

7. SUMMARY

Biodegradation of progesterone in surface water

Hormonal active substances in the environment are implicated in disturbances of reproduction and health's damages of human beings and animals. Synthetic and natural hormones as estrogens and gestagens contained in human and animal excrements reach the terrestrial and aquatic environment. The absorption of sex hormones can result in disturbances of the endocrine system of organism. Surface water is polluted by hormones especially. It is of high interest for the judgement of risks to men and animals to know the speed of degradation of these substances in the environment.

The development of concentrations of progesterone, the most important exponent of gestagens, in surface water will be analysed in this thesis. Water from river Spree was taken. 4-Pregnen-3,20-dion (P4) was then added and stored at 5 °C and 20 °C for 28 days. Samples were taken in regular intervals and freeze-dried at -20 °C. The concentration of progesterone in the individual samples was determined by means of enzyme immunoassay (EIA). All samples of a 28 day time interval were measured on an immunoplate. It was compared to sterilised river water added by P4. The influence of activated sludge and species of bacteria, isolated from river water on the concentration of progesterone was analysed additionally. These three experiments subdivide into different variants. All variants were prepared for three times. The colony forming unit respectively the sterility in these experiments was investigated by bacteriological assay. The results of these analyses were as follows:

- 1) Progesterone in river water is degraded by micro-organisms. The progesterone-concentration decreases within 6 days for 90 % at a storage temperature of 5 °C. At the storage temperature of 20 °C the progesterone-concentration decreases for 90 % at the second day already. The storage temperature has a strong influence on the speed of degradation of progesterone.
- 2) No degradation of progesterone is found in sterilized river water and in aqua bidest. Abiotic components have no important influence.
- 3) The degradation of progesterone by addition of activated sludge to sterilized river water is accelerated in relation to the degradation of progesterone in normal river water. The concentration is reduced for 90 % at a storage temperature of 5 °C till the second day. It is decreased to 10 % of the initial value at a storage temperature of 20

°C within the first day already. The results are comparable in aqua bidest. with activated sludge. Organisms of activated sludge are especially capable of degradation of organic matter and thus of degradation of progesterone. The storage temperature controls the speed of biodegradation of progesterone.

- 4) The bacteria species *Escherichia coli* and *Aeromonas sobria*, isolated from river water, cannot effect any reduction of concentration of progesterone in sterilized river water and physiological saline solution.
- 5) The storage temperature influences the increase of microbial growth in the different experiments. The colony forming unit increases in the river water experiments as well as in the experiments with activated sludge at a storage temperature of 20 °C stronger than at a storage temperature of 5 °C.
- 6) The application of the logistic function is well suited to the adaptation to the standard values and to the computation of the concentration of progesterone.

The biological purification in the wastewater treatment plant can reduce the concentration of progesterone in surface water, but a stress of water is expected at least. The experiments done for this thesis cannot exclude the participation of progesterone to the stress and disturbance of the hormonal system of aquatic creature. The speed of the biological degradation of progesterone is proportional to water temperature and kind of biological flora. The dimension of coactions of progesterone with other matters of endocrine disrupting activity needs further research.