Analysis of the effectiveness of greywater treatment in the coagulation process

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Introduction

The total freshwater resources available in Poland are relatively small and characterized by seasonal and regional variability. They amount to approximately 1,600 m³ per person per year, which is below the water stress level (1,700 m³). In Europe, only the Czech Republic, Cyprus and Malta have smaller water resources than Poland [2]. Treated greywater can be a source of water for reuse in buildings. The percentage of greywater that can be reused is approximately 75% of the total amount of water used in a building [1]. To make this possible, it is necessary to install a collection and treatment system and a dual installation. After preliminary mechanical treatment, greywater can be effectively treated by coagulation.

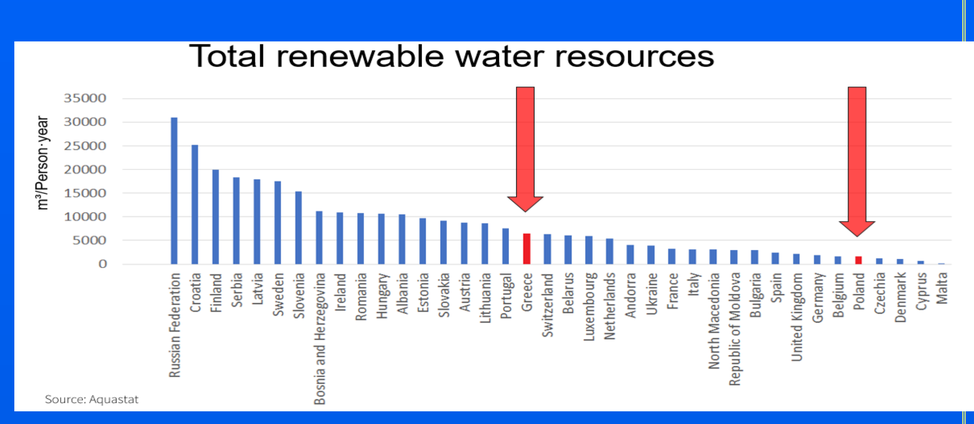

Figure 1: Total renewable water resources

Material & Methods

In order to estimate greywater resources, balance calculations were made for the unit production of wastewater for a typical residential building, broken down by sanitary facilities. The structure of greywater is as follows: 8.3% from washbasins, 54% from bathtubs, and 12.8% from laundry. Greywater collected from household sanitary facilities (washing machine – 8.5 L, washbasin – 5.5 L, bathtub – 36 L) was mixed in fixed proportions. The mixed wastewater was filtered through a 100 µm string filter and a sand filter at a speed of 5 m/h. The wastewater was then subjected to a coagulation process. The effectiveness of 7 coagulants was assessed for doses ranging from 0.1 to 0.25 mL/L. After the coagulation process, sedimentation (t=10 min) and rapid filtration (v=5 m/h) were carried out.

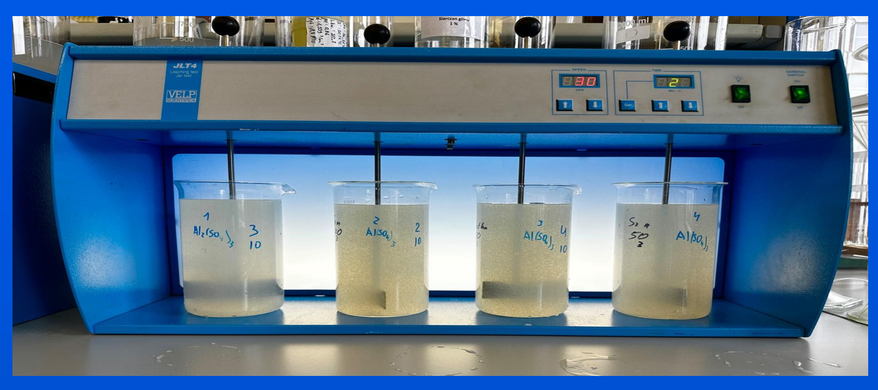

Figure 2: The coagulation process

Results & Discussion

Six test series of the coagulation process were presented, using two coagulants and four doses (Table 1, Figs. 1 and 2).

Table 1 Significant parameters of raw greywater

Parameter	Test series					
	S1	S2	S3	S4	S5	S6
pH	7.980	8.224	8.122	7.106	7.190	7.123
Turbidity [NTU]	101	69.8	164.0	151	47.8	44.0
COD Mn [mg/L]	46.4	64.0	80.0	57.6	40.0	36.0
COD [mg/L]	785	495	224	527	310	224

Greywater is characterised by a highly variable composition. Its high turbidity (44-164 NTU) and high organic content prevent its reuse without treatment processes. Compared to the literature data, its quality was characteristic of light greywater [3].

The data presented in Figs. 1 and 2 indicate that the quality of the treated greywater depended on the type and dose of coagulant. In the case of the PAX 18 coagulant, the use of a higher dose allowed better results to be achieved, but only in the case of S1 for a dose of 0.25 mL/L was the turbidity after treatment lower than 10 NTU (milestone). In the case of the Neofloc D804 coagulant, for all series, the best turbidity removal effect was achieved with a dose of 0.2 mL/L. As can be seen in Figure 2, COD Mn removal was not as effective, which indicates that the organic compounds were mainly in dissolved form.

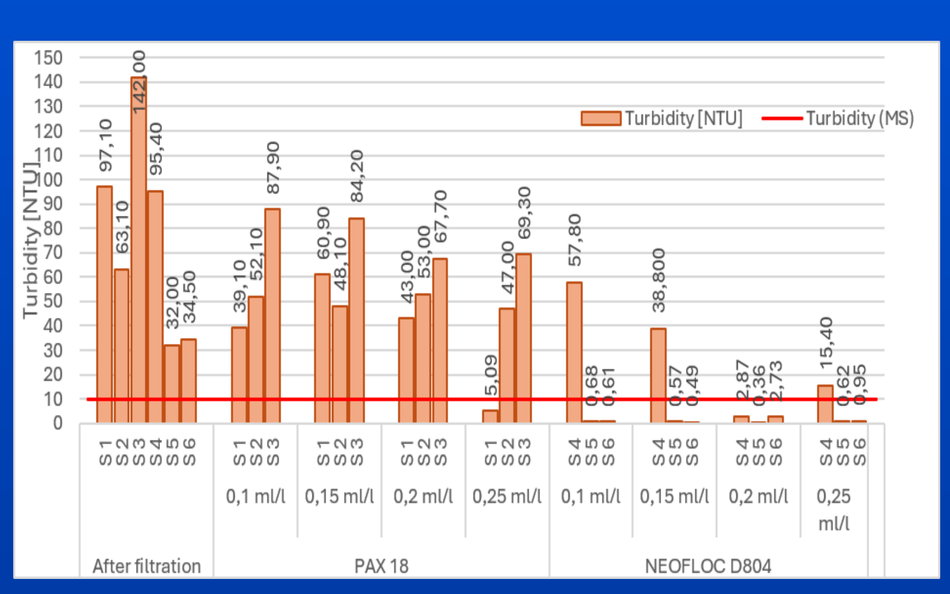

Figure 3 : Turbidity of grey wastewater after filtration and coagulation

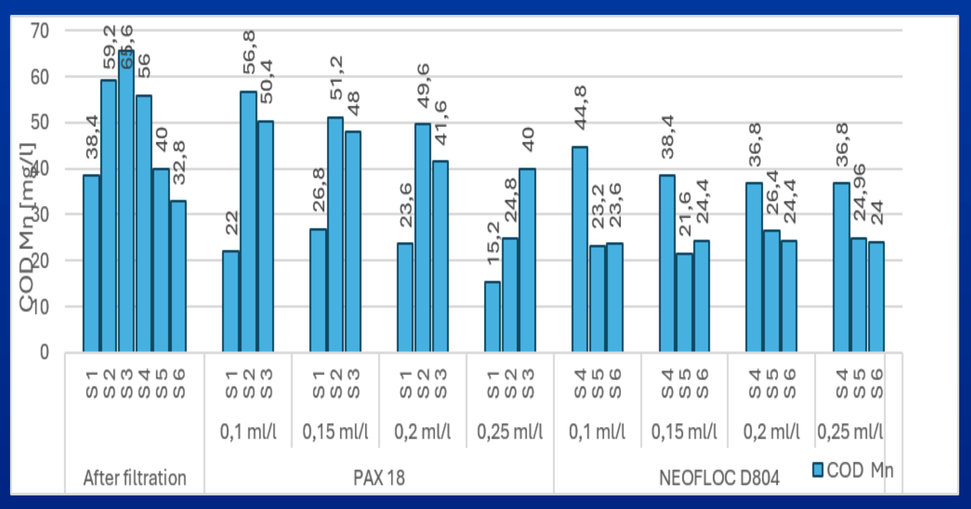

Figure 4 : COD Mn of grey wastewater after filtration and coagulation

Conclusions

Based on the research conducted, it was concluded that the coagulation should be one of the unit processes prior to the disinfection .

Acknowledgements

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