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LEGISLATION CONCERNING THE ENERGY REUSE OF SLUDGE FROM WASTE WATER TREATMENT PLANT IN THE REGION OF SLOVENIA

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ABSTRACT: The legislation on waste management in Slovenia was markedly renovated in the year 2008. The main changes were related to the treatment of biologically degradable wastes, which was extended to the energy-from-waste option. New regulations in Slovenia have set criteria on which wastes can be processed and transformed into a solid recovered fuel and the conditions concerning its quality and use. The legislation also outlines other process conditions for placing sewage sludge on the market as a secondary solid fuel and its application in various thermal processes. Sewage sludge represents the largest share of wastes, generated at biological wastewater treatment plants (BWWTP). In fresh form it is formed as excess active sludge formed during biological treatment of municipal wastewater and may be consecutive stabilized by an aerobic or anaerobic process. Anaerobic stabilization (digestion) of the raw gravity thickened sludge, followed by mechanical and thermal dehydration transform the fresh sludge into stable dry granules. In this form it is suitable for marketing and utilization in thermal processes. The main problems may be low calorific value and relative high metals content (especially mercury) and sulphur. Sulphur and cadmium are not among the limiting parameters of the noted technical specification for alternative fuels, so the new regulation in Slovenia will be appealed.

Keywords: legislation, alternative solid fuels, sewage sludge

1 PURPOSE OF THE WORK

The Republic of Slovenia occupies 20,273 km^2 in the centre of Europe and has population of 2 millions inhabitants. The Local Self-Government Act stipulates that a municipality is the basic self-governing local community, with at least 5,000 inhabitants; an urban municipality has at least 20,000 inhabitants.

There are now 210 municipalities in Slovenia. Among other things, they have the authority to manage their assets, facilitate conditions for economic development, prepare spatial development plans, create conditions for public accommodation and manage local public services.

The municipalities are organised into 12 Slovenia's statistical regions on one's own program to satisfied legislation on waste management.

Since there is no conventional waste incineration plant in operation, which would utilize energy content of sewage sludge in Slovenia and at the same time land-use and disposal of sewage sludge at landfills have become very limited and prohibited from 15th of July this year, new legal options represent extremely potential solution for many important types of waste.

Purpose of the work is short and schematic review of national legislation's renewal concerning energy utilization of sewage sludge. New regulations in Slovenia have set criteria on which wastes can be processed and transformed into a solid recovered fuel and the conditions concerning its quality and use.

Generators of sewage sludge in slovenian municipalities are faced with critical shortage of disposal options.

2 APPROACH

2.1 Renovation the Slovenian legislation

In the year 2008 the Slovenian legislation of wastes management came to an almost complete renovation. New regulations were issued, determining the quality criteria of biologically degradable wastes with calorific and fertilising value indented for further utilisation as alternative solid fuel or soil fertilizer. The fundamental intention of the legislation was to put the material/energy recycling of wastes before its removal.

Only non-hazardous waste may be transformed to alternative fuel. The alternative fuel must conform to a new set of quality standards, which are mainly dictated by strict environmental protection principles. The alternative solid fuels are classified into five quality classes, depending on the content of cadmium, mercury, chlorine, sulphur and the calorific value of waste. The set of limiting parameters is therefore larger than in the related European technical specification TS CEN/ TS15359 [5] .

2.2 Regulation concerning waste handling (Off. J., No. 34/2008 [1])

Processing wastes are procedures with a purpose of beneficial usage of waste or it constituents. This could be the preparation of waste for its reuse, recycling of its substances, its incineration, as well as incineration with energy reuse and processing into fuel. According to the European waste management hierarchy, preparation of waste for a reuse has an advantage to recycling and other forms of process. Processing of waste has an advantage to its disposal.

2.3 Regulation concerning the processing of non-hazardous waste into solid fuel (Off. J., No. 57/08 [2])

This regulation determines the conditions for processing non-hazardous wastes into solid fuel before it is used as fuel in the waste incineration device.

Legislation applies that only non-hazardous waste may be processed into solid fuel in order to be used as fuel. Sewage sludge is granted only if it meets the requirements of the input of silt into or on the ground, the requirements established in the prescript that regulates usage of sewage sludge in farming.

This regulation is used to determine the conditions of pre-processing non-hazardous waste into solid fuel with thermal treatment as dehydration.

Procedures of pretreated non-hazardous waste are used for non-hazardous waste that is produced from sludge of municipal or industrial biological waste water treatment plants and for the stabilized sludge of the anaerobic digestion of biologically degradable waste. The regulation states that only non-hazardous waste is allowed to be processed into an alternative fuel. Sewage sludge with the EWL classification number 19 08 05 (silt from the municipal waste water treatment plants) is acceptable if requirements are met for its land applications (the requirements established in the prescript that regulates usage of sewage sludge in farming).

On 5.7.2008 the Regulation concerning the usage of sludge from the municipal waste water treatment plants in the farming (Off. J. No. 62/2008 [3]) was issued, determining that in case when sludge is not usable for fertilization in farming a prescription is being used, regulating the process of biologically degradable waste.

Along with the regulation, the size of the incineration plant is as well regulated, the smallest power plant being 1 MW_{th}, where it applies that the solid fuel, allowed to be used, can be sludge, from municipal or industrial biological waste water treatment plants, as well as the stabilized sludge of the anaerobic degradation process of biologically degradable waste. It also has to classify according to:

- net calorific value, into the 1.2. or 3. class from the classification list of solid recovered fuels
- content of chlorine, into the 1. or 2. class
- content of hazardous substances (mercury, cadmium and sulphur), into the 1. class from the classification list of solid recovered fuels

2.4 Regulation concerning the process of biologically degradable waste (Off. J. No. 62/2008) [4]

The regulation applies for wastes with the classification number 19 08 05, which are, according to the above mentioned regulation, silts from the municipal waste water treatment plants, if they meet the requirements of the input of sludge into or on the ground, the requirements established in the prescript that regulates usage of sewage sludge in farming. The noted condition is a large contradiction in the regulations and indicates a probable mistaken

administrative perspective on the usage of wastes and their placement on the market.

Just as doubtful is the instruction in the regulation in the Addition 2, which states that the measured values for the parameters, such as for example metals, are calculated on a 30 % content of biologically degradable substances in a stabilized biologically degradable waste. A question occurs concerning which values for metals must the analytic laboratory give – the bigger of the analyzed or the smaller one.

The regulated quality of processed sludge includes reporting the contents of cadmium and mercury, but does not include sulphur as does the regulation concerning solid fuels [2] .

3 RESULTS

3.1 Sewage sludge as a waste 19 08 05

Excess sludge, generated during the biological treatment of waste waters represents the largest share of wastes in municipal waste water treatment plant Ljubljana, further on referred to as WWTPL. In WWTPL yearly more than 400.000 tons of excess sludge is formed, having about 1 % of dry substance. On the ground of its formation the excess sludge is anaerobically stabilized, and mechanically and thermally dehydrated to 91 % dry matter, yielding more than 4000 tons of stabilized dry sludge.

3.2 Sludge processing at WWTPL

WWTPL is the largest waste water treatment plant in Slovenia; it is size of near 360.000 PE and it is designed as a one-step mechanically biological treatment plant with a secondary level of cleaning which means removal of carbon compounds and nitrification. Excess sludge is formed at the aerobic treatment process and is extracted from the system daily. Settled sludge contains from 0.65 % to 1.2 % of dry substance. In this shape it is not appropriate for transport to the place of its final processing. It is infectious and subject to make a stench. Further processing converts the excess sludge to a controllable form. Procedures assigned to this are mechanical (gravitational) primary thickening in settling tanks, followed by a machine thickening with an addition of polymer. After this part the content of dry substance increases up to around 5.5 %, to 6.5 %. This is followed by an anaerobic stabilization of sludge in the anaerobic digester where the content of dry substance is reduced to around 3.5 % to 4.5 % (on behalf of biogas production) and therefore the sludge gains the feature of longer existence and broader options of further usage.

The sludge is then led to mechanic dehydration, preformed on a continual centrifuge with an addition of polymer. The sludge gains from 23 to 25 % of dry substance. In this shape it is appropriate to be led on the line of thermal dehydration (drying) where it gains its final 91 to 93 % of dry substance and gets the shape of granulate or pellets with the size of 3-5 mm and the bulk weight of 800 kg/m^3. This gives the sludge the ability of simple transportation and utilisation as an alternative fuel.

Dry sludge of WWTPL is currently processed by the R1 procedure as an additional fuel in the cement factory.

Table 1. Comparison of the regulated quality demands of the solid fuel, as a product of sewage sludge process at WWTPL and the two months average value of sludge control at WWTPL.

Parameter	units	Processed sewage sludge quality (nov./ dec.2008)[6]	4th classification class[2]	4th classification class[5]	Reg. [4]	Reg. [3]
Hg	mg/kg	1.9	-	-	7	1.5
Hg	mg/MJ	0.18	≤0.30	≤0.30	-	-
Net caloric value	MJ/kg	10 - 11	≥10	≥10	-	-
Chlorine	% (m/m)	0.04	≤ 1.5	≤ 1.5	-	-
Sulphur	% (m/m)	0.58	≤0.5	-	-	-
Cadmium	mg/kg	< 1.0	≤5.0	-	7	1.5

As stated the main problems with future marketing of dry sludge would be its sulphur and mercury content (Table 1). Limited content of sulphur in sludge is a novelity in the legislation and represents an obstacle to provision of the environmental permit for the plants that processes sludge into solid recovered fuel.

Sulphur is not a parameter which holds a tradition with the limit values in this sort of regulation. The list of polluters according to E-PRTR [7] does not state sulphur.

4 CONCLUSIONS

4. 1 The possible approaches for reuse of WWTPL sludge

Regarding the net caloric value and the content of hazardous substances, solid recovered fuel obtained from any other non-hazardous waste is classified in one of the five classes of the classification list of solid fuels from the Addition 3 which is the component part of this regulation [2]. Criterions for classifying solid fuels are established in technical specifications TS CEN/TS 15359 [5].

In the corresponding Slovene regulation two additional parameters Cd and S are included. According to the preliminary analyses, processed sludge should be classified between 4th and 5th classification class if there was no exceeded content of sulphur. It is true that the sulphur in waste is a source for SO_2 emissions, but those also depend on the amount of secondary fuel and its blending with other fuels.

The determined exceeding value of sulphur - the additional parameter in our regulation - represents great obstacle for the utilization of WWTP sludge as alternative solid fuel. This is unreasonable since most of the power plants are equipped with desulphurisation units. Cadmium has not been found critical, eventually.

Application in the cement kilns is more promising since they are allowed to set their own quality standards for acceptance of the secondary fuels.

4.2 Source of pollutants in the sewage sludge of WWTPL

The results express in mg/L by the regularly operational monitoring of inlet waste water to the WWTPL are not appropriate for solving these problems, as more precise analytical methods for mercury are required in the region of µg/L and ng/L. The project must be started regarding this matter to discover the main attributors of both critical parameters and, according to the type and the number of sources, the possible approaches for their elimination. Reduction of the content of Hg is most likely going to be a long term process as a consequence of total exclusion of Hg in raw materials. As for sulphur, it will be necessary to obtain additional knowledge and carry out test of the quality of waste water at different users of the municipal sewer system.

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