Advanced Membrane Wastewater Treatment

Palestinian – Jordanian – Israeli Project

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Wastewater is used for irrigation.

In the best scenario, secondary-treated effluent is used

Reduces levels of organic matter and biological activity.

Leaves some pathogens, toxic elements and most important, salts.

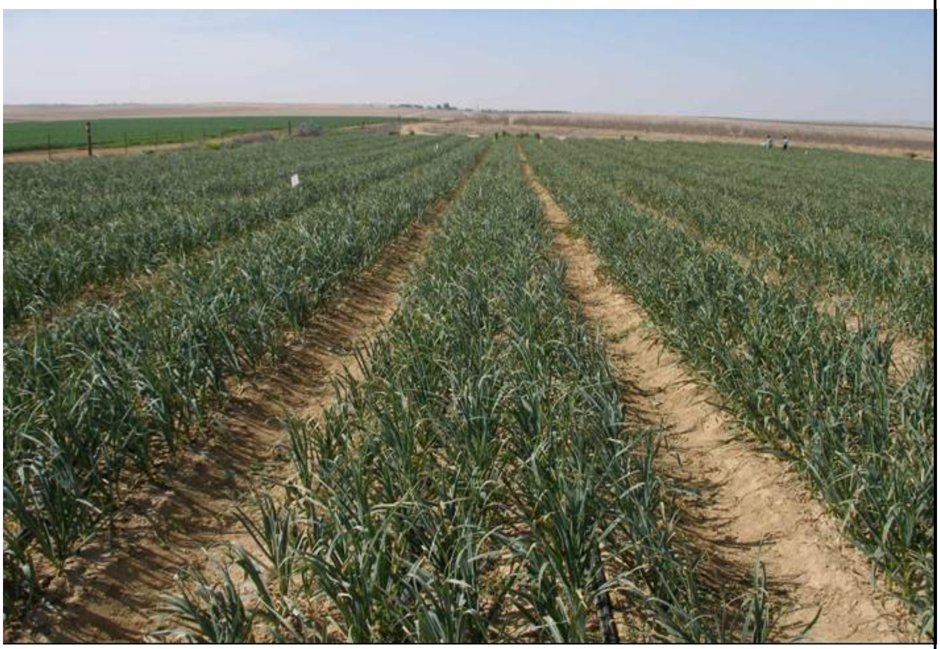
Environmental and health risks by raising soil and aquifer salinity.

For ensuring sustainability, tertiary and quaternary treatment is imperative.

A Palestinian – Jordanian – Israeli Project
was initiated

Pilot plants containing UF and RO membranes
were constructed and operated

Field, greenhouse and lysimeter
experiments were laid out



Effluent analysis at the BGU site

Treatment Stage	BOD mg O_2/l	COD mg O_2/l	pH	Fecal Coliforms CFU/100 ml	EC dS/m	N-NH_4 mg/l	PO_4 mg/l
Secondary effl.	105	640	7.8	7.2×10^5	1.81	41.9	25.8
UF permeate	2.0	106	7.7	4	1.78	52.1	7.8
RO permeate	0.1	1.4	6.2	0	0.11	3.0	0.8

Water melon yields, t/ha
and soil EC (ds/m), at 30 cm
BGU site

Irrigation water	Yield	EC
SP	28 a	1.3
UF	36 ab	1.2
UF70 + RO 30	34 ab	1.1
UF30 + RO 70	44 bc	0.9
RO	50 c	0.8

Soil salinity (EC) initial (2004)
and after corn harvest (November 2006)

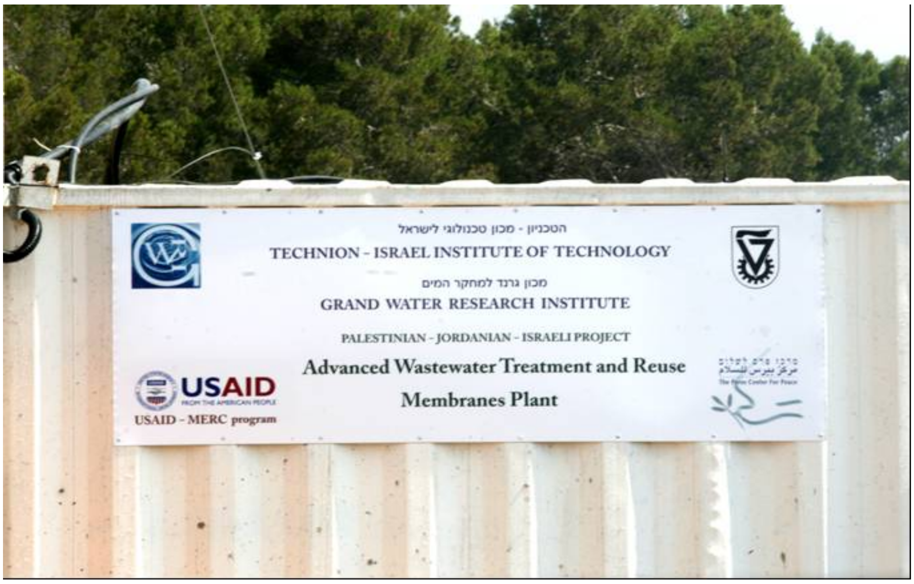
	EC dS/m			
	Al Baq`a Site			
Depth, cm	Before planting	EF	UF	MIX
0-15	1.8	6.3	4.2	2.3
	Ramtha Site			
0-25	0.6	14.3	10.4	5.3

Based on the results of the first stage,
literature review and computer modeling

A membrane plant, pumps, control units, monitors, data-logging unit and remote (cellular) connection were installed in a closed container.

Storage tanks are located out side of the container.

Secondary treated effluent is pumped from a pond



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Advanced Wastewater Treatment and Reuse
Membranes Plant
USAID
FROM THE AMERICAN PEOPLE
USAID - MERC program

Membrane system

Pre-screening 100 micron automatic disc filter

4 modules UF hollow-fiber, area 52 m^2 each

RO 1st stage: 5 modules Toray,area 37 m^2 each

RO 2nd stage: 10 modules Toray,area 7 m^2 each

Pump operation, backwash cycle, tank filling, pressure, temperature, flow rate and electrical power consumption are monitored continuosly.

A data-logging unit and remote (cellular) connection enable control and follow-up in real time and at distance.

Following the monitoring results, adjustments in operational parameters, like periods of running and backwash are made.

The UF and RO wastewater treatments are considerably less energy demanding than seawater desalination

A similar membrane system is under construction at the Jordanian National Center for Agricultural Research and Extension

The secondary wastewater treatment employs the activated sludge-extended aeration method.
The treated effluent is presently used for irrigation.
EC ~ 2 dS/m, COD ~ 77mg/l

At the Al Quds University
Data on spiral-wound UF membranes showed initial reversible fouling process, turning into irreversible over time, in spite of chemical cleaning

Exchange for hollow-fiber UF induced a significant drop in energy requirements.

Combination of hollow-fiber and spiral-wound UF membranes , leading to reduced energy and cleaning costs is tested

Ben Gurion University pathogen and virus removal by a UF hollow-fiber and RO membrane system.

Feed water concentration
$3x10^5$ fecal coliforms, $4x10^4$ entero cocci / 100ml
Reduced to zero in the final permeate.

Vaccine-strain polio virus injected into feed water.
Representing enteral viruses,
resistant to environmental conditions,
average size 23-27 nm.
UF membrane virus removal at a level of 5 logs.

Removal of Pharmaceuticals

Technion:
High potential of RO membranes
to remove pharmaceuticals from effluents.

Al Quds Univ.:
A detailed report is given in another presentation.

Within a year the tertiary and quaternary wastewater treatment processes will be optimized.
The membrane plants will serve as a model for constructing in a larger scale.

Considerable contribution to increase in availability of high quality water and ensure irrigated agriculture sustainability.