SLOVENSKI STANDARD
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Ļistilne naprave za odpadno vodo - 8. del: Obdelava blata in hranjenje

Wastewater treatment plants - Part 8: Sludge treatment and storage

Kläranlagen - Teil 8: Schlammbehandlung und -lagerung

Stations d'épuration - Partie 8: Stockage et traitement des boues

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Wastewater treatment plants - Part 8: Sludge treatment and storage

Stations d'épuration - Partie 8: Stockage et traitement des boues

Kläranlagen - Teil 8: Schlammbehandlung und -lagerung

This European Standard was approved by CEN on 8 March 2001.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 165 "Waste water engineering", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2001, and conflicting national standards shall be withdrawn at the latest by December 2001.

It is the eighth part prepared by the Working Groups CEN/TC 165/WG 42 and WG 43 relating to the general requirements and processes for treatment plants for over 50 PT. The parts of the series are as follows:

Part 1: General construction principles
Part 3: Preliminary treatment
Part 4: Primary settlement
Part 5: Lagooning processes
Part 6: Activated sludge processes
Part 7: Biological fixed-film reactors
Part 8: Sludge treatment and storage
Part 9: Odour control and ventilation
Part 10: Safety principles
Part 11: General data required
Part 12: Control and automation[1])
Part 13: Chemical treatment
Part 14: Disinfection[1])
Part 15: Measurement of the oxygen transfer in clean water in aeration tanks of activated sludge plants
Part 16: Physical (mechanical) filtration[1])

NOTE For requirements on pumping installations at wastewater treatment plants, provided initially as part 2 "Pumping installations for wastewater treatment plants", see EN 752-6 "Drain and sewer systems outside buildings — Part 6: Pumping installations".

The parts EN 12255-1, EN 12255-3 to EN 12255-8 and EN 12255-10 and EN 12255-11 became implemented together as a european package (Resolution BT 152/1998). The date of withdrawl (dow) of all conflicting national standards is 2001-12-31. Until the date of withdrawl is reached the National and the already published European standards both coexist.

This standard includes a Bibliography.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard gives design principles and specifies construction requirements for sludge treatment and storage facilities in wastewater treatment plants for more than 50 PT.

Other sludges and organic wastes may be treated together with the municipal sewage sludge.

Differences in wastewater treatment throughout Europe have led to a variety of systems being developed. This standard gives fundamental informations about the systems; this standard has not attempted to specify all available systems.

Detailed information additional to that contained in this standard may be obtained by referring to the bibliography.

[1]) in preparation

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 1085
Wastewater treatment — Vocabulary

EN 12176
Characterization of sludge — Determination of pH-value

prEN 12255-1:1996
Wastewater treatment plants — Part 1: General construction principles

prEN 12255-4:1997
Wastewater treatment plants — Part 4: Primary settlement

EN 12255-5
Wastewater treatment plants — Part 5: Lagooning processes

prEN 12255-6:1997
Wastewater treatment plants — Part 6: Activated sludge processes

prEN 12255-9:1999
Wastewater treatment plants — Part 9: Odour control and ventilation

EN 12255-10
Wastewater treatment plants — Part 10: Safety principles for the construction of wastewater treatment plants

EN 12880
Characterisation of sludges — Determination of dry residue and water content

EN ISO 5667-13
Water quality — Sampling — Part 13: Guidance on sampling of sludges from sewage and water treatment works (ISO 5667-13 : 1997)

3 Terms and definitions

For the purposes of this European standard the terms and definitions given in EN 1085 and the following apply.

3.1
psychrophilic
process conditions for organisms which are active below 30 °C.

3.2 mesophilic
process conditions for organisms which are active at temperatures between 30 °C and 45 °C, with an optimum of 32 °C to 37 °C.

3.3
thermophilic
process conditions for organisms which are active at temperatures between 45 °C and 80 °C, and have an optimum of 55 °C to 65 °C.

3.4
pseudo stabilisation
process which prevents organic degradation so long as particular conditions (such as pH value or dryness) are maintained, but for which degradation recommences when the conditions are no longer met.

4 Planning

Sludge treatment and storage influences subsequent utilization. It may be subject to a variety of regulations dependent upon the site of the treatment plant and the proposed routes for use or disposal. For new works or major upgrading an environmental impact assessment should be carried out.

The choice of the sludge treatment process depends on the size of the treatment plant, the type, origin and characteristics of the sludge to be treated and the final method of utilization or disposal. Processes which allow for more than one sludge utilization or disposal option are preferable.

Consideration should be given to the possibility of centralised sludge treatment facilities which allow a wider range of treatment techniques. Special care is needed in respect of extra loads e. g. of nitrogen generated from sludge liquors at centralised facilities.

Sufficient storage capacity shall be available on the source site for raw or treated sludge to prevent sludge overflow under all likely conditions.

The following factors shall be considered in planning sludge treatment:

— the utilization or disposal route and related quality requirements e. g. nutrients, harmful substances and calorific value;
— sludge characteristics;
— import of sludges and other organic wastes;
— minimum and maximum daily sludge production (volume and mass);
— future sludge production;
— range of solids concentrations (total and volatile solids);
— physical characteristics (viscosity, temperature);
— biological properties (degradability, inhibitors and toxicants);
— aggressive or corrosive conditions;
— likely emissions including greenhouse gases, and odours (see also prEN 12255-9:1999);
— removal or disintegration of gross solids which may cause blockage or malfunction;
— effect of abrasive or deposit forming solids such as grit;
— effect of additives used in wastewater treatment, such as precipitants, coagulants and flocculants and their influence on utilization;
— impact of return liquors on the wastewater treatment process e. g. peak loads of ammonia and phosphorus resolubilisation from sludge processing;
— health and safety of operators and the general public (see also EN 12255-10) e. g. the generation of toxic and /or explosive atmospheres;
— nuisance e. g. smell and visual intrusion;
— environment e. g. effect of leakage.

5 Process requirements

5.1 General

Provision shall be made to allow the sampling of input and output for each unit process (see EN ISO 5667-13). Flow measurement for each unit process should be considered.

The design shall take account of any requirements for control of odour, noise, vibration and explosive atmospheres in accordance with prEN 12255-9:1999 and EN 12255-10.

5.2 Thickening

5.2.1 General

Sludge thickening is carried out in a continuous or batch mode of operation, using gravity thickeners, mechanical thickening equipment such as filters or centrifuges, or dissolved air flotation.

The selection of the thickening method and its design shall take account of the following factors:

— the sludge solids concentration required by subsequent processes;
— the solids recovery from the process;
— resolubilisation of phosphorus in gravity thickeners;
— retention times, which when exceeding one day can result in anaerobic degradation, causing odour emission, foaming, bulking and impaired dewaterability;
— control of the sludge feed and liquor removal rates;

— the storage and controlled return of sludge liquor where nitrification or nitrogen removal is required.

Due to enhanced viscosity, positive displacement pumps should be used for transferring the thickened sludge.

A programme of sludge testing and analysis shall be considered where practicable to assist in the design of gravity thickeners.

5.2.2 Gravity thickening

Gravity thickeners should have a depth of at least 3 m, have a bottom slope of at least 50° (conical) or 60° (pyramidal) to the horizontal or be equipped with either an agitator or a rake which includes a bottom scraper (e.g. picket fence). Other features which shall be considered include:

— retention and removal of scum;
— supernatant withdrawal at different levels (e. g. using a vertically moveable device);
— observing the quality of the supernatant liquor during removal;
— ventilation and exhaust air deodorisation if thickeners are covered.

Factors which affect the design of gravity thickeners include:

— the surface loading rate;
— the mass surface loading rate;
— the solids detention time;
— the total depth of the consolidation zone.

5.2.3 Mechanical thickening

Where thickening equipment is similar to that used for mechanical dewatering the relevant construction principles apply. The most common machines for mechanical thickening are:

— drum filters;
— belt filters;
— centrifuges.

Mechanical sludge thickening equipment should:

— normally operate automatically with the facility for manual override;
— include all equipment required for storage, preparation and dosage of any necessary flocculant;
— be enclosed or located in adequately ventilated rooms to reduce corrosion and for the health and safety of the operator.

The requirements and guidelines for mechanical sludge dewatering equipment in 5.5.2 are also appropriate to mechanical sludge thickening.

5.2.4 Air flotation

Waste activated sludge or backwash water from biofilters can be thickened by dissolved air flotation with or without chemical flocculation.

Dimensioning of a dissolved air flotation unit shall take account of the following:

— the surface loading rate;
— the mass surface loading rate;
— the air/solids ratio.

5.3 Disinfection

Sludge disinfection may be achieved chemically (see 5.4.4) or thermally.

Processes which can achieve disinfection include:

— thermophilic aerobic digestion;
— thermic processes e.g. heat treatment, thermal drying;
— thermophilic aerobic digestion as a pre-treatment before mesophilic anaerobic digestion;
— thermophilic anaerobic digestion as a pre-treatment before mesophilic anaerobic digestion;
— composting;
— addition of lime to liquid sludge or sludge cake;

— mesophilic anaerobic digestion in combination with long term storage.

NOTE Pasteurisation is time/temperature dependent. It may take place before or simultaneously with any stabilisation process used.

5.4 Stabilisation and pseudo-stabilisation

5.4.1 General

Stabilisation is a process for transformation of readily degradable organic substances into mineral or slowly degradable organic substances. Treatment of sludge with lime or thermal drying is known as “pseudo-stabilisation”. It can prevent organic degradation so long as particular conditions (pH value or dryness) are maintained, but degradation recommences when the conditions are no longer met.

Pseudo-stabilisation processes may be used to reduce odour emission during storage, to improve sludge handling as well as to achieve disinfection. They remain an option for treatment before land application, but they do not reduce the long-term potential for gas production which shall be considered if the sludges are to be landfilled.
Methods which measure degradability may be used to characterise the quality of stabilisation.

Methods which measure sulphide evolution may be used to characterise septicity (or the potential for odour formation and emission).

A degree of sludge stabilisation can be achieved by the extended aeration process (see prEN 12255-6:1997).

5.4.2 Anaerobic digestion

5.4.2.1 Design considerations

When designing an anaerobic digestion plant the following factors shall be considered depending upon whether the plant is heated:

— the required volatile solids reduction;
— degradability;
— operating temperature;
— temperature control;
— hydraulic retention time;
— average and peak loads;
— dimensions of the digester;
— one or two-stage processes;
— gas production (average and peak);
— gas storage and use;
— limitation on gas emissions;
— limits and controls on odour emissions;
— frequency of feeding ;
— scum and foam control and removal;
— seeding;
— mixing;
— short-circuiting and dead-space;
— mixing energy (Wh/m^3 d) and mixing intensity (W/m^3);
— thermal insulation.
— generation of aggressive components in sludge or gas;
— corrosion protection to the interior surface in contact with biogas;
— corrosion protection for gas holders, or means of adding inhibitors to water seals;
— the sum of the maximum hydrostatic pressure plus the maximum gas pressure;
— effect of static and dynamic forces (for example, due to mixers, recirculation, pumps, or temperature variations);
— equipment repair or replacement without emptying the digester;
— overflow routes shall not be obstructed by any valve arrangement;
— provision of a view port with external and internal wiper on top of the digester;
— pressure relief mechanisms;
— equipment for dosing e. g. alkali or anti-foam agents.

The average influent solids concentration should be greater than 4 % total dry solids by mass (see EN 12880).

Pipelines connected to the digester below the minimum sludge level should have a section between the isolation valve and the digester which can be isolated by freezing.