

SANBOX system in Mediterranean area-overview

In south-east part of Europe sanitary systems at tourist sites without sewage infrastructure seldom meet contemporary environmental requirements. In addition many rural tourist enterprises are facing extremely challenging conditions regarding technical and legal requirements, extreme climatic conditions, limited energy and water supplies and large variation in activity depending on season. **SANBOX** is a novel, environment-friendly, compact and integrated source separating sanitary wastewater treatment system for remote tourist facilities in Europe based on mechanical and biological processes. The **SANBOX** provide users with comfort comparable to traditional water toilet systems. The vision for **SANBOX** is to come close to a self sustaining zero effluent treatment system by following the main principles of ecological sanitation: source separation, water and energy saving, and nutrient recycling.

In 2010 **SANBOX** system was constructed in Mediterranean area in the frame of 7OP; “Capacities; Reserach for the benefit of SMEs”. The location for the SANBOX technology prototype was selected on Adriatic coast at Sečovlje Saline Natural Park in Slovenia in Mediterranean climate conditions. The selected area is defined as an area of natural value with habitats of the rare, endangered and characteristic vegetal and animal species, where, due to the long-lasting human action, a typical saltpans ecosystem came into existence.



Natural park Soline, Sečovlje, Slovenia.



SANBOX prototype at Natural park Soline, Sečovlje, Slovenia in 2011.

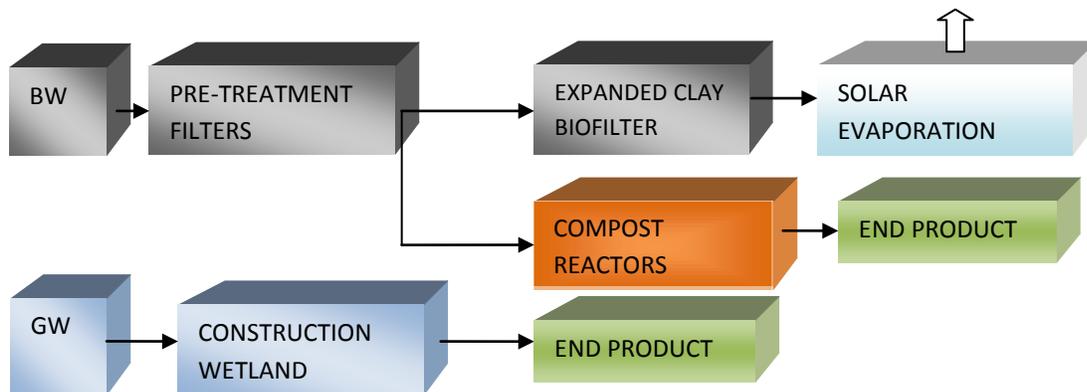
The main goal of **SANBOX system in Mediterranean area (Soline)** was to reach zero water emissions of valuable end products. The wastewater from the toilets (blackwater) is separated to liquid and soild fraction. The liquid fraction of blackwater is treated in bio filters to remove solids and nutrients. A solar evaporator uses solar radiation to disinfect and evaporate the liquid part of the blackwater. The evaporation module as such should ensure safe release of final emissions into the environment. The solid part of blackwater is composted to obtain a safe

end-product for agricultural purposes. Grey water from sinks is treated in a hybrid constructed wetland system to a quality that it can be used for toilet flushing.

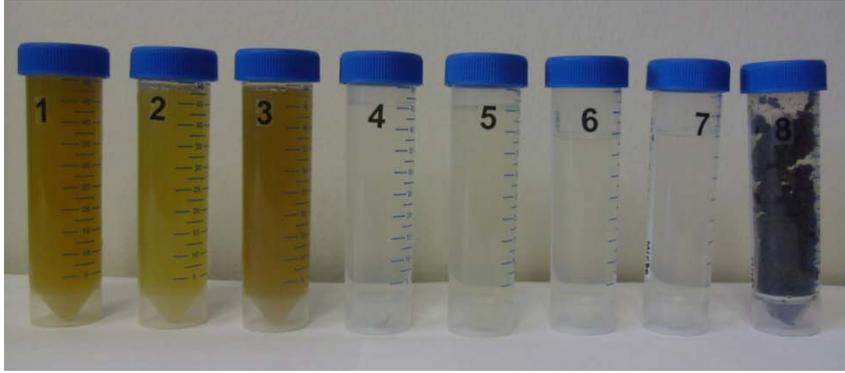
The **SANBOX** system aims to reach satisfied treatment performance, recycle water and nutrients and use solar power as its energy source. The benefit of source separation is that nutrients are not sent to sea or fresh water but are recycled and reused.

Benefits: (1) reduction of water pollution/eutrophication, (2) reduction of water consumption, (3) water reuse, (4) nutrients reuse on the fields.

The specific steps of the **SANBOX** are: (1) **pre-treatment filters for separation/dewatering**, (2) **expanded clay based biofilter for treatment of blackwater liquid phase**, (3) **solar evaporation module for evaporation of blackwater liquid phase**, (4) **self heating with organic material compost reactors**, and (5) **hybrid constructed wetland**. Blackwater is pre-treated by filtration with organic filters, solids are recycled into sanitized and nutrient-rich compost, and the liquid fraction is treated by recirculation through an expanded clay-based biofilter and evaporated. Roots of plants in association with microbial biofilm stabilize and enhance the treatment process in the constructed wetland.



A scheme of the Sanbox sanitary unite. BW-blackwater, GW-greywater.



Wastewater at different treatment segments in SANBOX sanitary unit at Soline. 1-raw blackwater, 2-blackwater from pre-treatment filters, 3-blackwater from expanded-clay biofilter, 4-greywater at inflow into the constructed wetland, 5-greywater at outflow from horizontal constructed wetland, 6-greywater at outflow from vertical constructed wetland, 7-blackwater from Solar evaporator, 8-compost.

Greywater treatment results from the SANBOX Mediterranean prototype at Natural park Soline, Sečovlje, Slovenia have proven that it is possible to reach substantial removal rates under the extreme challenging conditions that are related to a Mediterranean climate. Blackwater liquid phase reached zero water emission, while compost could be used as fertilizer on agricultural area.