Low Cost On-site Wastewater Treatment & Reuse System
Description of Household Pilot Plant Model

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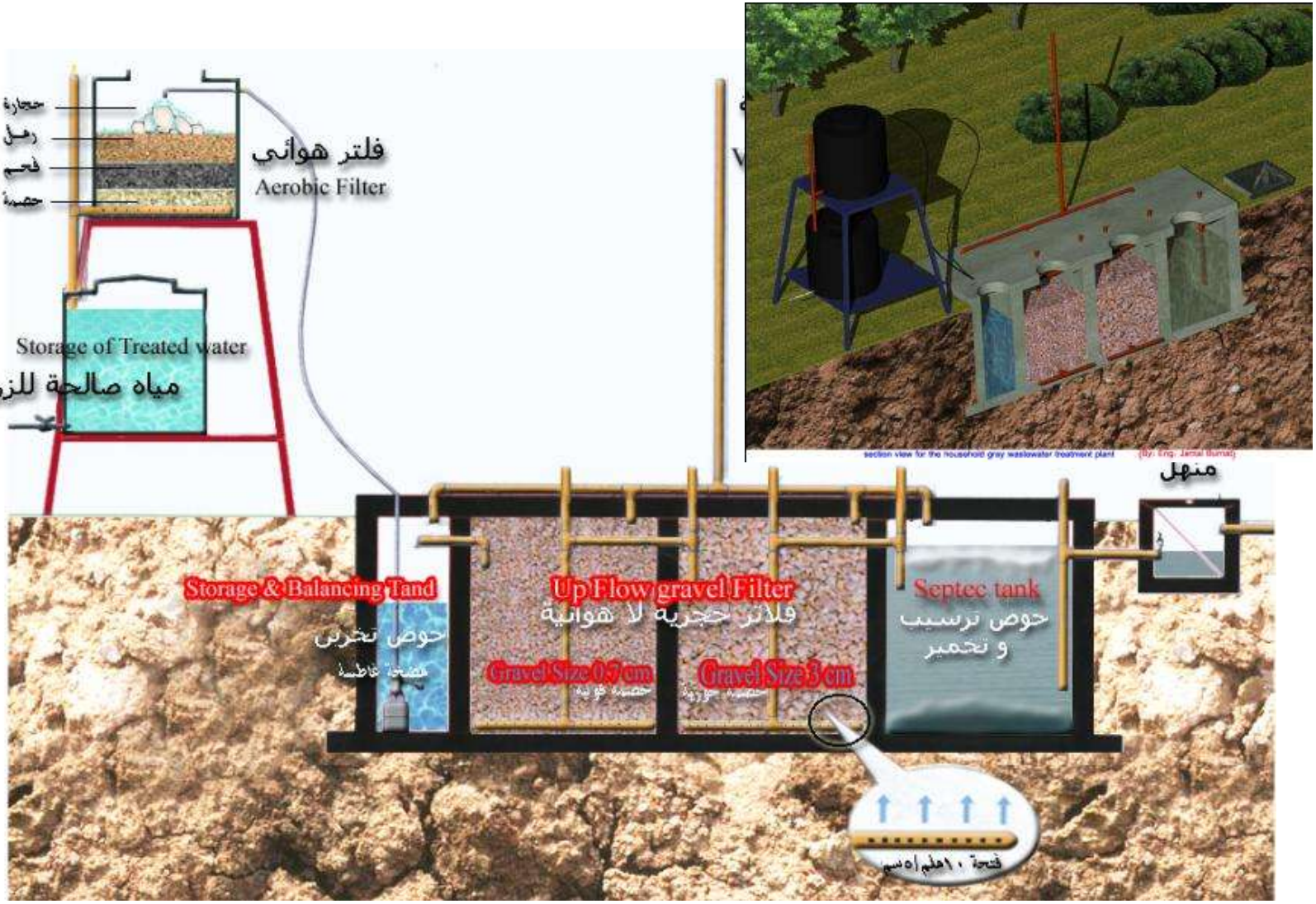
The house plumbing fixtures installations were changed so as to separate the gray and black wastewater streams. The black wastewater (from toilet) is discharged into the existing cesspit or to a safe disposal modified cesspit. While gray wastewater is directed to the treatment plant. The main treatment part is anaerobic process followed by aerobic multi-layer filter (sand, coal, gravel). The layout of the pilot plant is shown in Fig below. The upflow gravel filter is designed as gravity loaded system, works at maximum flow at day hours and zero flow at night hours. The gravel filter media are mainly hard crushed stones or washed wadi gravel of hard limestone of 0.7 to 3 cm in size. The pilot plants have been constructed with concrete or/and bricks. The septic tank –upflow gravel filter is divided into four compartments, where the first compartment is used as septic tank and grease trap, the second and the third are used as upflow graduated gravel filters, and the fourth compartment is used as a balancing tank for treated wastewater where a submersible pump is installed. The pump lifts the water to a multi-layer aerobic filter, the water pass through the layers (sand, coal, gravel) to a storage tank from where it goes to the home garden irrigation network.

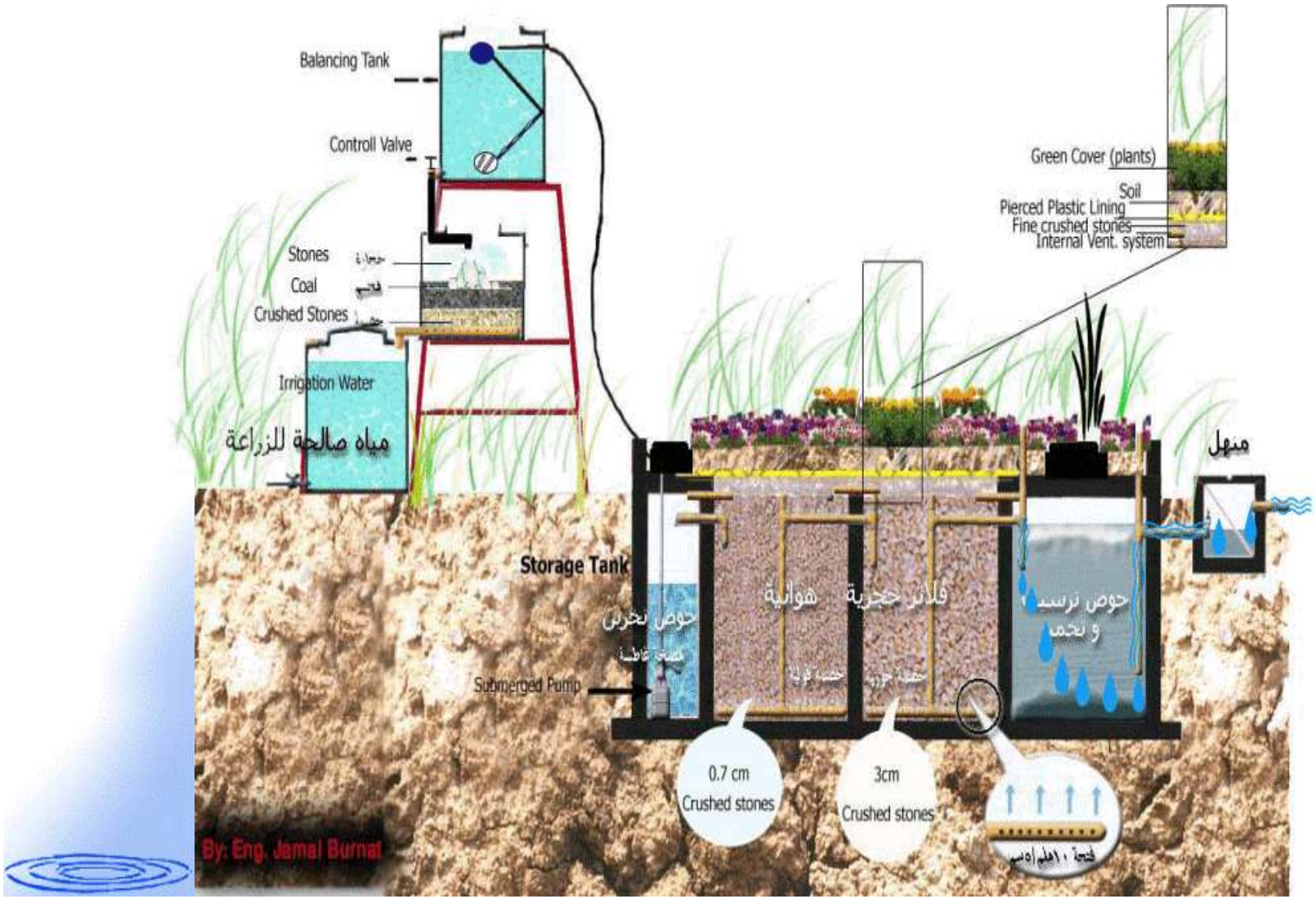
The septic tank receives the gray wastewater (shower, kitchen, sinks and washing machine) from the house through a 2-inch or 4-inches diameter PVC pipe. The wastewater flows into the septic tank by means of a T shaped inlet, with one end directed upward, and subjected to atmospheric pressure and the other at a level of about 30 cm from the bottom of the septic tank. The retention time of the wastewater in the septic tank is 1.5 to 2 days. Accumulation of grease occurred by installing a T-shape pipe at the outlet of the septic tank at same level of the inlet T.


حجارة
رمل
فحم
حصى
فلتر هوائي
Aerobic Filter
Storage of Treated water
مياه صالحة للزراعة
منهل
Storage & Balancing Tand
حوض تخزين
Up Flow gravel Filter
فلاتر حجرية لا هوائية
Gravel Size 0.5 cm
Gravel Size 3 cm
Septec tank
حوض ترسيب
و تخمير
فتحة ١٠ملم/٥سم

Description of Household Developed Pilot Plant Model

The house plumbing fixtures installations must be changed, to separate the gray wastewater and the black wastewater. The black wastewater (from toilet) is discharged into the existing cesspit or to a safe disposal modified cesspit, while gray wastewater is directed to the treatment plant. The upflow gravel filter is designed as gravity loaded system, maximum flow at day hours and Zero flow at night hours. The main treatment part is anaerobic process followed by aerobic multi-layer filter (coal, gravel). The layout of the pilot plant is shown in **Figure below.**

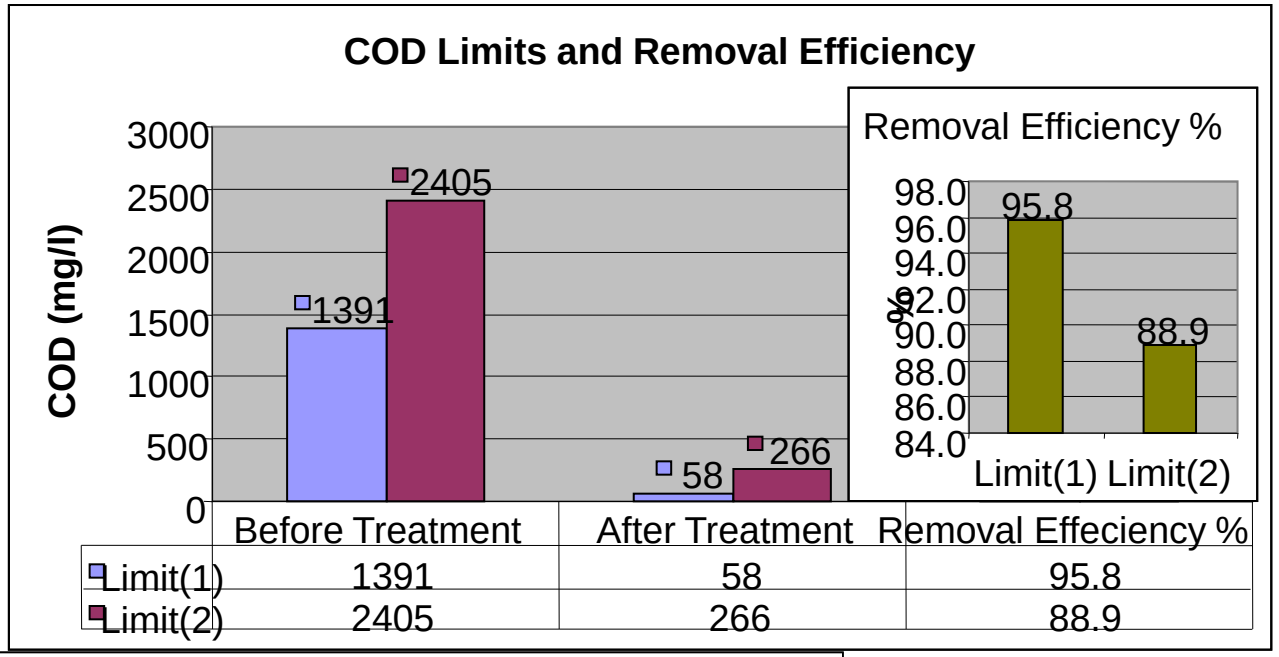
Based on an intensive literature survey and on field investigations, most of the on-site treatment systems were analyzed and evaluated with regard to design, performance, operation and maintenance, environmental impact (air pollution, noise production, soil pollution, and ground water pollution),energy consumption, and construction and operation cost.

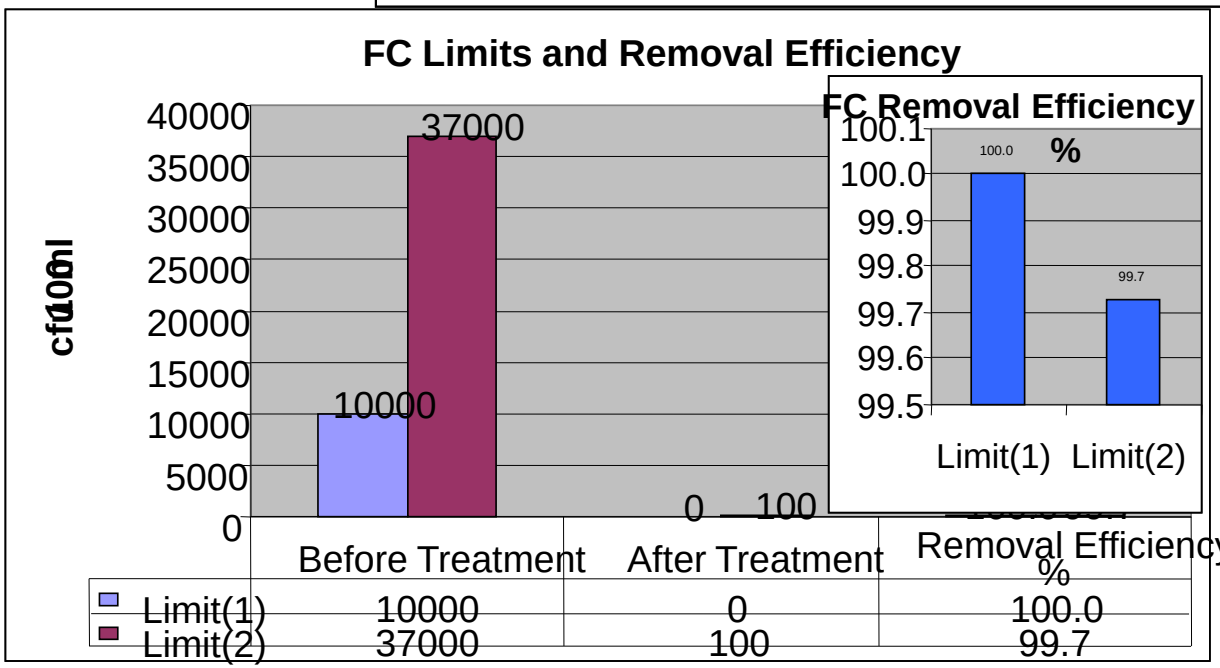

Balancing Tank
Controll Valve
Stones
Coal
Crushed Stones
Irrigation Water
مياه صالحة للزراعة
Green Cover (plants)
Soil
Pierced Plastic Lining
Fine crushed stones
Internal Vent. system
منهل
Storage Tank
حوض تخريش
هوائية
فلاتر حجرية
حوض ترسيب و تجميع
Submerged Pump
0.7 cm
Crushed stones
3cm
Crushed stones
By: Eng. Jamal Burnat

Before







COD Limits and Removal Efficiency
COD (mg/l)
3000
2500
2000
1500
1000
500
0
1391
2405
58
266
Removal Efficiency %
98.0
96.0
94.0
92.0
90.0
88.0
86.0
84.0
%
95.8
88.9
Limit(1) Limit(2)
Before Treatment
After Treatment
Removal Effeciency %
Limit(1) 1391 58 95.8
Limit(2) 2405 266 88.9


FC Limits and Removal Efficiency
40000
35000
30000
25000
20000
15000
10000
5000
0
37000
10000
0
100
FC Removal Efficiency
100.1
100.0
99.9
99.8
99.7
99.6
99.5
100.0
99.7
%
Limit(1) Limit(2)
Before Treatment
After Treatment
Removal Efficiency %
Limit(1) 10000 0 100.0
Limit(2) 37000 100 99.7

Findings

After