

SUSTAINABLE DEVELOPMENT OF THE WASTE WATER TREATMENT STRATEGIES FOR THE FOOD INDUSTRIES

I. D. Sekoulov*

* Technical University Hamburg – Harburg, Eisendorferstr. 42, DE –21073 Hamburg

ABSTRACT

The sustainable development of the environmental protection is new created philosophy. It means continuously development of better protection of the air, soil, water and the resources, used from the industry, to be save also for the next generations.

The globalization of the economy is an other process, which interferes with the environmental ideas, and equilibrium of socio-eco-sustainable development is expected.

The industry is subjected to big changes depending on the economical development. Thus the treatment plants at the and of the pipes must be constructed with maximal flexibility. A removal of devices if not necessary, must be considered at the beginning as a possibility.

Priority is given to integrated production processes solving the waste water problems directly by the production devices.

The treatment of the process waste water streams will became more important. The and of the pipe solutions will be reduced.

The reuse of valuable waste substances and treated water will reduce the total cost of the treatment plants.

KEYWORDS

Sustainable development; globalization; agro industry; waste water treatment systems

INTRODUCTION

The concept of sustainable development burst into visibility in 1972 with the publication of Dennis Meadows' book "The limits of growth" and with the United Nations' Conference on Human Environment in Sweden which coined the words "Sustainable development". It received growing support from the global conference "Earth Summit in Rio de Janeiro" in 1992.

The Helsinki European Council in December 1999 invited the European Commission to "prepare a proposal for a long-term strategy developing policies for economically, socially and ecologically sustainable development" in time for the Gothenburg Council in June 2001.

The most widely quoted definition of sustainable development is described as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". This covers economical, social and environmental components. The policy should focus on steady long-term management with verifiable progress.

Despite the fact that the term sustainable development is widely used and explained, there is no broadly accepted definition up till now.

A comprehensive definition is f.e:

“Sustainability is an economic state, where the demands placed upon the environment by people and commerce can be met without reducing the capacity of the environment to provide for future generations.”

The world is changing with the world economy. We are living now in the midst of a changing global economic order, which seems to have own strategies. All technology is not necessary beneficial as a support to sustainability. As criticism is pointed out that “the impact of technology on the environment is characterized by ignorance, uncertainty and diffuse knowledge base”. This has to be changed.

The Agro-Industries sustainability means that agricultural production and processing practices are economically viable and environmentally friendly and maintain or improve the quality of life, today and in the future.

For a success of the food industry is necessary to sustain the productivity of the natural resources on which the industry depends, to maintain the industry’s access to international markets and fulfill the obligation as global citizens.

Essential for agricultural production and processing are necessary: good water quality and quantity, good soil and land base and clear air.

To protect them, we need long-term sustainable strategies of all used resources. The waste water treatment and water management are essential to ensure the water quality and quantity over the years.

GLOBALIZATION

The globalization trend in the economy has a big influence also on the agricultural production and food processing around the world.

Old established food-processing companies are bought and soled, sometimes within short periods of time, f.e: several years on big international concerns, because of economical reasons.

The production is made more economic through modernization and better productivity, reducing of uneconomical diversity of producing processes and products a.o. The started unification is also a chance to be introduced within a big company the most modern technology and operated with high experienced staffs. This process is started, but it will take time to be finished.

The sustainable economical development has in many cases the priority. And the protection of the environment as normally not productive part is left for later realization.

For better acceptance in this field, a sustainable development of the environmental protection must be presented in which important economical benefit f.e, with a waste water treatment must be made visible.

We have to improve the production processes to reduce the use of clean water, trying to introduce recycling of process water and reusing valuable substances from different wasted process streams. This will allow are reducing of the total pollution load of the discharged waste water, causing at the and a reduction of the treatment plant costs.

TECHNICAL SOLUTION

Food processing and agricultural industry need large amounts of fresh waters with high quality, clean air and not contaminated soil, hygienic surrounding a.o. For a sustainable development of the environmental protection must be considered the assessment of all this different parts on the impact of the environment. A holistic solution of the problems is wanted.

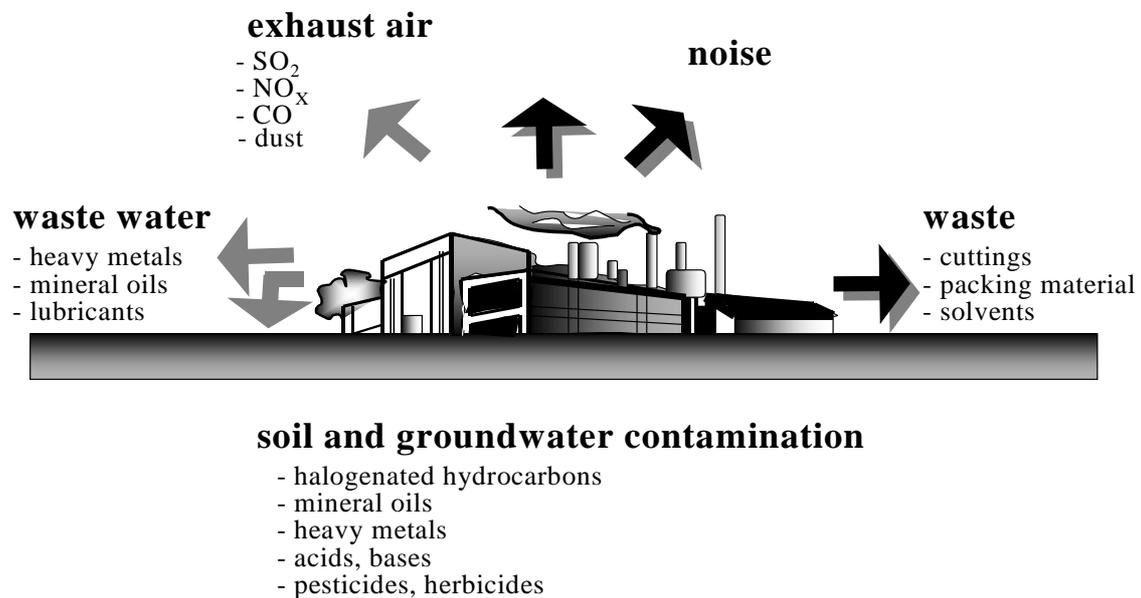


Fig. 1 Environmental pollution emitted from an industrial plant

This is possible only with inter-disciplinary specialist and a great responsibility of the people involved.

Without reducing the importance of the scientific research and development contribution in this matter, it has to be mentioned also the significance of the experience of the staff for creating of new ideas. The responsible officer for the technology is also available partner for new proposals, reducing the waste water discharge.

According our competence in this case, as engineers for water and waste water treatment, our contribution will be focused on this subject.

Creative and intelligent solutions are expected on the producing apparatus and devices, allowing the introduction of dry technologies.

The treatment of the waste water on the place of origin is recommended. The pollution in concentrated form can be removed easily, f.e. with membrane technology. This technology is used also to recover valuable substances out of the waste water, f.e. not used dyes, detergents a.o.

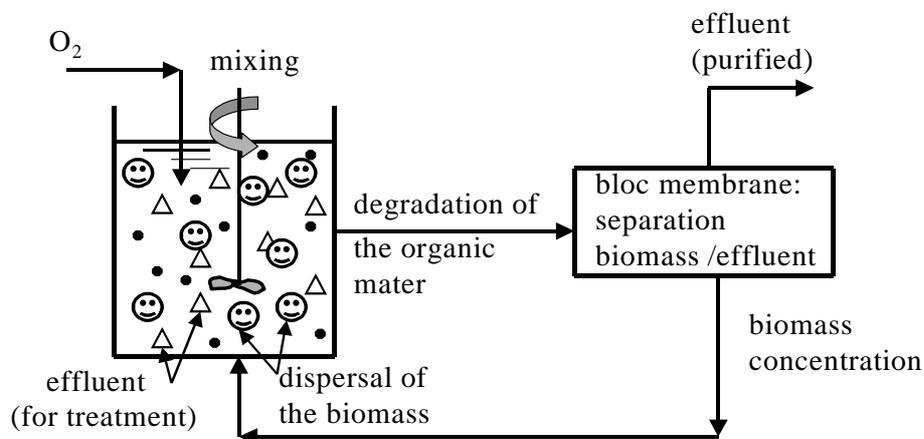


Fig. 2 Scheme of a treatment system with a membrane technology

Heavy pollution of the waste water is also observed, when the crops were treated unprofessionally with pesticides. The control of the raw material for toxic substances can reduce substantially later the treatment costs.

The discharged waste water from many food processing devices is with high temperature $> 60^{\circ}\text{C}$. This is also the case in the addible oil industry. The waste water must be could of $t \leq 35^{\circ}\text{C}$, to allow the aerobic biological treatment. The cooling is often causing operational problems in the plant.

A new approach can be the use of extremophilic aerobic bacteria with optimum between 60° and 90°C , to treat biologically directly the hot waste waters.

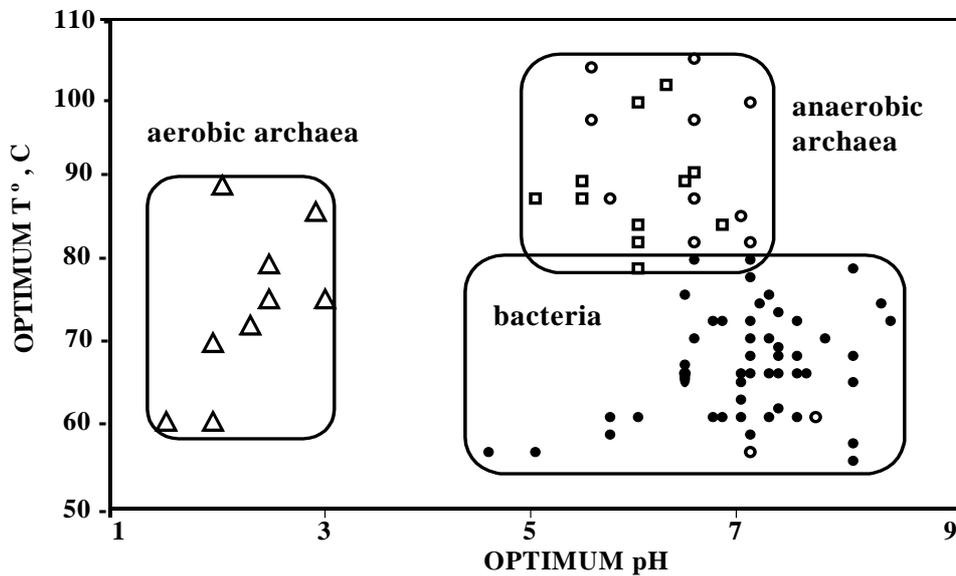


Fig. 3 Extremophilic microorganisms and their depending on temperature t° C and pH

All new treatment system of the waste waters are developed to be most economical and with higher efficiency compared with the known one. This means, that the industry using new better-integrated technologies, can produce at low costs. The created competition between similar factories is prohibitive for spreading of information and the best available technologies outside of a certain company.

Cooperation in the research and development of new devices in the field of the sustainable environmental protection in the form of an international cooperation can be probably a way to overtake this barrier.

New products produce on the base of wasted substances such as activated carbon from the stones of fruits plates and boards from the wood shreds. Production of energy with organic wastes (solid or liquid) a.o. can be mentioned.

The reuse of waste material or waste water substances for new secondary products has good chances to be implemented in short time.

The integrated producing processes solving environmental problem direct by their discharge are wanted.

TECHNOLOGICAL CONCEPT FOR TREATMENT PLANTS

The technological concept of a treatment plant at the “and of the pipe” is from technical and economical point of view very important. In Fig. 4 is shown a diagram – the development of the saving of costs in dependence of the project design stage.

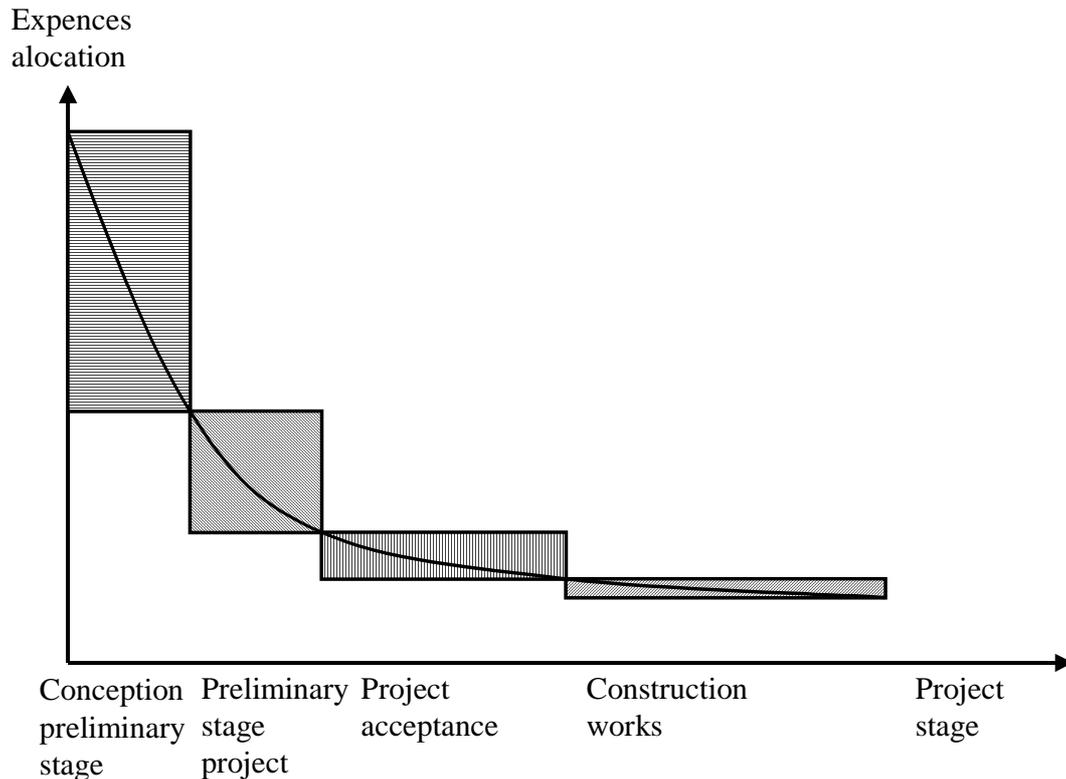


Fig. 4 A possible reduction of the investment costs in dependence of the engineering stage of the treatment plant

It is evident, that the great possibility to save costs is namely during the step of preliminary design.

Before taking a discussion for a treatment plant concept, we need the study of several alternatives and may be a new tailored solutions need. A support of laboratory or pilot studies on situ is always to be recommended.

Only good proved concepts can satisfy the requirements of the effluent at the lowest costs and with an operation with less troubles.

Taking into account that a food processing industry can change unpredictably its production and the owners, because of a market situation, the treatment plant must be constructed with maximum flexibility. It must be able to meet these changes with less additional expenses.

Devices with which it can be reached some flexibility are f.e. providing equalization tanks, SBR-technology, possibility to use technical oxygen by high loading periods, multy stage treatment systems a.o. The material of the devices is preferably of steel or plastic and the form is also very important. A construction above the floor can be recommended. A possibility to remove not used devices from the treatment plant has to be considered also.

Some technical solutions will be given as examples for flexible treatment plants, build in the last few years.

In Fig. 5 is shown a waste water treatment system, applied in the Coca-Cola factory and in a milk processing company.

It is developed an aerobic process with separate activated sludge stabilization. The stabilized sludge has good adsorption capacity for many substances, which are present in the waste waters. Stabilized sludge is dosed at the and part of the aeration tank for adsorption of not easy biodegradable substances. They are later eliminated from the plant with the excess sludge. In Fig. 5 is given a scheme of the process.

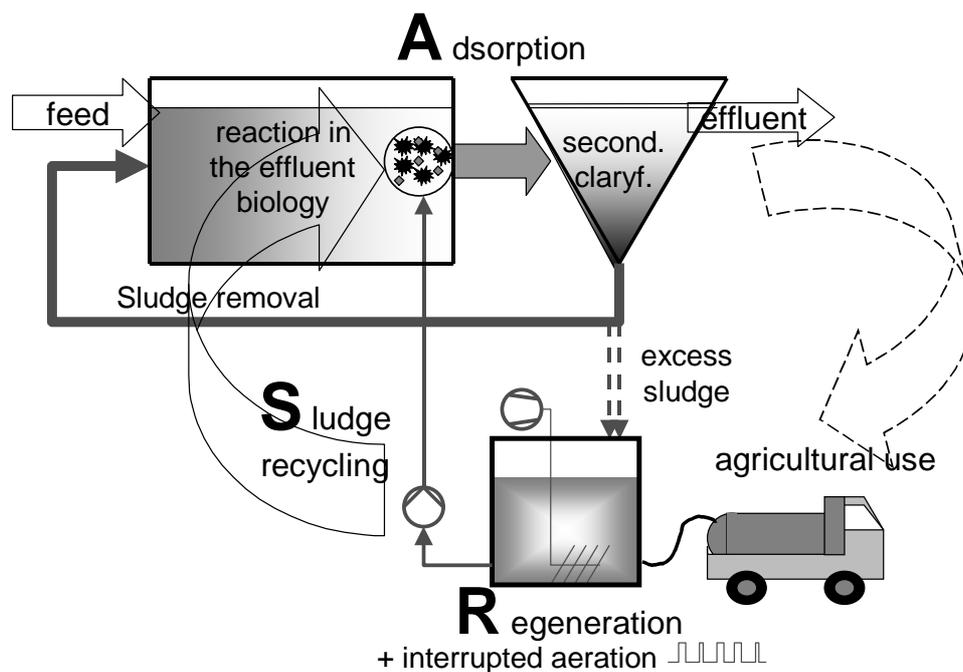


Fig. 5 Regenerated activated sludge, used for adsorbing of not biodegradable substances

From the edible oil industry are discharging some process waters with high temperature $60^{\circ} - 80^{\circ} \text{C}$ and oil content. The developing of a biological treatment system with

extremophilic aerobic bacteria may be promising. The cooling of this waste water from 60° C to 35° C will be then avoided.

A device with great flexibility is shown on Fig. 6. It is an SBR-Reactor type with fixed film biology, which can be fluidized by high loads or used as filter by discharging of the water.

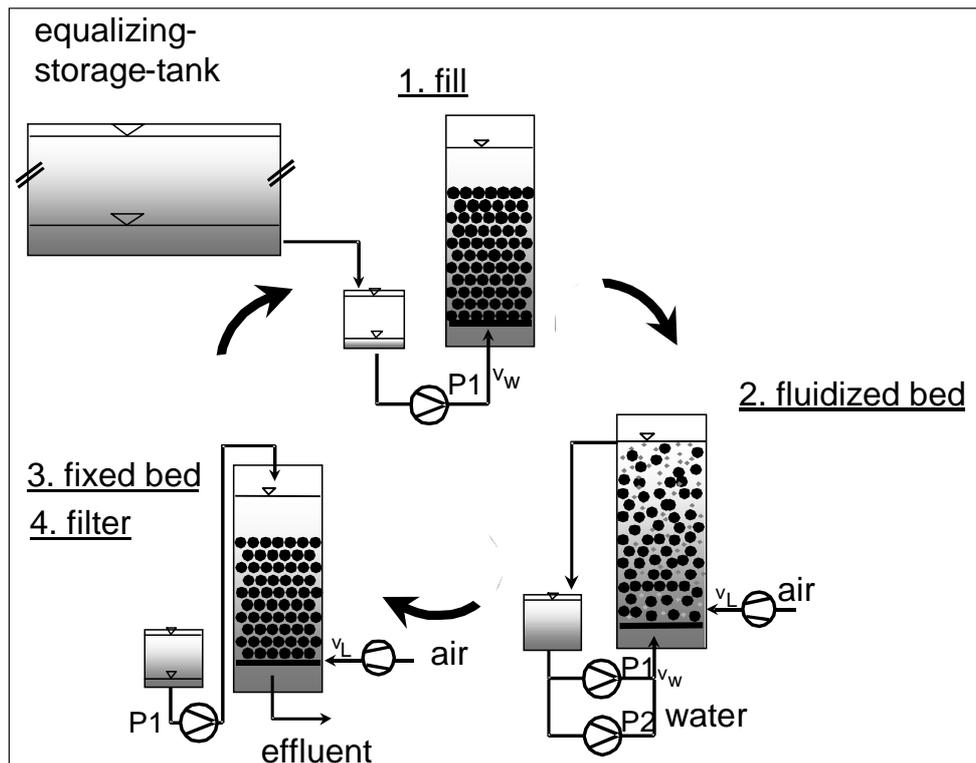


Fig. 6 SBR – operation mode of a single fixed film reactor

The anaerobic reactors such as USB and others are well known, as very successful and with less excess sludge and costs device. A further development for anaerobic processes is the sludge-blanket reactor, operated under pressure (Fig. 7).

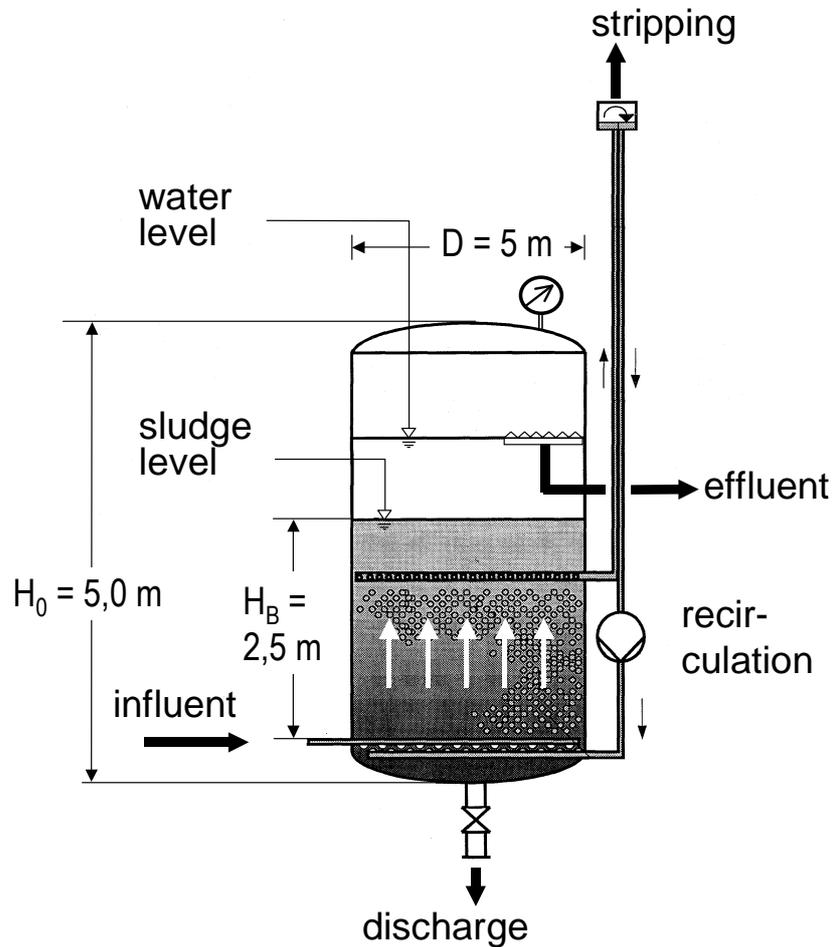


Fig. 7 Anaerobic sludge blanketed reactor under pressure

With no doubt the membrane technology is introduced in many cases for partially treatment of process waters, reusing of retained materials and for final treatment with success. It will be rapidly further developed and its broad application in the food industry can be expected.

The research and development of new methods, systems and devices for treating of the waste waters and reusing valuable substances will be intensified in the future. Better and less expensive technic is necessary to fulfill the requirements of sustainability.

CONCLUSION

Sustainable environmental protection means continuously developing, better possibilities to protect the nature and resources for the next generation, taking into account the socio-economical development and benefit of the society in the same time.

The globalization trend of the economy has big influence on the agricultural industry, because it is widely organized international.

The transfer of a technology from one country to another is not always optimal even possible. Tailored treatment systems are the better solution.

The transfer of integrated processes is the best way of international experience transfer.

The treatment or reuse of the waste water on situ has to be preferred always.

The developing of new treatment methods or devices can be considered as a continuous process.

The sustainable development of the waste water treatment plants must be flexible and not design for long periods of time. According my experience, in 7 to 12c years the industry my change the production with the consequence, that the treatment plants must be upgraded using new developments.

REFERENCES

Environmental Sustainability for the Agro-food Industry (2001). Alberta, Agriculture, Food and Rural Development.

European Commission issues working paper on sustainable development (2001). Brey 10/217, Rue de la Loi/Westreat 200, B-1049 Brussels, Belgium.

International Conference on Sustainable Development of Water Resources (2000). Socio-Eco-Institute a. Eur. Asp., New Delhi.

Indikatoren zur Nachhaltigkeit der Berliner Wasserwirtschaft (1998). Seminar: Produktintegrierter Umweltschutz, TU – Berlin.

Rohbrecht-Buck K., Kuzmanova K. and Sekoulov I. (2000). *Behandlung von Abwaessern aus der Lebensmittelindustrie – Beispiele aus Deutschland und Bulgarien*. 5th BNAWQ – Conference, Sofia, Bulgaria.