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FACULTY OF CIVIL ENGINEERING

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Optimising sludge management at the Municipal Solid Waste Incinerator

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Outline:

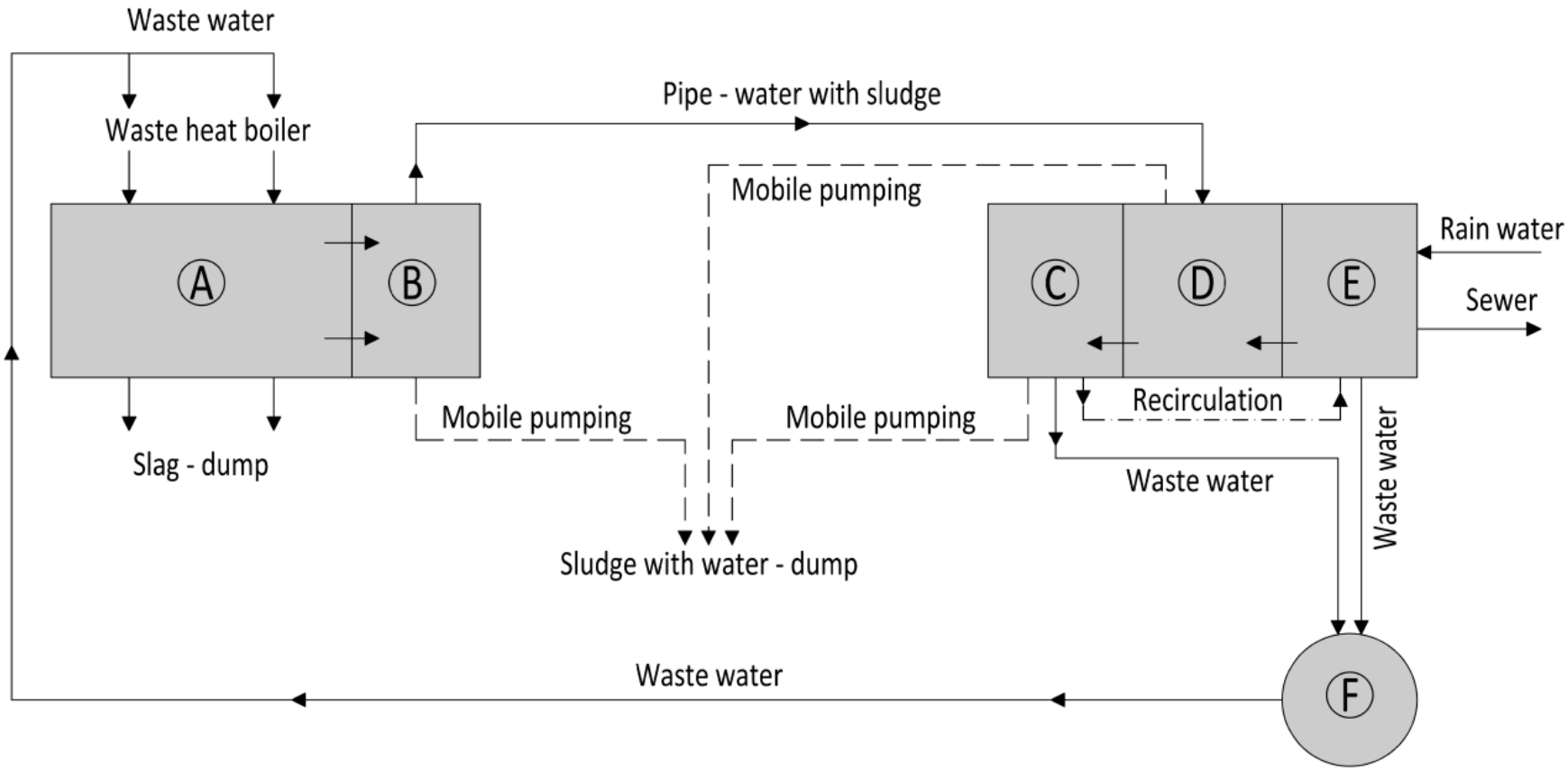
1. Introduction: problems with sludge management at SAKO;
2. Materials and Methods: selected parameters, technologies, tests, ad/disadvantages, categories;
3. Results: flocculation tests
4. Discussion: mobile sludge dewatering press
5. Conclusion: combination polymers, further research

1. Introduction

- Sludge management at the Municipal Solid Waste Incinerator (MSWI) at SAKO Brno;
- the original concept was designed to be waste-free;
- problems with operating costs for cleaning of tanks;
- Designed solution:

A) Standard WWTPs use chemical management, absorption, neutralization, sedimentation and dewatering…;

B) New use of available technologies.



Legend

A Bottom ash tank B Soggy slag tank C Left tank D Middle tank E Right tank F Pump station

2. Materials and Methods

- Slag production is approx. 48 000t of slag a year;
- selected parameters of the waste water were compared with the limits;
- Table 1. Selected parameters – analyses of soggy sediments in the retention tank.

Parameter	pH (-)	DS ($mg.L^{-1}$)	Chlorides ($mg.L^{-1}$)	Barium ($mg.L^{-1}$)	Molybdenum ($mg.L^{-1}$)
Analysis 1 (2015)	12.3	26 900	17 100	0.39	0.81
Analysis 2 (2015)	11.9	61 300	25 900	5.83	2.00
Limits	6.0 – 9.0	40 000	18 000	0.30	0.01

2. Materials and Methods

- Selected and compared:

A. Standard WWTP

B. New use of available technologies (3 pieces of equipment):

- b1. chamber filter press,
- b2. screw dehydrator (sludge dewatering press)
- b3. belt press.

- Solution A was not recommended;
- For solution B 3 pieces of equipment were tested;
- Materials and methods used:

- 20 L of sludge for each piece of equipment;
- sedimentation tests and standard dewatering tests (laboratory, pilot or real test) were used

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2. Materials and Methods

- Table 2. comparison of technologies used.

Technology	Thickening method	Advantages	Disadvanages
Chamber filter press	Laboratory (Brno, CZ)	Medium operating costs High dewatering efficiency Low price High abrasiveness of particles	Worse automated operation Exacting cleaning requirement Continuous operation
Screw dehydrator	Real equipment (SAKO Brno, a.s., CZ)	Min. operating costs Automated operation Minimum cleaning requirement Discontinuous operation	Low dewatering efficiency High price High abrasiveness of particles
Belt filter press	Pilot test (SK)	Medium operating costs Medium dewatering efficiency High abrasiveness of particles	Worse automated operation High price Exacting cleaning requirement Continuous operation

2. Materials and Methods

- Screw dehydrator - main advantages for the operator:

- minimal operating costs;
- automated operation;
- minimal cleaning requirements;
- discontinous operation;
- lower dewatering efficiency is not a disadvantage;
- can be small mobile equipment.

- The main disadvantages:

- high price;
- high abrasiveness of particles.

=> The screw dehydrator was selected for futher flocculation tests.

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2. Materials and Methods

- Defined categories C1 – C4;

Table 3. Evaluating the efficiency of dewatering.

Category	Description of the evaluation	Evaluation of dewatering efficiency
C1	The best dewatering efficiency achieved by selected polymers or combinations of polymers, dry solids above 20 % in the sample	Excellent
C2	Good dewatering efficiency achieved by selected polymers or combinations of polymers, dry solids at 15 – 20 % in the sample	Good
C3	Low dewatering efficiency achieved by selected polymers or combinations of polymers, dry solids at 10 – 15 % in the sample	Medium
C4	Dewatering using the selected polymers or combinations of polymer is not possible, dry solids below 10 % in the sample	Bad

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3. Results

Table 4. Lab. flocculation tests for screw dehydrator.

Test	Polymer YESfloc	Conc. (%)	Polymer volume (mL)	Sample volume (mL)	Total sample volume (mL)	Evaluation according to the size of formed flocs	Evaluation of dewatering efficiency, category
Simple	CWE823	0.5	50.0	500.0	550.0	Bad	C4 - Bad
Simple	AWE30	0.5	5..0	500.0	550.0	Bad	C4 - Bad
Combination	PA+ AWE30	20.0+ 0.5	0.5+20.0	500.0	520.5	Good	C2 - Good
	CWE35	0.5	60.0	200.0	260.0	Good	C3 - Medium
Combination	PA+ AWE30	20.0+ 0.5	0.5+10.0	500.0	510.5	Good	C2 - Good
	CWE35	3.0	20.0	200.0	220.0	Excellent	C1 - Excellent
Combination	CoFloc+ AWE30	50.0+ 0.5	0.5+20.0	500.0	520.5	Good	C3 - Medium
	CWE35	0.5	20.0	200.0	220.0	Bad	C3 - Medium

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3. Results

- Figure 3. Flocculation tests.

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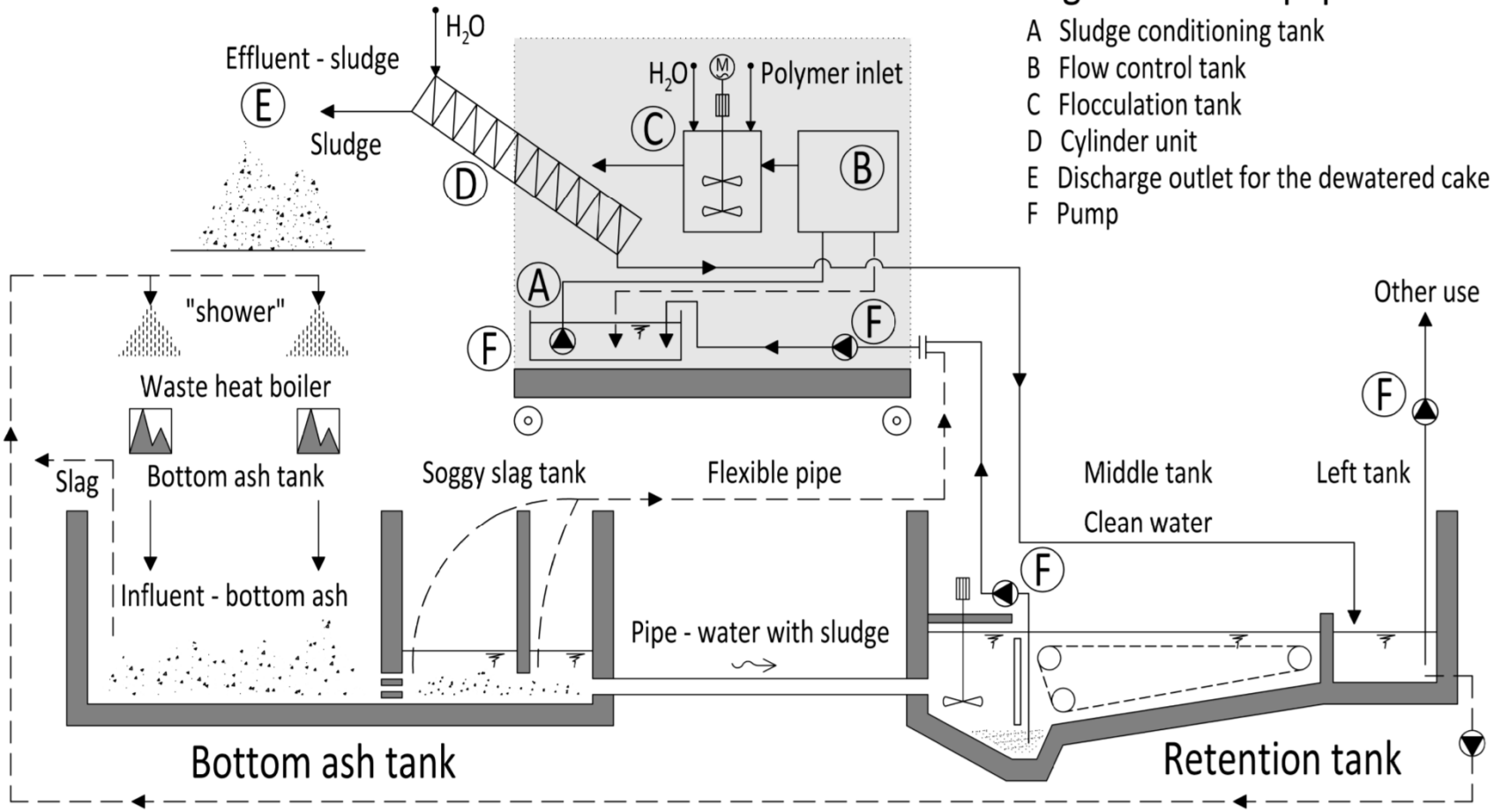
3. Results

- Table 5. Laboratory flocculation test result evaluation – excellent solution.

Polymer	1st phase		2nd phase
	Coagulant	Flocculant	Flocculant
	PA	YESfloc AWE30	YESfloc CWE35
Dosage (kg/t solids)	7.0	20.0	4.0
Diluted flocculant concentration (%)	20.0	0.5	3.0

Mobile sludge dewatering press



5. Conclusion

- Pilot testing of dewatering screw dehydrator under real conditions;
- comparison with chamber press and belt filter press;
- laboratory flocculation tests, several polymers;
- categories;
- after testing optimal combination of the following polymers: PA20, YESfloc CWE35 and YESfloc AWE30 found;
- Recommended use of a mobile sludge dewatering press installed on a mobile chassis.

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5. Conclusion

- Optimum solution: a mobile sludge dewatering press unit has been proposed with a suitable flocculant combination.
- the research has shown that there is no need to install a standard WWTP to treat sludge;
- treated water from the mobile dewatering press can be used for cooling and for diluting lime milk;
- design documentation prepared base on the results of the research;
- implementation of the sludge management system is scheduled for the end of 2017.

THANK YOU FOR YOUR ATTENTION

EGAR RESEARCH GROUP

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