

# PERMEABLE REACTIVE BEDS FOR GROUNDWATER RECHARGE WITH RECLAIMED WASTEWATER

## DESCRIPTION

At IMDEA Water Institute, in association with the Alcalá University and the Rey Juan Carlos University, we implement Permeable Reactive Beds technology as a wastewater reclamation treatment for application in artificial groundwater recharge activities.

This technology is considered an in situ passive treatment, based on reactive materials which act as a filter for the water that goes through it. The filter retains or sorbs the chemicals, improving the water quality. This technology is the result of combining two well-known remediation techniques: SAT – Soil Aquifer Treatment and PRB – Permeable Reactive Barrier) (Fig.1).

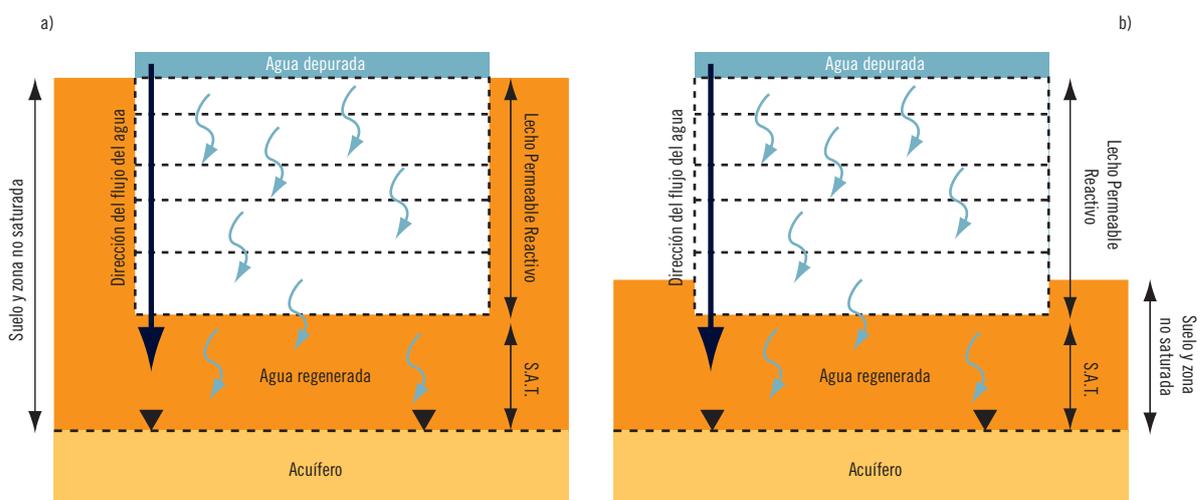


Figure 1. Permeable Reactive Beds scheme. a) Dug; b) Superficial setting.

# scientific & technical offer

The main contribution of Permeable Reactive Beds technology is that it includes several layers of different reactive materials (natural or artificial), forming a horizontal barrier, so that the pollutants are removed from the water and are retained or modified by the solid phase through physical, chemical and/or biological processes (including precipitation, sorption, redox and degradation). Many parameters have influence over these processes, such as pH, redox potential, concentration or temperature. Permeable Reactive Beds can be settled either on the ground (superficial setting) (Fig. 1b) or in a trench (dug) (Fig. 1a). This horizontal position ensures reclamation of the water that flows through the bed.

## IMDEA-WATER SOLUTIONS

Permeable Reactive Beds technology is especially interesting for in situ water reclamation, as much of its cost-effectiveness stems from its low maintenance requirements. Thus, it is one of the most viable alternatives for wastewater treatment plant effluent reclamation before its use in artificial aquifer recharge activities.

This technology shows many advantages: a) low-energy system (the water leaks free), b) low-cost maintenance, both in equipment and staff, c) low-cost materials.

Some of the requirements for its application are: a) more time, as the water to be treated flows at its natural leaching speed; b) more land than with conventional technologies; c) water pre-treatment to decrease the total suspended solids load; d) regular replacement of reactive materials due to clogging processes.

Compared to the permeable reactive barriers and beds installed to date, this new approach counts on an innovative and essential component: it combines different layers of reactive materials, thus increasing the remediation potential. Traditionally, these beds were composed of only one material which reacts only with one or two pollutants. However, nowadays we need to remove a large number of different and variable compounds present in wastewater, including emerging pollutants such as PPCPs (Pharmaceuticals and Personal Care Products). So, in order to achieve better efficiency, the best solution is the use of multi-layered reactive beds, which are able to retain both organic and inorganic chemicals. We work with activated carbon, zeolite and palygorskite. This way, the percolated and reclaimed water will reach the aquifer in optimum conditions for subsequent use.

Thanks to this technology, reclaimed water (until now considered waste) can be taken into account as a new and valuable resource, contributing to groundwater conservation.

## IMPLEMENTATION SECTOR

Besides the fact that this technology is useful for reclaiming wastewater, it can also be efficient in the treatment of different industrial spills.

- Agricultural associations and irrigators associations
- Farms (wastewater and spills previously treated)
- Councils, community of municipalities, provincial councils, rural development associations
- Wastewater treatment plants (water reclamation for further reuse)

## ADDITIONAL INFORMATION

<http://www.consolider-tragua.com/1280.htm>

<http://www2.uah.es/filtrosverdes/>

[https://portal.navfac.navy.mil/portal/page/portal/NAVFAC/NAVFAC\\_WW\\_PP/NAVFAC\\_NFESC\\_PP/ENVIRONMENTAL/ERB/PRB](https://portal.navfac.navy.mil/portal/page/portal/NAVFAC/NAVFAC_WW_PP/NAVFAC_NFESC_PP/ENVIRONMENTAL/ERB/PRB)

<http://www.epa.gov/ada/gw/prb.html>

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## TECHNOLOGY KEYWORDS

Horizontal Permeable Reactive Barriers, Permeable reactive beds, Reclaimed wastewater, Groundwater recharge, Activated carbon, Zeolite, Palygorskite

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