

Treatment of Sludge from Septic Tanks in Municipal Wastewater Treatment Plants

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I. General

Prack Consult GmbH is a consultant engineer acting world-wide a.o. in the environmental field. The R&D activity of Prack Consult is always close to the practice and related to the projects Prack is working for. Prack Consult as a middle size company often carries out its - always practice related - R&D projects with the support of the BMBF. One of the latest project was realised in Thailand in the years 2000-2004: "Transfer and adaptation of sewage sludge treatment in reed beds to Thailand standards".

Today's presentation deals with the R&D project "Co-treatment of faecal sludge as a mean for operation cost-reduction on wastewater treatment plants", realised between 1998 and 2001.

II. Introduction

In 1996, the year the idea of the project was born, many millions inhabitants in the former Eastern Germany were not connected to a central wastewater treatment plant (WWTP). Most of the wastewater was treated in septic tanks and disposed off as faecal sludge. A connection of these inhabitants to central – state of the art - wastewater treatment plants was not possible in the short to medium term. On the other side many newly built wastewater treatment plants in the new "Länder" were not working on full loading capacity. The target of the R&D project was to close the gap between the overproduction of poorly treated faecal sludge and not utilised treatment capacities in central WWTPs on the other side.

III. Treatment of sludge from septic tanks in municipal wastewater treatment plants

The R&D project was realised between 1998 and 2001 in co-operation with a wastewater treatment plants building company and the Neustrelitz's (Mecklenburg-Vorpommern) department of works. It includes 3 main parts:

- a research on the actual status of sludge treatment in Germany,
- a pilot-plant test in a container wastewater treatment plant over 2 years
- an economic research.

The main results of the project are presented in the following.

1. Actual status of sludge treatment in Germany

The target of the research was to review the actual situation with regards to sludge out of septic tank in former Eastern Germany and to define the frame of applicability for faecal sludge treatment in central municipal treatment plants, i.e. to define the potential market for the research “results”.

In Germany the municipalities are responsible for the wastewater – thus for the faecal sludge – disposal and treatment. This task is often transferred to a wastewater operation company. The transport of faecal sludge is however for 80 % realised by third parties, the treatment of the sludge takes place in 51 % of the cases on a wastewater treatment plant of the company.

In 1998 about 5 million inhabitants or 30 % of the population of the former Eastern Germany were not connected by pipe to central WWTPs. About 85 % of them were connected to septic tanks. Even if the connection rate to central WWTPs still grows, in many rural area the rolling sewerage – i.e. the transport of faecal sludge in tank trucks – and co-treatment of faecal sludge in municipal wastewater treatment plants will still be important in future.

2. Pilot plant test

In Germany the co-treatment of faecal sludge in municipal wastewater treatment plants is regulated in the ATV-A-123. According to this working sheet of the German Wastewater Association (Abwassertechnische Vereinigung ATV) each WWTP with more than 10,000 p.e. (people equivalent) design capacity and sufficient capacities can treat up to 20 m³/d faecal sludge per 10,000 p.e., without any analysis of the faecal sludge. The inflow should not exceed 5 % of the wastewater inflow. As per ATV-A-123 the following polluting loads are admitted for faecal sludge:

Parameter	Unit	Min.-Value ATV	Mean Value ATV	Max.-Value ATV
BSB₅	mg / l	500	2,500	5,000
CSB	mg / l	1,000	6,000	15,000
NH₄-N	mg / l	100	300	500
P_{tot}	mg / l	50	150	400

Table 1: Polluting loads in faecal sludge as per ATV-A-123

The table shows that the concentrations have high range of value and that two different faecal sludge batch can differ from 1 to 15. Compared to municipal

wastewater faecal sludge is highly concentrated and has a low BSB₅/CSB-ratio.

The aim of the R&D project was to define the limits of the co-treatment of faecal sludge in municipal wastewater treatment plants. It was chosen to work on the Neustrelitz WWTP (designed by PC), with a capacity of 100,000 p.e., and 3 lines. The tests were realised in 2 container-WWTP since the faecal sludge quantities were not available for a test in the WWTP. One container was the reference, exclusively fed with municipal wastewater. The second container had an initial load with 85 % (of the total design capacity, expressed in volume) municipal wastewater and was fed also with faecal sludge (up to 80 %).



Figure 1: Container for the pilot plant test

The main results of the test are that – under the premises of an adapted input of faecal sludge in the WWTP all over the day – the quality of the effluent is up to the highest request in Germany with a faecal sludge addition up to 50 % in volume. A treatment of the faecal sludge alone in the container WWTP lead to an effluent quality as requested for a WWTP of small size. In short faecal sludge can be co-treated in municipal WWTP in much higher concentration as usually done according to the ATV-A 123, if the quality of the sludge is controlled beforehand.

3. Economic research

Three alternatives of the wastewater treatment in rural areas – taking Neustrelitz as an example – were investigated:

- first, the treatment in septic tanks with transport of the sludge to the central wastewater treatment plant in Neustrelitz,
- in second, the connection of the population to a local sewerage and a local WWTP with a design capacity of about 1,000 p.e.,
- in third, the connection of the total population to the central WWTP Neustrelitz over sewerage.

Taking into consideration the investment and operation costs over a period of time of 25 years, the disposal of wastewater in septic tanks with co-treatment of the sludge in central WWTP is the most economic variant.

For the WWTP, the co-treatment of faecal sludge – to fill not utilised existing capacity – can lead to substantial cost reductions.

IV. **Conclusions**

The co-treatment of faecal sludge can be realised in municipal WWTP at a much higher degree as commonly admitted in Germany, keeping the high quality of the effluent, if the faecal sludge is added according to its quality and to the actual load of the WWTP. This co-treatment can lead to substantial wastewater treatment cost-reduction (up to 0.25 €/m³).

Basing on the results of the R&D-project, Prack Consult GmbH developed a measure and control unit for faecal sludge stations on WWTP (registered utility model). This unit will allow a higher faecal sludge input, adapted to the existing wastewater flow and the capacity of the wastewater treatment plant.

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Development Consultants, Germany

Presentation

**„Treatment of sludge from septic tanks
in municipal wastewater treatment
plants“**



Prack Consult GmbH – Development Consultants



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Development Consultants, Heide



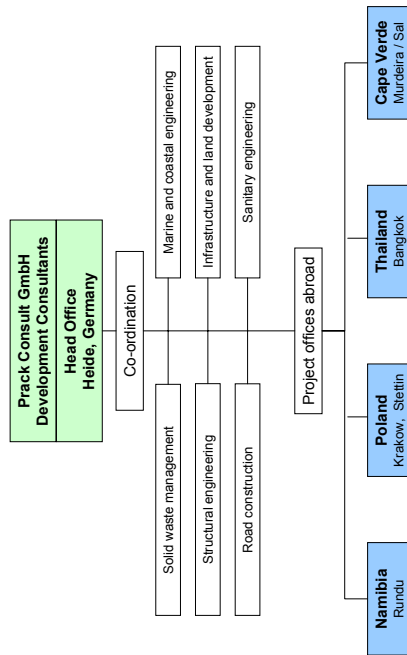
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Organisation



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**Treatment of Sludge
from Septic Tanks in Municipal
Wastewater Treatment Plants**

- I. Research on the actual status of sludge treatment in Germany**
- II. Pilot plant test in a container wastewater treatment plant over 2 years**
- III. Economic research**



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Actual Status of Sludge Treatment (1998)

- Former Western Germany:
- 66 Mio. Inhabitants
 - 93.5 % connected to central WWTP
- Former Eastern Germany
- 16 Mio. Inhabitants
 - 70.0 % connected to central WWTP



Actual Status of Sludge Treatment (1998)

- Origin of the sludge:
- Cesspools
 - Septic tanks
 - Small WWTP without sludge treatment



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- 66 Mio. Inhabitants
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Actual Status of Sludge Treatment (1998)

- Treatment of the Sludge:
- In central WWTPs (75 %)
 - Agricultural utilisation (11%)
 - Composting (4 %)
 - Dumping on landfill (2 %)
 - Separate treatment plant (1 %)



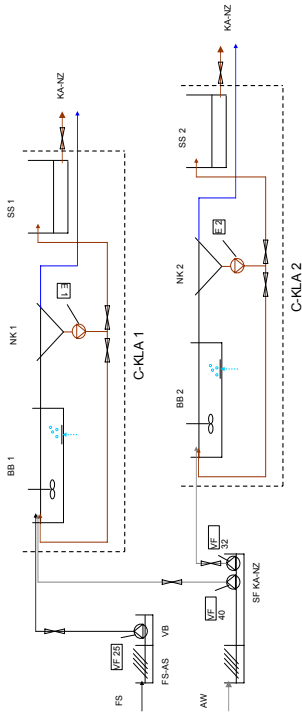
Pilot Plant Test (1999-2001)



Pilot Plant Test (1999-2001)



Pilot Plant Test (1999-2001)



Pilot Plant Test (1999-2001)

Boundary conditions for the co-treatment of Sludge in WWTP:

- > 10,000 p.e. design capacity
- Sufficient capacity
- 20 m³ per 10,000 p.e.
- < 5 % of wastewater inflow



Pilot Plant Test (1999-2001)

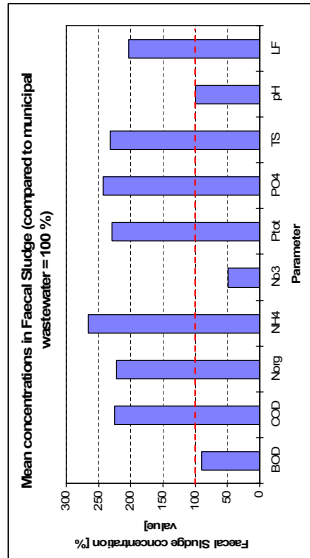
Polluting loads in Faecal Sludge as per ATV-A- 123:

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Pilot Plant Test (1999-2001)

Faecal sludge and wastewater:



Pilot Plant Test (1999-2001)

Results of the tests:

- Co-treatment of up to 50 % Sludge (in vol.) with effluent quality up to highest German Standards
- Sole treatment of faecal sludge leads to effluent quality as requested for small WWTP (up to 1,000 p.e.)



Economic research

Why:

- Central wastewater treatment plants with free treatment capacities
- Not sufficiently treated sludge



Economic research

Approach:

- Treatment in cesspools with transport of sludge to a central WWTP
- Connection of the population to a local WWTP
- Connection to a central WWTP



Economic research

Approach as per LAWA:

- Investment costs for the treatment capacity, the sewer and the transport mains
- Transport costs
- Operation costs



Economic research

Results:

- For regions with a low density of population
- Septic tanks, transport to and treatment of the sludge in a central WWTP is the most economic solution



Economic research

Results:

- For central WWTP:
- Reduction of the costs through acceptance and treatment of much higher quantities of faecal sludge – only possible with a proper faecal sludge management



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**Thank you for
your attention**

