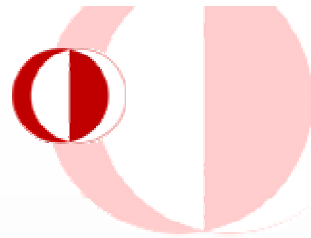


Municipal Wastewater Management in Turkey: Impacts & Reuse

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ABSTRACT

An inventory of the urban wastewater treatment plants (WWTPs) in Turkey is presented. There are a total of 129 urban WWTPs in Turkey within 43 cities. According to 2001 figures, 35% of the total population is served by urban WWTPs. Distribution of untreated and treated municipal wastewater disposal practices based on flow show the highly impacted water bodies. For a part of the WWTPs, discharging to inland water bodies, quantity and type of reuse was examined. Survey results indicate wastewater reuse either directly in agricultural irrigation, or indirectly through a receiving water body.

WASTEWATER MANAGEMENT IN TURKEY

The provincial distribution of the wastewater generation throughout Turkey emphasize the metropolitan and highly populated cities (Fig. 2). Priority have been given to the treatment of municipal wastewaters originating from large cities. There are many other WWTPs either under construction or project phase for the large cities, such as Adana.

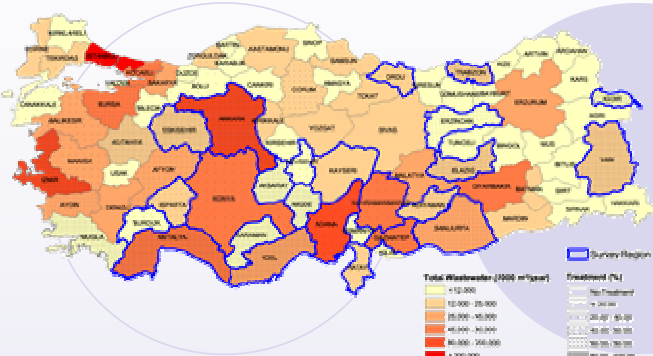


Figure 2. Provincial distribution of total municipal wastewater generation and treatment

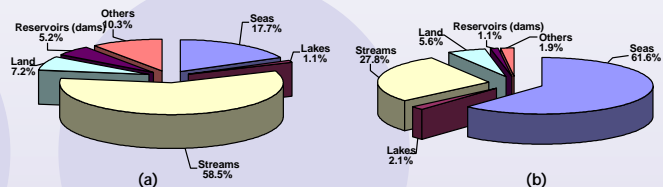


Figure 3. Distribution of a) untreated, b) treated municipal wastewater disposal (based on flow rate)

WASTEWATER MANAGEMENT WITH EMPHASIS ON REUSE - SURVEY REGION

Majority of the untreated municipal wastewater is discharged into streams (59%) pointing to the significant potential impacts on these water bodies and communities surrounding them (Fig. 3). The majority of the treated wastewater, on the other hand, is discharged into seas (62%) making it very difficult for these wastewaters to be reused since most WWTPs that practice sea disposal have only preliminary treatment.

A detailed study was carried out as a part of a EU-MEDA funded project (MEDAWARE) to investigate Turkey's potential for treated wastewater reuse in agriculture. Mainly inland provinces for which boundaries are outlined with bold in Fig. 2 were selected for this purpose. There are 56 WWTPs located within the survey region. The size of these WWTPs as well as the flow based ratio of the types of treatment they apply can be seen in Fig. 4. The majority of the WWTPs having capacities greater than 5 Mm³/yr utilize biological treatment.

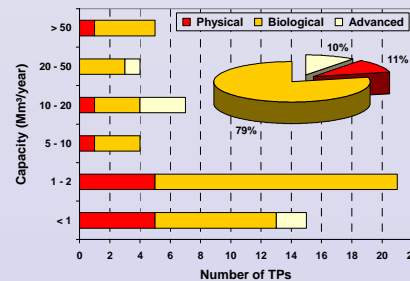


Figure 4. Capacity and type of treatment for the 56 WWTPs located within the survey region

The treatment technologies applied and the effluent disposal from the 56 WWTPs (Fig.5) depict the high potential for the effluents from these plants to be reused.

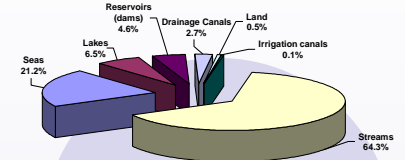


Figure 5. Distribution of treated municipal wastewater disposal for the 56 WWTPs in the survey region (based on flow rate)

WASTEWATER FACTS

- Population of Turkey in 2000 was 67.8 million
- 2001 figures show that 60% of the total population is connected to a sewerage system
- More than 3 billion m³ of municipal wastewater is generated yearly, of which:
 - 2.73 billion m³ is collected by a sewerage system, and
 - 1.2 billion m³ is treated in municipal WWTPs

WASTEWATER TREATMENT FACTS

- Turkish Water Pollution Control Regulation - 1988, amendments: 1989-1993
- The population served by WWTPs in a continuously increasing trend: 20.4% in 1994, reached 35% in 2001
- There are 129 WWTPs located in 43 cities
- The type of treatment applied in the WWTPs (based on flowrate): 49% biological, 38% physical, 13% advanced

HEALTH IMPACTS

The distribution of WWTPs as well as incident risks caused by water-borne diseases are given in Fig. 1. There are no direct records of epidemiological evidence concerning the impacts of untreated wastewater in Turkey, however the latest statistics on the number of incidents of the waterborne diseases is presented to provide relevant information. South eastern region appears as the most problematic, having the cities with the incident risk values above the average for Turkey (0.093%). Reuse of untreated wastewater have been noted in Siverek located between Diyarbakir and Sanliurfa. Such practices in the region may contribute to the observed high incident risk values.

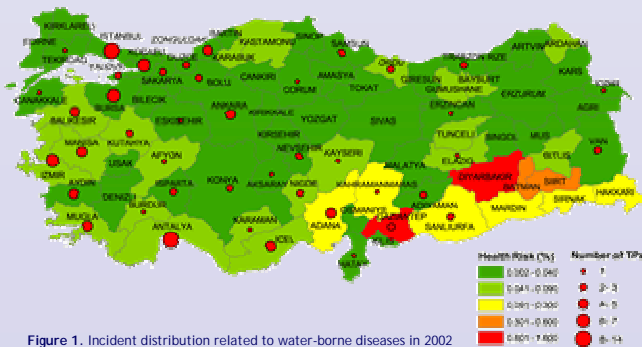


Figure 1. Incident distribution related to water-borne diseases in 2002

REUSE FACTS

DIRECT REUSE

Treated effluent from :

- Igdir WWTP - 7,300,000 m³/yr is used to irrigate 5000 ha of field,
- Konya-Kadinhani - 1,400,000 m³/yr is used to irrigate 100 ha of field,
- Nigde-Bor - 2,800,000 m³/yr is used to irrigate 150 ha of field, all within 5 km of the WWTP.

INDIRECT REUSE

Treated effluent reused via the water body the effluent is discharged:

- Eskisehir WWTP - 24,820,000 m³/year is used to irrigate 50,000 ha of field
- Gaziantep WWTP - 73,000,000 m³/year is used to irrigate 8,000 ha of field
- Konya-Ilgın - 1,000,000 m³/year is used to irrigate fields
- Neveshir-Urgup - 213,000 m³/year is used to irrigate fields

Other WWTPs where the streams that the plants discharge are known to be used extensively for agricultural irrigation:

- Ankara WWTP - 192,700,000 m³/year discharges to Ankara Creek
- Aksaray WWTP - 9,125,000 m³/year discharges to Karasu Creek
- Adana-Kozan WWTP - 2,780,000 m³/year discharges to Kozan Stream

CONCLUDING REMARKS

Investigation of the removal efficiencies for the selected WWTPs show that the plants utilizing biological and advanced treatment have effluent water qualities better than the regulation levels. The effluents from these plants have a high potential to be reused in agricultural irrigation with minimum technology improvements. Nowadays in Turkey, reuse is starting to be a concern during the planning of WWTPs, for example Kayseri WWTP, having a capacity of 40 Mm³/yr was put into operation recently with agricultural reuse planned and will start in the near future. Currently, 75% of Turkey's freshwater consumption is used in agricultural irrigation. Reuse of WWTP effluents in agriculture would lower the demand on freshwater and help realize sustainable use of our water resources.

SOURCES OF INFORMATION

- State Institute of Statistics (SIS) Municipal Sewerage and Wastewater Statistics Survey: SIS has been conducting Sewerage and Wastewater Statistics Survey throughout Turkey within the context of a project covering a period of 1999-2003. The most recent survey data for 2001 was used in this study.
- Surveys Conducted: Survey forms prepared in parallel to SIS survey forms, but with more emphasis on reuse practices, were sent out to selected TPs. The TPs were selected based on the population served and the wastewater reuse potential in the region.
- Contact with Treatment Plant Personnel: In order to confirm the data collected, direct contact with most of the TPs was established.

ACKNOWLEDGEMENT

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