

Alternative hybrid UF-SAT or SAT-NF treatments to upgrade effluent quality

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INTRODUCTION

Israel is a semi-arid country with a long history of water reclamation. It started in the 70s with the Dan Region Project that over the years expended and other reuse projects were added the last 30 years reaching the 75% reuse of all municipal effluents for irrigation.

The Dan Region Reclamation Project (Shafdan) is the largest wastewater treatment and reclamation project in Israel. Today it treats and reclaims more than 140 Mm³/yr of wastewater from the Tel-Aviv Metropolitan area and several other neighboring municipalities. The Shafdan (WWTP) that is operated by Mekorot, treats the sewage biologically (single – stage simultaneous nitrification – denitrification) and delivers the effluents for further tertiary treatment using the classical Soil-Aquifer Treatment (SAT) technology (infiltration of the secondary effluents in open fields while each field receives effluent during 24 hrs. and rests for 48 hrs.). High quality reclaimed water produced by this technology is used for unrestricted irrigation in agriculture in the South of Israel (Negev), and enables its economic development.

The existing infiltration areas are not any more able to cope with the problem of lack of land for new SAT sites due to rapid urbanization, more effluents available for reuse due to demographic increase, and the fact that during the years the infiltration velocity has slow down. There is a need for improvement of the reuse technologies, in order to increase their efficiency and shorten the time of treatment without jeopardizing the treated and reclaimed water quality.

SUGGESTED SOLUTIONS: HYBRID UF-SAT OR SAT-NF TREATMENTS

In order to improve the current extensive method (classical SAT) and be able to infiltrate more effluents in a given infiltration area two EU Research projects were started in 2005-2006. The RECLAIM project: UF+ short SAT and the SWITCH project: short SAT+NF.

THE UF- short SAT PILOT PLANT (RECLAIM)

RECLAIM project, which has been already completed was dealing with ultra-filtration (UF) of the secondary effluents and dug well injection at short term (up to two months). The results from this operation were compared with the actual long - term (up to 12 months SAT) system. The RECLAIM project results showed that, when UF as pretreatment to SAT is used, the infiltration velocity is considerably increased (10 m/d instead of 1 m/d), since most polysaccharides and other clogging material were retained on the UF. Although the subsequent 1-2 month retention time - short SAT was able to remove all N, and most of C (only 2-3 mg/l DOC left) and all bacteria and viruses also were removed, still, in comparison to the long SAT (DOC 0.5-1 mg/l) some micropollutants were present.

Therefore it is important to check and compare an alternative method that is based on the principle of removal of the clogging material by an extensive short SAT (the infiltration velocity will be improved then by prefiltration on a sand filter) and polishing on a nano-filter (NF) which will remove the micropollutants efficiently. This was suggested in the context of SWITCH R&D and part of the Demo activities.

THE short SAT-NF PILOT PLANT (SWITCH)

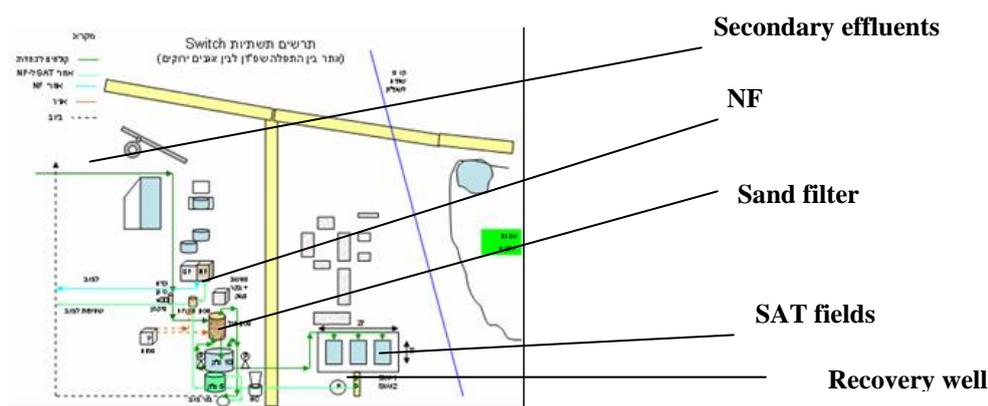
The preliminary planning for the pilot plant in Shafdan started in the second half of 2006.

The biggest problem was in assigning a suitable site from the hydrologic aspect. This demanded long hydrologic studies till mid 2007 when a suitable site was chosen (see Fig.1). After that stage the construction of the SAT –NF pilot has started and first 3 SAT fields, each 5X8 m. and an observation well (5 m. from the SAT fields) and a recovery well (15 m. from the SAT fields) have been constructed.

Fig. 1 – Location of the pilot



Fig. 2 – SAT-NF pilot plant



The sand filter as prefiltration to SAT and the polishing NF was then leased from a local company. In early 2008 the first tracer tests were run to determine the retention time of the infiltrated effluents in the aquifer, before being sampled at the observation and reclamation wells. The tests were run with water recovered from conventional SAT (third Line water) diluted with a Bromide (Br) as tracer. Two tracer tests were run while the first was static (no recovered water), in that case 120 m³/d of third line water was infiltrated intermittently to each field while letting the others to rest for 2 days. The tracer reached the further well after 46 days. But in the second test, after a constant flow of 15 m³/d has been reclaimed each day from the reclamation well (April-June 2008) a retention time of 20 days to the observation well (5m away from the SAT) and 35 days retention to the reclamation well (15 m. away from the SAT) were obtained. After the completion of these tests and due to late installation of the sand filter and NF, the first infiltration tests with sand filtered secondary effluents started in September 2008 and the first samples after SAT that will be sent to analyses are being prepared these days (end October 2008) to see if the polysaccharides and other clogging material had been retained by the sand filter and the short SAT. Then the second and final stage of the nanofiltration will be operated. The sand filter is removing turbidity and TSS from the secondary effluents to a level of 1 NTU (from 1.5-3 NTU) and 1 mg/l TSS (from 2-4 mg/l). As a result no clogging of the fields is seen even at 3-4 m/d infiltration velocity.