Reclaimed water

B. Manjula[1] and S.K. Priyadarshini[2]

[1]Department of Agricultural Processing and Food Engineering, Tamil Nadu Agricultural University, COIMBATORE (T.N.) INDIA

Email : manjulakrishna.08@gmail.com

[2]Centre for Plant Breeding and Genetics, Tamil Nadu Agricultural University, COIMBATORE (T.N.) INDIA

Reclaimed water or recycled water, is former waste water (sewage) that has been treated to remove solids and certain impurities, and then used in sustainable landscaping irrigation or to recharge groundwater aquifers. This is done for sustainability and water conservation, rather than discharging the treated wastewater to surface waters such as rivers and oceans.

The recycling and recharging is often done by using the treated wastewater for designated municipal sustainable gardening irrigation applications. In most locations, it is intended to be only used for nonpotable uses, such as irrigation, dust control, and fire suppression. There is debate about possible health and environmental effects with its uses. However, Los Angeles County's sanitation districts have provided treated wastewater for landscape irrigation in parks and golf courses since 1929. The first reclaimed water facility in California was built at San Francisco's Golden Gate Park in 1932. The Irvine Ranch Water District and Orange County Water District in Southern California are becoming the leaders in reclaimed water through their 'Green Acres Project.' Also in Orange County, and in other locations such as Singapore, water is given more advanced treatments and is used indirectly for drinking.

Characteristics of wastewaters:

Municipal wastewater is mainly comprised of water (99.9%) together with relatively small concentrations of suspended and dissolved organic and inorganic solids. Among the organic substances present in sewage are carbohydrates, lignin, fats, soaps, synthetic detergents, proteins and their decomposition products, as well as various natural and synthetic organic chemicals from the process industries. Table 1 shows the levels of the major constituents of strong, medium and weak domestic wastewaters. In arid and semi-arid countries, water use is often fairly low and sewage tends to be very strong, as indicated in Table 2 for Amman, Jordan, where water consumption is 90 l/d per person.

Municipal wastewater also contains a variety of inorganic substances from domestic and industrial sources (Table 3), including a number of potentially toxic elements such as arsenic, cadmium, chromium, copper, lead, mercury, zinc, etc. Even if toxic materials are not present in concentrations likely to affect humans, they might well

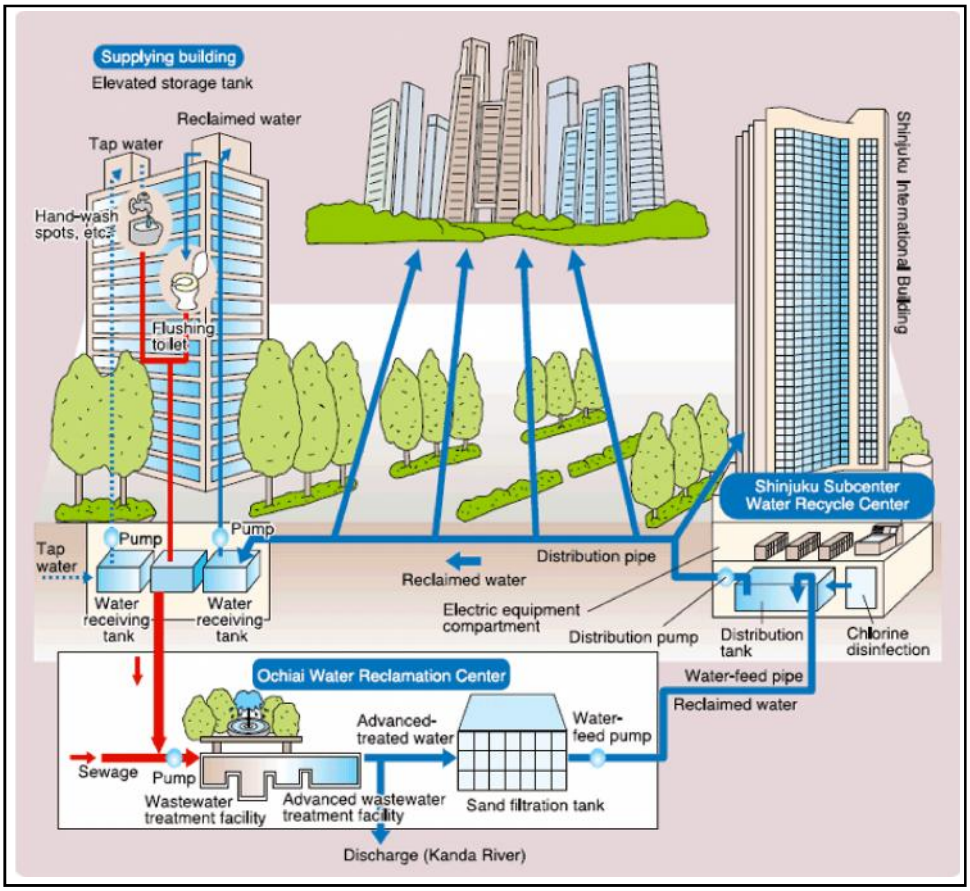

Table 1 : Major constituents of typical domestic wastewater

Constituent	Concentration, mg/l		
	Strong	Medium	Weak
Total solids	1200	700	350
Dissolved solids (TDS)[1]	850	500	250
Suspended solids	350	200	100
Nitrogen (as N)	85	40	20
Phosphorus (as P)	20	10	6
Chloride[1]	100	50	30
Alkalinity (as $CaCO_3$)	200	100	50
Grease	150	100	50
BOD_5[2]	300	200	100

[1] The amounts of TDS and chloride should be increased by the concentrations of these constituents in the carriage water.
[2] BOD_5 is the biochemical oxygen demand at 20°C over 5 days and is a measure of the biodegradable organic matter in the wastewater.
Source: UN Department of Technical Cooperation for Development (1985)

Table 2 : Average composition of wastewater in Amman, Jordan

Constituent	Concentration mg/l
Dissolved solids (TDS)	1170
Suspended solids	900
Nitrogen (as N)	150
Phosphorus (as P)	25
Alkalinity (as $CaCO_3$)	850
Sulphate (as SO_4)	90
BOD_5	770
COD[1]	1830
TOC[1]	220

COD is chemical oxygen demand TOC is total organic carbon
Source: Al-Salem (1987)

Table 3 : Chemical composition of waste waters in Alexandria and Giza, Egypt

Constituent	Alexandria		Giza	
	Unit	Concentration	Unit	Concentration
EC	dS/m	3.10	dS/m	1.7
pH		7.80		7.1
SAR		9.30		2.8
Na_2^+	me/l	24.60	mg/l	205
Ca_2^+	me/I	1.50	mg/l	128
Mg	me/I	3.20	mg/l	96
K^+	me/I	1.80	mg/l	35
Cl^-	me/I	62.00	mg/l	320
SO_4^{2-}	me/I	35.00	mg/l	138
CO_3	me/I	1.10		
HCO_3^-	me/I	6.60		
NH_4^+	mg/l	2.50		
NO_3	mg/l	10.10		
P	mg/l	8.50		
Mn	mg/l	0.20	mg/l	0.7
Cu	mg/l	1.10	mg/l	0.4
Zn	mg/l	0.80	mg/l	1.4

Source: Abdel-Ghaffar *et al.* (1988)

be at phytotoxic levels, which would limit their agricultural use. However, from the point of view of health, a very important consideration in agricultural use of wastewater, the contaminants of greatest concern are the pathogenic micro- and macro-organisms.

Pathogenic viruses, bacteria, protozoa and helminths may be present in raw municipal wastewater at the levels indicated in Table 4 and will survive in the environment for long periods, as summarized in Table 5. Pathogenic bacteria will be present in wastewater at much lower levels than the coliform group of bacteria, which are much easier to identify and enumerate (as total coliforms/100ml). *Escherichia coli* are the most widely adopted indicator of faecal pollution and they can also be isolated and identified fairly simply, with their numbers usually being given in the form of faecal coliforms (FC)/100 ml of wastewater.

* * * * *