

## COMPARATIVE STUDY ON ANTIBIOTIC RESISTANCE IN SELECTED BACTERIAL SPECIES ISOLATED FROM WASTEWATER ORIGINATING FROM SLAUGHTERHOUSES AND OF MUNICIPAL SOURCES

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### Introduction

Antibiotic resistance in man may be hospital acquired or community acquired (1,2,3). The use of antibiotics in agricultural animal production is often blamed to contribute predominantly to the community acquired antibiotic resistance in the human population. One of the ways multiresistant bacteria may be introduced into the biocoenosis and into humans via environment may be by faeces of treated animals (4). Since human sources are also contributing to introduce antibiotic resistant bacteria into the biocoenosis via municipal wastewater a comparative study has been performed by characterizing selected bacterial species from municipal wastewater and wastewater from a slaughterhouse according to their resistance patterns.

### Material and Methods

Wastewater was taken by an automatic sampler over the period of one year at two different sewage treatment plants. One plant was receiving only wastewater from municipal source, the other from municipal sources and from a slaughterhouse. At the latter also samples of gut content had been collected during slaughtering. The samples were characterized by determining the bacterial count of bacteria growing at 37 °C, total coliforms, faecal Streptococci and Staphylococci. In *Escherichia coli*-, *Enterococcus faecalis*- and *Staphylococcus aureus*-strains, identified on species level, the sensitivity against certain antibiotics was determined with the help the agar diffusion test (DIN 58 940 part 3/1989) and the micro dilution method (DIN 58 940 part 8/1990). A total number of 400 *E. coli* strains, 245 *E. faecalis* strains and 188 *S. aureus* strains was investigated.

### Results

While 21% of the tested *E. coli*-strains that could be isolated from the slaughterhouse waste water were as resistant, the *E. coli*-strains isolated from the municipal waste water were to 18% resistances. A seriously increasing resistance situation has been found with respect to the *E. coli*-strains, both from samples of slaughterhouse- as of municipal-waste water against Tetracyclin. 46% resistant strains could be found in the slaughterhouse waste water and 42% resistant strains were found in the municipal waste water. A more favorable situation otherwise arose for the resistances against the further tested antibiotics for both *E. coli*-strains.

In *E. faecalis*-strains a problematic resistance situation against the examined antibiotics was found. This concerned resistance against Doxycyclin, Erythromycin, Bacitracin, Ofloxacin, Chloramphenicol and Penicillin. Only Amoxicillin and Vancomycin show a good effectiveness (93%-100% sensitive). In the slaughterhouse waste water, 61% of the tested *E. faecalis* were determined as resistant. In the comparison to it, the

municipal waste water contains less resistant *E. faecalis* (47%).

*S. aureus*-strains showed with 24% also a high resistance-frequency against the penicillinase resistant antibiotic „Oxacillin“ in the municipal waste water. It could be determined unequivocally that with *E. coli*- and *E. faecalis*-strains from the slaughterhouse waste water more multi-resistances than with those from the municipal waste water existing is introduced in the environment. With *S. aureus*-strains, an exactly reverse situation was found.

### Discussion

The results of the agar diffusion test deliver fast statements over the antibiotics sensitivity of pathogens, against which the results worked out with the dilution test (micro dilution method) appear more exactly and therefore micro dilution method is in principle more suitable for the monitoring of resistance. Although the examinations were done under same conditions, the results with both methods are slightly different. For example *E. coli*-strains isolated from the slaughterhouse waste water were over all in the agar diffusion test to 75% sensitive, to 13% intermediate and to 12% resistant, while in the micro dilution method the tested *E. coli*-strains are found to be for 54% sensitive, for 25% intermediate and for 21% resistant.

It is still open how the ways of transmission of multi resistant bacteria via surface water or living carriers may happen and how big the practical importance of this scenario is, but it is a fact, that agriculture is contributing to the introduction of multi resistant *E. coli* and *E. faecalis* into the environment, while the introduction of multiresistant *S. aureus* seems to be mainly due to human sources.

### Conclusion

The results of the sensitivity testing of the bacteria from municipal- and slaughterhouse waste water isolated *E. coli*, *E. faecalis* and *S. aureus* show that important quantities of antibiotic resistant bacteria can be introduced with the cleaned waste water into the environment. Adequate measures have to be taken.

### References

1. Bennett, P.M. (1995): The spread of drug resistance  
In: Baumberg, S.; Young, J.P.W.; Wellington, E.M.H.; Saunders, J.R.: population genetics in bacteria.  
University press, Cambridge, 317-344
2. Böhm, R. (1995): Der Einfluß veränderter Strukturen der Nutztierhaltung auf die Umweltbelastung durch Abfall und Reststoffe aus der Tierproduktion. Dtsch. tierärztl. Wschr. 102/7, 278-283
3. Klare, I; Heier, H.; Claus, H.; Witte, W. (1993): Environmental strains of *Enterococcus faecium* with inducible high-level resistance to glycopeptides FEMS Microbiol Lett 106, 23-30
4. Helmuth, R. (1989): Zum Problem der Antibiotika-Resistenz .Bundesgesundheitsbl. 4, 160-162