

Unique amendment for PFAS treatment incorporated in Tektoseal® Active

Tektoseal Active – Geocomposite contaminant barrier



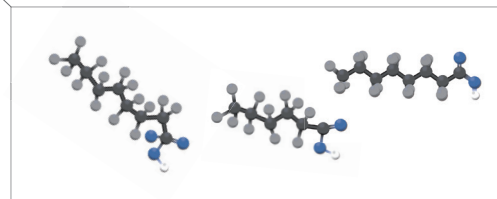
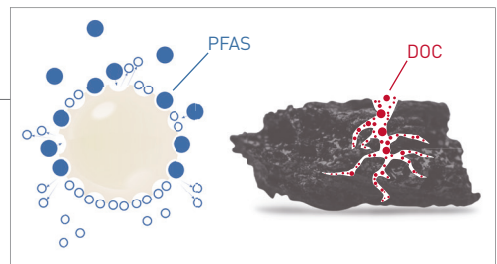
Tektoseal Active PFAS has been demonstrated to be successful for the removal of dissolved PFAS from liquids, such as groundwater, porewater, soil, and landfill leachates. Tektoseal Active products are permeable geocomposites, contaminant barriers, also known as active geocomposites. They are used to contain pollutants with containment cells, avoiding the migration to subsurface water bodies. The specific product variant for PFAS can be used, for example, at landfills for the safe disposal of PFAS-contaminated waste (ask for HUESKER's technical note on PFAS diffusion through landfill lining systems). Active geocomposites consist of an approximately 1 cm thick layer of amendment media sandwiched between geotextiles. In this way, the fine granules can be installed in the soil in a practical, and controlled manner and with a constant thickness over a large area. For the removal of PFAS from leachate, HUESKER relies on a unique strong anion exchanger combined with carbon with an ideal porosity capturing PFAS.

Challenge in PFAS treatment

PFAS is a group consisting of several thousand different individual compounds. They all consist of a fluorinated carbon chain with a functional head. The variation in carbon chain length and function head results in this large variety of different molecules. The challenge in water treatment is to reduce to safe levels as many different PFAS compounds as possible with the selected technology. At the same time, it must be considered that other co-contaminants may be present. HUESKER's many years of experience with active geocomposites were used for the development of our PFAS-selective active geocomposite. Various types of geotextiles and amendment medias were investigated individually and later in combination with one another to assess their effectiveness. In this way, the final product was optimized iteratively. This report outlines the advantages of the unique amendment material in Tektoseal Active PFAS.

Premium amendment – The anion exchanger

In laboratory and field studies, a specific strong anion exchange media has shown to be highly effective for the removal of a wide range of individual PFAS compounds even with a comparatively short contact time with the contaminated water or leachate. Kinetics are very important in active geocomposites to ensure an effective pollutant uptake. In addition to the media's high effectiveness, the removal capacity for many individual PFAS compounds is also high when using the selective anion exchanger. Depending on the composition of the leachate, the capacity of the anion exchanger used by HUESKER is much larger than activated carbon or organophilic clays. Another advantage is the strong bond between the PFAS and the amendment material. The PFAS is not only sorbed by means of van-der-Waals forces, but even more substantially through the exchange of ions, which significantly strengthens the bond between the PFAS and media. These mechanisms make it extremely difficult for desorption to occur, even with the aid of solvents. This attribute is critical and highly relevant for long-term applications in the field. Please contact HUESKER to obtain the test results from independent laboratories on the properties described.



Dissolved Organics (DOC)
Per- and Polyfluorinated Substances (PFAS)

PFAS removal by ion exchange and adsorption

Durability for leachate treatment by sacrificial carbon amendment

With all the advantages of a strong anion exchange material, the question arises why the active layer of Tektoseal Active PFAS also includes the addition of carbon. To explain, let's examine the use of these materials in filtering contaminated soil and landfill leachates. The effectiveness of an anion exchanger for a particular target molecule can be greatly reduced if certain types of impurities are present in the leachate. Typical contaminants that affect the performance include (natural) dissolved organic compounds (DOC), heavy organics such as oils and greases, and fine particles and suspended solids. Despite its strong affinity for PFAS, the DOC also competes with the PFAS molecules for the free adsorptive exchange sites. Furthermore, DOC with high molecular weight can accumulate on the surface and cause a decrease in access to the surfaces and pores of the anion exchanger. For these reasons, adding carbon as a sacrificial amendment offers a significant advantage to the overall performance of the active geocomposite. The DOC adsorbs to the carbon and thus doesn't impair the anion exchange. Consequently,



the service life of the premium amendment – the anion exchanger – is extended. In terms of sorption ability, the carbon is of course also able to bind specific PFAS. However, the performance is essentially limited to long-chain molecules. With regard to desorption behavior, it has to be noted further, that for long-term applications, such as leachate filters installed in the soil, the sole use of carbon is not recommended. Previously sorbed short-chain PFAS molecules can potentially desorb from carbon with a time lag when competing with DOC or long-chain PFAS molecules.

Unique amendment in Tektoseal Active PFAS

Durability for leachate treatment by the geotextiles

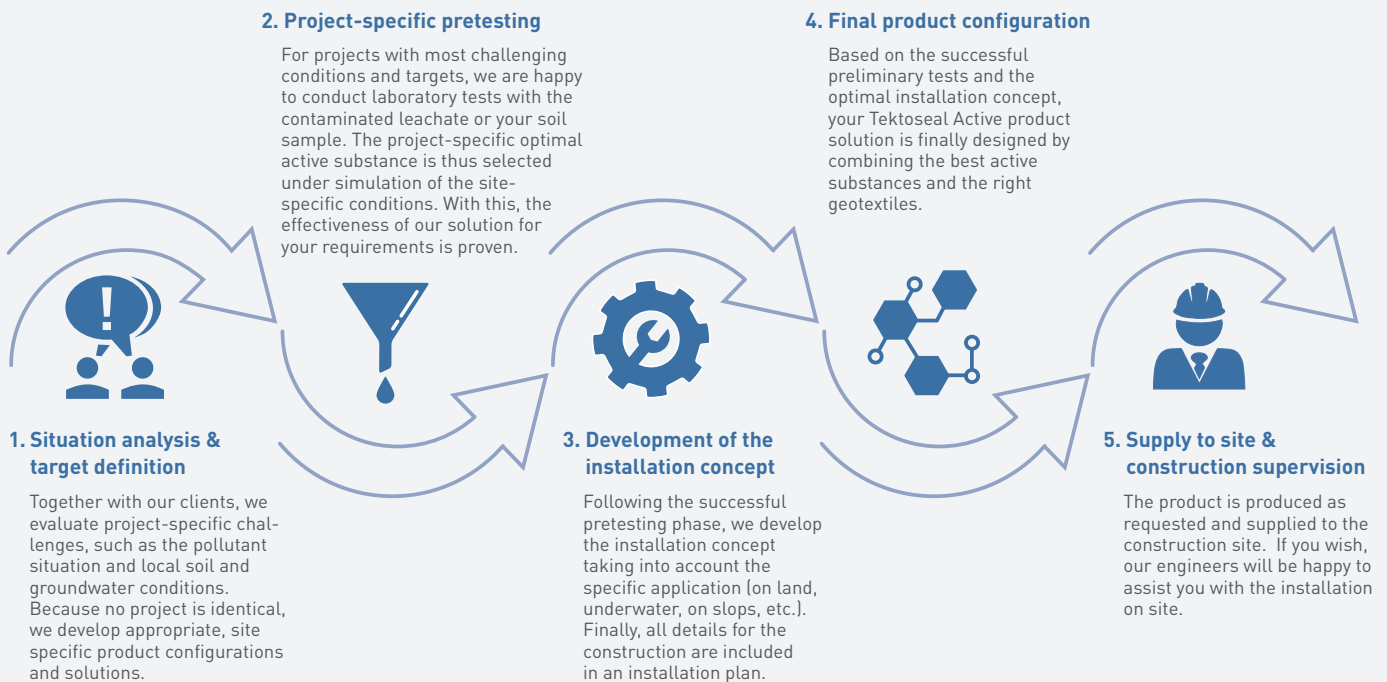
In addition to the benefits of the different amendments, the leachate's interaction with the geotextiles is also important for the longevity of the product. As previously mentioned, suspended solids, fine particles or larger contaminants in the water are problematic for the amendments. In almost any soil leachate, these fine particles are present. Therefore, it is imperative to prevent fine particles from clogging the granules and impairing access to the media's functional surface or pores, to successfully conduct filtration. Appropriate nonwoven geotextiles with a defined opening width are therefore required for the long-term use of anion exchanger and carbon in leachate filter mats. If it is known that oil and grease are also present in the leachate, special lipophilic geotextiles can be used as cover layers. These materials filter the heavy organic compounds from the leachate before it encounters the active layer, thus permanently protecting the amendments.



High performance geotextile contaminant barrier Tektoseal Active PFAS

The HUESKER approach

Various amendments are on the market that promise high effectiveness and capacity or even give blanket quantitative information about their performance. This, from our understanding, is impossible without in-depth knowledge of the specific environment and the leachate to be filtered. HUESKER can provide support through preliminary tests to determine the performance of our Tektoseal Active products for the project-specific challenges and derive the estimated service life of the active geocomposites. It is important that our products perform as anticipated and maintain their high effectiveness throughout the project's duration. This is achieved with the help of a detailed, project-specific problem analysis, and collaborative efforts amongst the project team members.



Product Management – Tektoseal®

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