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Membrane technology in environmental engineering – meeting future demands and challenges of the water and sanitation sector

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Water facts: The percentage of people served with some form of improved water supply rose from 79% (4.1 billion) in 1990 to 82% (4.9 billion) in 2000. For sanitation purposes an increase from 55% (2.9 billion people served) to 60% (3.6 billion) was registered during the same period. At the beginning of 2000 one-sixth (1.1 billion people) of the world's population was without access to improved water supply and two-fifths (2.4 billion people) lacked access to improved sanitation (Fig. 1) [1]. At the Second World Water Forum, The Hague, 17–22 March 2000, targets were presented in the report VISION 21 where the aim was by 2015 to reduce by half the proportion of people without access to sanitation and access to adequate quantities of affordable and safe water, and by 2025 to provide water, sanitation, and hygiene for all [1]. To achieve these targets billions of people will need access to sanitation and access to water supply by that date. This means providing water supply services to 280,000 people and sanitation facilities to 384,000 people every day for the next 15 years. To reach universal coverage by the year 2025, almost 3 billion people will need to be served with water supply and more than 4 billion with sanitation. The water supply and sanitation sector will face enormous challenges over the coming decades where the water industry will need to meet the fast growing needs in a global perspective.

Attempts at predicting the future needs and investments in the water and sanitation sector have been done, however, comparing the various regions in the world and making assessments both of urban and rural needs is not easy. Some studies though have indicated the extent and challenges for the water industry in general. Investment in water quality in developing nations will help drive an estimated 5.9% annual increase (including price increases) in demand for water treatment products through 2009, according to a new study, World Water Treatment, by research firm The Freedonia Group, Inc. [2]. The same firm has also recently made an assessments of the advancement of membrane technology in a study entitled "Membrane Separation Technologies". This study stipulated a yearly increase of 7.8% in the demand for membrane materials with a total value of

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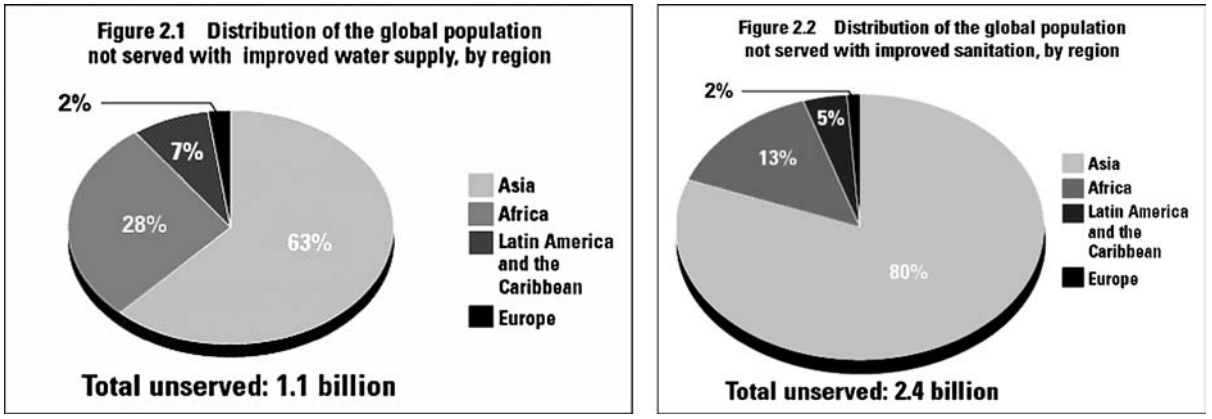

Fig. 1. Distribution of global population served with water and sanitation [1].

membrane systems (including equipment such as pumps and piping) reaching USD4.8 billion in 2004. Water and wastewater treatment has been identified as the largest end use for membrane materials, where they will continue to dominate. Implementation and expansion in consumer applications combined with replacement sales to municipal and industrial customers are suggested as the main reasons for this.

The global water marked has been estimated at a total value of around 224 billion € with an anticipated annual growth of around 16–20% depending on the market segment. Drinking water production is stipulated to have the largest growth with a doubling of the market value in the period 2000–2015. The market for wastewater treatment is the largest sector with an anticipated growth of around 43% for the same period. Membrane technology will of course play an important role in this market. Cross-flow membrane systems are expected to grow from 4.8 billion € in 2004 to 6.5 billion € in 2007 on a global basis where desalination has been reported to represent about 1/3 of this growth. The fastest growing segment, however, has been predicted to be the development of membrane bioreactor systems for wastewater treatment with a yearly growth estimated at 15% (Fig. 2).

Looking at the water and sanitation sector in general, certain trends may be found regarding the advancement and implementation of membrane technology in Environmental Engineering. Microfiltration membranes (MF) are recognized as the accounting for the largest portion of the market. The nature of MF separation make them by far the most widely used membrane process where they can either constitute the final separation stage or are applied as pretreatment options in for example reverse osmosis (RO) systems. RO for desalination of brackish water or sea water to produce potable water is a well established industry. The cost of desalination is expected to drop drastically (presented at Fourth World Water Forum, Mexico, 2006) and reports about the implementation of large desalination

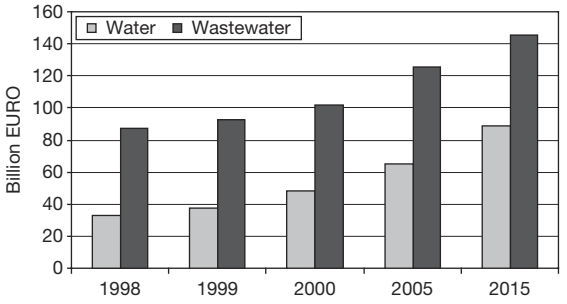

Fig. 2. Stipulated growth in the water and wastewater industry to 2015 [3].

plants to produce fresh water can often be found in the news media. In areas of the world experiencing water shortages or high demands on limited fresh water resources, wastewater recycling and reuse is becoming a necessity. Membrane technology is a central and key element in implementing sustainable solutions for wastewater recycling and reuse. Numerous examples of membrane systems success for this application can be found there is an increasing interest in implementing the available technology.

The aim of this presentation at EUROMembrane 2006 is to give an overview of the demands and challenges in the global water and sanitation sector, the significance of the water and wastewater market, and the role and prospective of membrane technology applied to environmental engineering in general.

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