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SEWERAGE AND WASTEWATER TREATMENT IN THE 21ST CENTURY

Edward S. KEMPA
ul. Okrzei 6/2 51-676 Wrocław

The sewerage and wastewater treatment facilities should be considered as elements of the same, ho wever complicated, system.
The history of sewerage and wastewater treatment systems is somehow imprinted in our minds. We should not go back as far as to the ancient world of Greek or Roman times, but we should rather focus on more contemporary times – from the time of invention of the flushed toilets up to the advanced water recycling and reclamation.

As wastewater collection and treatment processes go back some 200 years, we should reflect if the previous knowledge, technologies and systems are still valid, and if they fulfill the needs of the today's world. If not, what should be changed and how to approach it? We should not criticize the past but consider that:

"Yesterday's solutions are the problems of today, today's solution will be the problems of tomorrow."

Therefore, are the paradigms of the beginning of the 19th century still valid? Do they apply to general knowledge or just to the sanitary engineering know-how?

Considering the sewerage system we should ask what this system should collect as well as what it can potentially collect. Where do we draw the line? Should the collection system receive all waste that can be flushed with the household water? Should the grinders in the sinks, so popular in the past, be prohibited? What about the storm water disposal?

The current trend is to collect and carry storm waters in the short piping and to discharge and dispose them on the nearest un-built areas. This implies provision of the separate sewerage nets and elimination of large storm water collectors. Technical solutions, including design and construction, for these systems are well known.

What about domestic wastewater? Should they be directl carried to a wastewater treatment plant? Is it possible to separate various components of the wastewater in the piping household?

The commonly used terms for various waters are: ***white water, grey water and black water.***

White water is usually defined as water flowing in the municipal supply system and used for the household needs. After the household use (except for water used for toilet flushing) water can be described as **"grey water"**, which can be recycled (usually after filtration and disinfection) to an internal but separate water distribution system. This recycled water can be used e.g. for green space irrigation but generally for toilet flushing. And only here and now **"black water"**, or wastewater, is generated. This wastewater is collected and carried to a wastewater treatment plant. Such solution requires a provision of a more complex in-house installations for water distribution and used-water collection. It is sounds to be economical for large office or apartment buildings, houses of care, schools, etc. It is possible that the solutions in question will become more and more common – especially due to increasing prices of water and a need to save the water resources.

The newest solution is

a transition from flushing of all waste to source separation of the used materials

(as an analogy to solid waste separation). In practical terms it means ***a separation of the urine from the faeces***. It sounds simple and logical but how can it be actually accomplished? All mammals (including human beings) have certain body-internal systems to excrete these wastes – urine and faeces separately. Hence, we already have a potential separation at source. After that we should consider how to implement a proper technology. Human urine (as well as that of cattle) is called ***"yellow water"*** and it can be captured separately in specially designed toilets (the most commonly known are the European and Asian designs). The urine is then carried in specially designed conduits and stored in temporary storage tanks, from which the "yellow water" is collected and transported in tracks to urea factories, producing fertilizers of this natural resource.

Approximately one half of the pollutant loads in the domestic wastewater comes from the urine (based on the literature data available to the author), with the approximate nitrogen load reaching 80% and almost all phosphorus. The urine consists mostly of urea (H_2NCONH_2) and ammonia. Accordingly, the production of a nutritious fertilizer from the urine is possible and realistic, even in a small non-industrial scale.

Faeces contain small quantities of nitrogen and phosphorus, just enough to support a proper metabolism of the microorganisms responsible for the biological wastewater treatment. Practically, it means that the wastewater treatment plants would not need to be built with the extended steps of nutrient removal. Hence, there would be no need for denitrification and phosphorus removal and the wastewater treatment plants would be much smaller and less costly than today's treatment facilities. We should not forget, however, the costs of introducing new fertilizer factories. Accordingly, there is always a price to pay.

Is this really how the wastewater treatment will look like in the 21st century? It is difficult to answer in details so many questions mentioned above at this stage of our knowledge. It is, however, one of the possible scenarios, which is currently researched extensively.

Today, two-stream toilets are manufactured in Europe and Asia, with some solutions being better than others. Fertilizers are produced from the urine and proper functioning of the biological treatment process is being studied. The wastewater from which urine was separated is more concentrated, hence application of anaerobic processes for their treatment are studied and sometimes preferred.

At the end we should realize that these thoughts apply to the next 50 years or may be even to the year 2100, since it is impossible to reconstruct all of the existing systems in a short timeframe.

References with the Author.