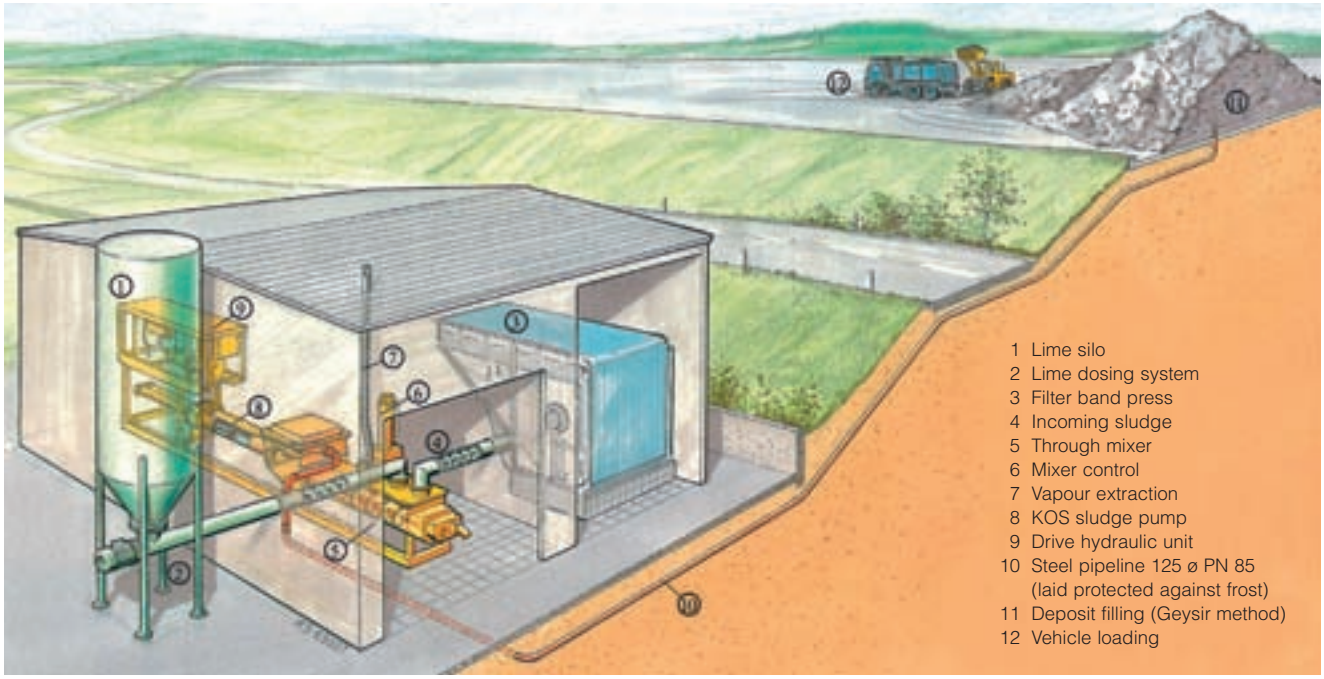
Project report

MIXOPRESS plant at Års sewage plant (Denmark)

Conditioning of sewage sludge with lime in hermetically sealed system



Schematic diagram of Års sewage sludge conditioning plant

Operators of local sewage plant of medium size often get into great difficulties in using the dewatered sludge produced in the plant. Years ago, a large part of the sewage sludge in rural areas was deposited in agricultural or forestry areas. In the meantime, many farmers have been made unhappy by the continual discussion among experts and in publications on the limits for heavy metals and for dioxin, so that they refuse to accept sludge on their fields. The dumping of sludge in deposits (together with domestic waste) is also becoming more difficult in some areas. The regulations are being changed, so that the decisive factor will no longer be a minimum solids content (eg: 36 %), but keeping to minimum shear strength for accepting sludge at deposits. Whatever these new regulations will look like, one thing is already certain, that the output from centrifuges and band filters (solids contents of 20 – 25 %) must be raised by additives to solids contents of over 40 %. One method of increasing the solids contents is by the MIXOPRESS process: A whole series of local sewage plants has used this process for many years.

In the MIXOPRESS process the sludge dewatered by the centrifuges is nearly always solidified by adding quick lime.

The following article reports on a new case in which a band filter is used as a dewatering machine.

After very extensive preliminary investigations, those responsible were of the opinion that the requirements could best be met by the Putzmeister MIXOPRESS process. A MIXOPRESS plant was therefore installed in the sludge dewatering building, which has by now come into service.
The plant is dosed with quick lime from the adjacent lime silo.

A shaftless auger conveyor supplies the sludge dewatered by the band filter to about 21 % solids content to the THS 332 mixer from the right. The lime is supplied from the left.

View of the filter band press. A shaftless auger conveyor for sludge passes through the wall

The mixer has two hydraulically-driven meshing augers (self-cleaning!). It has a relatively high speed of 60 rpm. It can therefore transport considerably more than is put in. This means that the material being mixed passes through the mixing zone several times and the material always flows back. A so-called “mixing roller” is formed. The KOS 1050 sludge pump connected to the mixer, is switched on and off via an ultrasonic level sensor, so that a “mixing roller” is retained. An hydraulic unit HA 45 on top drives both the THS 332 mixer and the KOS 1050 sludge pump.

The delivery pipe (125 mm diam. PN 85) of the sludge pump is equipped with the Putzmeister SK fast coupling system. It is buried in the soil outside the building and is taken underground to the centre of an asphalt pad in the deposit (filling the deposit by the Geysir method).

After the lime quenching reaction $CaO + H_2O = Ca(OH)_2 + 1177$ KJ/kg of CaO the sludge with lime has a solids content of 40 %. It has been heated to about 60 °C. This temperature is maintained for at least 30 minutes, even in winter.
Together with the alkalinity of the lime (pH of 14), this method offers a reliable guarantee that all bacteria are completely dead. The sludge is distributed in a relatively thin layer over the Geysir vibration cone, causing drying cracks to be formed. The carbon-dioxide in the air has better access through these cracks, so that there is further consolidation of the material due to the formation of calcium carbonate. The end product is a bulk material which is similar to dry soil. It is spread by normal commercial manure spreaders on agricultural land, or it can be dumped with domestic waste in a deposit, without problems.

The plant has been in continuous use at Ars for several months. The operator has confirmed that the requirements are fully met. One must emphasize that the mixture is homogeneous and that there are no small lumps of lime in the mixed material. This shows that the lime is used economically.

The planning engineers had to solve the following problems:

- Intermediate storage of large quantities of band filter sludge, as the sludge is produced continuously, but is accepted discontinuously.
- Solidification of the sludge by raising the solids content.
- A reliable sterilisation of the sludge (eg. by killing coli bacteria, salmonella and parasites).
- Local problems: the only area available for the intermediate dump was on the opposite side of a busy road. (Distance 50 metres, height difference 6 m). The plant to be designed had to be safe and had to work automatically. Subjecting the operating staff to the smell of ammonia had to be avoided.

There is no smell of ammonia anywhere on the plant. The above-mentioned difficult transport problem was solved in the best way by the sludge pump and by the pipeline laid in the ground (protected against frost). The heat generated in the lime quenching operation is retained because of the relatively small surface (pump and pipeline). This guarantees a reliable sterilisation of the sludge.

KOS 1050 sludge pump with THS 332 feeding device and hydraulic unit HA 45 on top (background). The sludge is introduced from the right and the lime from the left. One can clearly see the supported pipeline for the sludge with lime.

The sludge with lime has a solids content of about 40%. It is distributed over a wide area by the Geysir method.

There are no problems in the storage of the bulk material and transport via loaders and vehicles available everywhere is easy.

Visitors to the Års sewage works have now assessed the integrated MIXO-PRESS process as a new example of the successful cooperation between competent Putzmeister engineers and demanding plant operators, in order to reduce the strain on the environment for the future.

Technical data:

Mixer	Hydraulically-driven double auger trough mixer THS 332 LIB auger speed n = 60 rpm
Sludge pump and pipeline	Hydraulically driven two cylinder piston pump with S pipe Type .....KOS 1050 Delivery cylinder .....180 mm ø, ...1000 mm stroke Stroke time .....16 secs Oil pressure in drive cylinders .....120 bar Delivery pressure in pipeline .....approx. 30 bar Pipeline .....DN 125, PN 85 Length of pipeline .....49 m Pipe elbows .....2 x 45°, 4 x 90° Radius of pipe elbows .....1000 mm Pipelines equipped with Putzmeister ZX fast coupling system
Hydraulic unit	Type .....HA 45 Drive motor.....45 kW, n = 1500 rpm Mixer and sludge pump driven by 2 axial piston pumps of adjustable type. Drive by the PM in line concept (without using belts).
Process	Quantity of sludge .....Q = 5 m³/hour Solids content of sludge .....21 % Addition of quick lime (CaO) .....1.05 tonnes/hour Solids content of mixture .....40 % Temperature of sludge when leaving the pipeline.....approx. 60 °C

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