Austria and Switzerland

Status and development of MBR-technology

Currently, there are only a small number of applications of membrane bioreactor technology in Austria and Switzerland. Only two full scale applications using the submerged membrane technology exist. The limitation lies mainly on the fact that there are abundant water reserves of high quality for both countries and the receiving streams are generally quite efficient. Despite these factors, there are still areas in which MBRs can offer advantages over conventional systems. In particular, the high purification performance as well the small basin volumes and reduced space requirements open a wide range of opportunities in the future.

Säntis mountain station

According to the Austrian and Swiss regulations, wastewater has to be treated in compliance with the 'State of the art'. In Austria, the 'State of the Art' is defined by several emission ordinances (Emissionsverordnungen), which embody detailed descriptions of the effluent quality for different sectors. It contains exact specifications concerning the parameters which have to be followed. The selection of the wastewater treatment procedure itself is left to the respective applicant. At present, there are no financial incentives for improving the quality beyond the set limits. Only in special cases, e.g. small receiving streams, more stringent standards are required by the authorities. In Switzerland, legislative requirements are similar. The regulatory limits are described in the water protection ordinance (Gewässerschutzverordnung), although less detailed than that of Austria. Limit values of parameters not enumerated in the ordinance are determined using a corresponding 'State of the art' technology, which is described in several recommendations and directions by the Swiss' Ministry of Environment, Forestry and Agriculture (BUWAL). In particular, the authorities can impose more stringent standards if the 'State of the art' facilitates this.

At present, there is a limited number of applications using MBR process in both countries. In Austria, MBR technology is only used for the treatment of industrial wastewater and landfill leachate. Since 1994, only a few plants have been built to treat landfill leachate using external cross flow filtration systems. The biggest plant of this type is in Halbenrain, Styria, with a bioreactor volume of 390 m³ and ceramic cross flow membranes having a total surface area of 40 m². It has been designed to treat 100 m³/d at concentrations of 25.000 mg COD/l and 4.000 mgNH_4-N/l. On the other hand, there is only one full scale plant which uses submerged membranes. The Austrian pharmaceutical company, Biochemie Kundl, has been using this type of plant to treat its wastewater since the end of year 2000. The MBR is a partial extension of the existing conventional system and treats 15 to 20% of the total flow and has been designed based on laboratory assessments over a period of five years. The total volume of the wastewater plant is 1,460 m³ with a treatment capacity of 1350 m³/d. The filtration modules are located in two separate basins, each with a total volume of 130 m³. Two different types of submerged membranes have been installed due to the fact that preliminary investigations did not show a clear advantage for one of the tested

Wastewater treatment plant at Säntis.

Visit of MBR installation of Biochemie at Kundl for the treatment of pharmaceutical wastewater (photo: DHV Water).

membrane system. One of the basins contains the Zenon hollow fiber membranes with a total surface area of 3680 m². The second basin includes a 720 m² of the Kubota-Flat sheet module.

In the area of municipal wastewater treatment, there is no full scale MBR existing in Austria. At present, only a few pilot plant investigations have been undertaken. The company, Rotreat, and the consulting firm, EnviCare, performed assessments for the treatment of wastewater from the city of Weiz. Since 1999, they have also investigated the rehabilitation of a municipal wastewater pond in St. Peter o. J. (1400 inhabitants) using MBR technology. Pilot-scale trial in treating municipal sewage was also carried out by the company, VA-Tech Wabag, in cooperation with the Interuniversitäre Forschungsinstitut IFA-Tulln. The pilot plant in Tulln includes a membrane area of 102 m² and has a capacity to treat wastewater from a maximum of 500 inhabitants.

In Switzerland, only one municipal wastewater treatment plant exists currently. It is situated in the summit of Säntis, where it treats the wastewater from the restaurant and hotel in the Säntis Mountain station. The concept of MBR was developed by the company, Aqua-system. The decision was based on the stringent requirements for the effluent quality as well as the fact that all existing installation parts and equipments could be used without larger structural changes. A membrane with an area of 140 m² (hollow fiber membrane from Zenon) was installed to treat a maximum daily wastewater flow of 40 m³. The unit consists of a wastewater collection container (12.5 m³) and an activated sludge tank (40 m³ with denitrification of 15 m³ and nitrification of 25 m³). There are five projects dealing with MBR technology currently being planned. In the municipality of Stäfa (20 km from Zurich), a decision was made to install a MBR for a maximum flow of 5000 m³/d. The rational behind this decision was due to several reasons, which include the direct discharge of wastewater to the Zurich lake that also serves as a drinking water reservoir, the problem of limited space, and the necessity to completely enclose the plant due to olfactory reasons. Other planned projects are wastewater from mountain restaurants/hotels in Schilthorn (2002; 20 m³/d), Schwägalp (2002; 100 m³/d), Aengstligalp (?, 15 m³/d) and the municipality of La Côte-aux-Fês (2002; 800 inhabitants).

Several reasons can be attributed to the limited use of MBR technology so far. There are abundant water reserves of high quality available for both countries and the receiving streams are generally quite efficient. Despite these limitations, there still exists areas in which MBRs can be applied. In Austria, the main source of drinking water is the ground or spring water and only 1% comes from surface water. On the contrary, 20% of the Swiss drinking water comes from surface water (lakes). Therefore, there is a higher pressure placed on the part of the purification plant operator in fulfilling higher standards. There is also an increasing concern about the effect of micropollutants on the quality of the drinking water. MBR technology offers an advantage due to its high performance in treating wastewater. This topic is currently being investigated by several research groups in Europe. For instance, the Swiss' research institute, EAWAG, operates a test plant which can treat 60 m³/d with a total membrane (Kubota, Mitsubishi and Zenon) area of 126 m². The main objective of the project is to purify wastewater at the micro level using membrane technology.

In Austria, according to the latest survey, only 273 out of the total 1272 of the municipal wastewater treatment plants fulfill EC-standards (carbon removal, nitrification, denitrification and phosphorous elimination). MBRs provide several advantages compared to conventional systems, in particular, the small basin volumes and reduced space requirements. When considering the continuous reduction of membrane prices as well as further developments in membrane technology, MBRs will be an attractive alternative for the extension of existing plants even on the basis of commercial competitiveness.

In conclusion, the application of the MBR technology is still in its infancy in Austria and in Switzerland. However, it can provide a wide range of opportunities in the future. At present, there is a lack of information about membrane biotechnology within public authorities and plant operators, as recognized by the Austrian Water and Waste Management Association (Österreichischer Wasser- und Abfallwirtschaftsverband). Therefore, a specialized committee which is comprised of experts in the field of MBR was created in order to disseminate information and to help the technology reach its maximum potential. ¶

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