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THE INVESTIGATIONS ON THE EFFECT OF SELF-PURIFICATION OF WATER IN FLOODED MEADOWS

The ever increasing pollution of surface water with more and more harmful, hardly biodegradable and often toxic substances makes serious difficulties in the process of drinking water treatment. A hazard of ground water pollution with these substances is also increasing.

In search of new techniques of water treatment the attempts are more and more often udertaken to utilize living organisms, both plants and animals. Their role in biological self-purification of water is commonly known, nevertheless in the commercial scale water treatment they have not been used yet. This is mainly due to the lack of adequate methods allowing the control of biological processes, and selective choice of the species of groups of organisms particularly fitted to this purpose, as well as to the fact that a number of biochemical processes referring to the definite pollutants are not adequately known yet.

At present in a number of industrialized countries, like U.S.A Soviet Union, Japan, France, Poland, the large-scale investigations on this subjects are being conducted. It is believed that the utilization of living organisms in the drinking water treatment, in primary treatment, in particular, may appear to be quite efficient, and therefore this problem deserves a special attention.

In 1977 model investigations on the effect of purification of water by its infitration through the sand with the upper layer of soil grown with hydrophilic flora, mainly grass, were undertaken by the Institute for Environmental Development in Poznań.

Flooded meadows — according to the literature data — are an extremaly efficient biological filter, characterized by a high elasticity and adaptability to the changing conditions, in particular, to the qualitative changes of the water introduced.

In a complex soil ecosystem the compound pollutants may be mineralised (sometimes totaly) and deactivated. Some poisons may even be assimilated as nutrients — in particular, by bacteria. Owing to its sorptive properties the soil retains some substances diluted in water, and its buffering capacities plays a main role in elimination of toxic substances.

The investigations have been conducted on concrete model filters, $\varnothing = 150$ cm and $h = 200$ cm, unstalled out of doors of the Institute building. The filters were filled with sand and gravel; a 25 cm surface layer consists of soil grown with vegetation characteristic of waterlogged meadows, mainly with grass. One filter treated as the control has no vegetation.

Some equipments installed on different levels of the filters allow the sampling of water and sand for physicochemical and bacteriological analyses. Due to their construction excluding the sampling of water percolating internal walls of the filters, they allow to obtain more representative samples.

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Filters are flooded with tap water (because of small variation in its quality) polluted with the selected substances. The choice of the pollutants was dictated by their frequency of occurrence in surface water, toxicity to men and animals and difficulties in their removal by classical treatment methods. Considering the above criteria the following substances have been selected:

— surfactants — of which Manoxol OT being recommended in Poland as a standard anion surface active substance has been introduced in the concentration of 0.1 mg/dm^3;

— phenol — given in concentration of 0.1 mg/dm^3;

— insecticides — Lindan, readily soluble in water, given in concentration of 0.1 mg/dm^3;

— chromium — Cr^{+6}—0.2 mg/dm^3,

— lead — Pb ($Pb(NO_3)_2$)—0.2 mg/dm^3,

— copper — Cu^{+2} (as $CuCl_2 \cdot 2H_2O$—0.4 mg/dm^3).

The experiment was preceded by chemical and bacteriological analyses of soil and sand, as well by the analysis of overground and underground portions of the plants. Bacteriological analyses of water, sand and soil samples involved:

— determination of the total number of bacteria,

— determination of the number of *E. coli* — according to the literature data these bacteria adsorb Lindan decomposing it into 2, 3, 4, 5, 6 pentachlorocyclohexane,

— determination of the number of *Pseudomonas sp.* These bacteria are a ,,universal" group of microorganisms able to utilize carbon and nitrogen from many compounds,

— determination of phenol degrading bacteria, to indicate the biodegradation intensity of these compounds,

— determination of bacteria participating in nitrogen cycle (*Nitrobacillus, Nitrosomonas sp. Nitrobacter sp.*). This will allow to establish the degree of their inactivation due to the pollution of water with substances limiting the amount of nitrogen substances entering the soil. The observations conducted parallely concern the presence of organisms on the flooded surface, and their migration inside the filter.

In the first stage of the investigations flooded irrigation of the filters will be conducted within the whole vegetation season (from the early spring to the late autumn), and in case of very mild winter— for the whole year. Filters will be flooded continuously, if necessary with several day intervals to allow the regeneration of plants.

Preliminary measurements have shown that the capacity of filters is of order of 0.4 m^3/m^2/24 h. The investigations have been performed having in mind the application of results to the drinking water treatment, as well as the enrichment of the ground water resources and their protection.