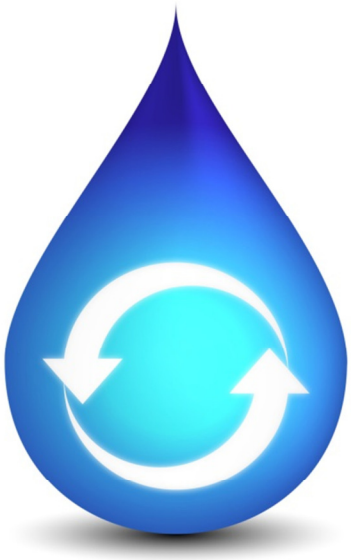
The PolycarbonPlus-System

INNOVATION IN Watertreatment



Water is our Passion!

Environmental Solutions

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Introduction

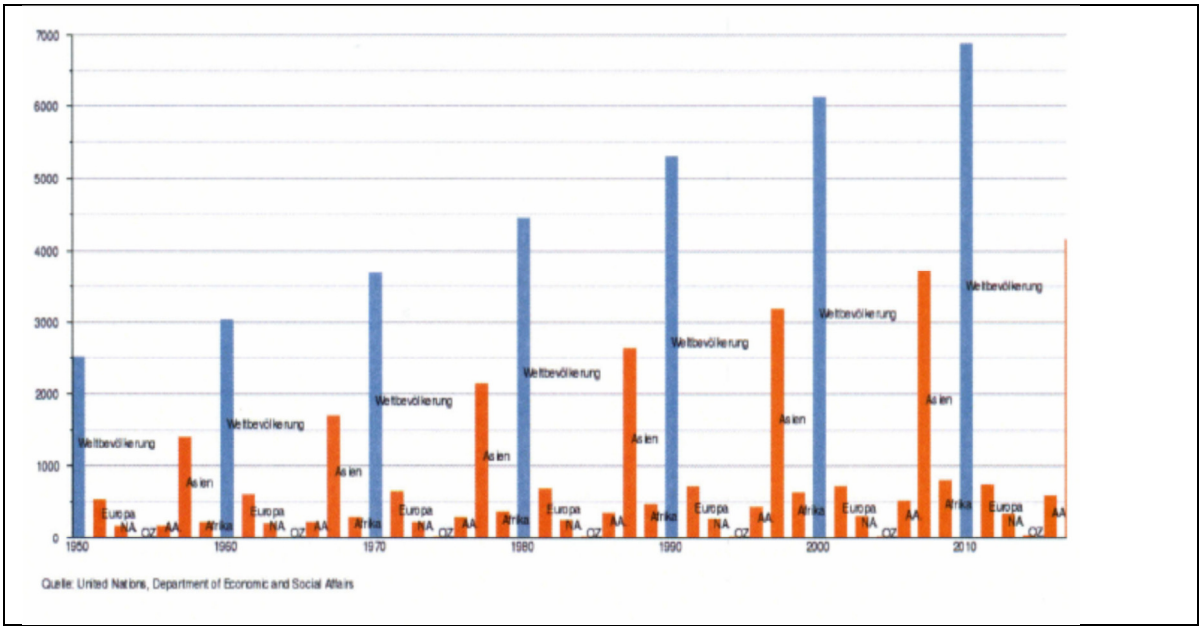
Water, as the most important element on our planet has to be regarded as very precious natural resource. Although the Earth is called the “Blue Planet“ due to the existing amount of water, the share of usable fresh water is very limited. Water is the most important element on earth, because every living thing needs water. The majority of the water resources on earth are not available for plants and animals, though.

The total water resources (gaseous, liquid, solid) existing on our Earth are 1.39 billion cubic kilometers. Of these 14.6 million km^3 (1.05%) are ground water and only 145,950 km^3 (0.01%) are found in rivers and lakes as fresh water.

Due to the water cycle 13,000 km3/a renewable fresh water reserves are available worldwide while the global water consumption is 4,200km^3/a. Agricultural and industrial productions consume approximately 92% and households 8% of this water.

Presuming a constant water cycle the problems in providing the world population with sufficient amounts of water will increase. A value below a volume of 1,000m^3 per year and person for food production and as drinking water is referred to as constant water scarcity.

According to the federal environment ministry 1,200,000,000 people were without sufficient access to drinking water in 2001. Partially these 1.2 billion people live in areas where fresh water exists but is not suitable as drinking water. Due to the increasing industrialization globally the associated pollution of the drinking water resources as surface or ground water and the growing world population, the sufficient supply with drinking water becomes more and more difficult. This affects not only developing countries but also industrial countries.



Topic

The increasing pollution of our water resources and the scarcity of usable fresh water present a major problem that needs to be addressed. The patented system PolycarbonPlus, product name MesoFix, has been specially developed for various applications for the purification and treatment of water and sewage of various origins.

MesoFix is a molecular adsorbing absorber, constructed as a multi-component system consisting of special carbon compounds and other conditioned components that are homogeneously mixed into their intended form. The material is available as pellets and / or as granules in pads, booms, moldings of any design or as bulk material, depending on the area of application or requirement. MesoFix adsorbs the entire group of hydrocarbons, e.g. BTX, PAK's, LHKW's and other substances, as well as crude oil and all its derivatives in liquid and also gaseous consistency. The special feature of the system is that it not only adsorbs the pollutants mentioned, but also absorbs them. This special effect prevents the absorbed pollutants from being released again.

The PolycarbonPlus system is a molecular adsorbent
Absorber and therefore has a unique feature!

Application possibilities

The MesoFix product can not only absorb and incorporate highly toxic media, such as polychlorinated biphenyls (PCBs) or dioxins from leachate waters, but also contributes significantly to lowering the COD / BOD5 values of polluted sewage water. This effect of adsorption with subsequent absorption is so far unique on the world market.

Examples where it can be used:

- Crude oil, all its derivatives (petrochemical substances) in liquid as well Gaseous consistency
- on water surfaces (even with a strongly moving surface)
- on the ground (sediment) • in the flow process (for dissolved substances)
- in the ground (in situ soil remediation) • in water-bearing areas (aquifer)
- Sewage treatment to reduce the COD value
- all organic compounds (mainly those with a complex molecular structure)

At present, test results are available with 46 different substances from A such as acetone over P such as P cresol to T such as tetrahydrofuran. For all substances the binding capacity in MesoFix has been measured. Very successful experiments were carried out in cooperation with the IUV (Institute for Environmental Process Engineering) of the University of Bremen. For the elimination of BTX (benzene,

toluene, xylene) from reservoir water. This storage water falls during the production of gas and during fracking.

	Concentration before adsorption /mg l^{-1}	**Concentration after adsorption /mg l^{-1}**	**adsorption in %**
Benzene	790,96	158,49	79,96
Toluene	301,88	49,55	83,59
Xylene (sum)	222,38	32,98	85,17

Further series of experiments are very successful in the field of gas extraction, as well as tests with conditioned pellets, which are produced for their special application, depending on the place of use, the target and the pollution. For this purpose, certain substances are introduced into the pellets in order, for example, to remove heavy metals or arsenic and the like with MesoFix.

Functioning

MesoFix is a molecular adsorbing absorber for various carbon compounds and a variety of organic molecular structures. In the water purification and the water treatment, adsorption processes play a special role in pollutant removal. Adsorption processes are often a very efficient solution for low to medium pollutant loads. Preliminary tests with MesoFix in the IUV, University of Bremen, show a great potential and range of application for the innovative adsorbent, since conventional methods only allow an extremely limited absorptive uptake of lipophilic substances. This is the great strength of MesoFix, which has both excellent adsorbing and absorbing properties. Five common areas of application have been identified.

These are as follows:

1. Rehabilitation of oil damage on the water surface and in groundwater

2. Rehabilitation of oil habitats on water bodies

3. Purification of dissolved KW water (BTEX contamination)

4. Cleaning of rainwater from traffic areas and roads

5. Treatment of contaminated rainwater for domestic hot water production

Market and Applications

From the preliminary investigations carried out on the adsorption of dissolved organic substances and on oil elimination, it can be concluded that the novel adsorbent MesoFix provides practical applications with a high market potential in the field of environmental technology and, in particular, in water treatment.

- Elimination of BTEX substances (eg reservoir water treatment, groundwater remediation), elimination of organic water constituents, in particular with nonpolar properties. • Elimination of polycyclic aromatic hydrocarbons (PAHs) from the aqueous phase (including depollite percolation water treatment)

- Use of MesoFix for residual oil removal

- Use of MesoFix for oil separation from fine and coarsely dispersed emulsions with average oil contents with and without surfactant additives

- Use for oil separation from emulsions with high oil contents.

In surface waters and influenced groundwaters, increasingly resistant, i. Biochemically stable and chemically difficult or non-oxidizable substances. A part of them is of health concern, e.g. The complex group of chloro-organic compounds with the haloforms, polychlorobiphenyls. While the genuinely dissolved low molecular weight organic compounds are only slightly reduced by the traditional steps of water treatment, membrane technology and adsorption are very effective methods. Adsorption processes are always equilibrium processes, the position of the equilibrium being decisively dependent on the character of the adsorbent and the adsorbate, on the concentration gradient, and on the contact time.

Increasingly, chemical waste water (COD) is becoming more and more common in industrial sewage water since the frequent re-use of the water cycle in the production process leads to an increasing concentration of water-polluting and water-polluting substances. Concerning this concentration, an increase in COD is becoming more and more common. This reduces the amount of waste water, but the waste water treatment becomes more difficult and more complex. This increasingly leads to an increase in the waste water costs with a COD-dependent fee calculation.

MesoFix vs. Activated carbon

MesoFix is an adsorbent that has a similar spectrum of action as active carbon and can effectively replace it with a higher cleaning performance. The experiments of the new laboratory-scale product by the Institute of Environmental Process Engineering with the model substances used (low-molecular compounds, high-molecular organic substances, nonpolar low molecular compounds) gave adsorption capacities Which are not only comparable to activated carbon, but are significantly higher. While activated carbon only has micropores, MesoFix has a structure with macro- and mesopores and can therefore absorb larger molecular structures.

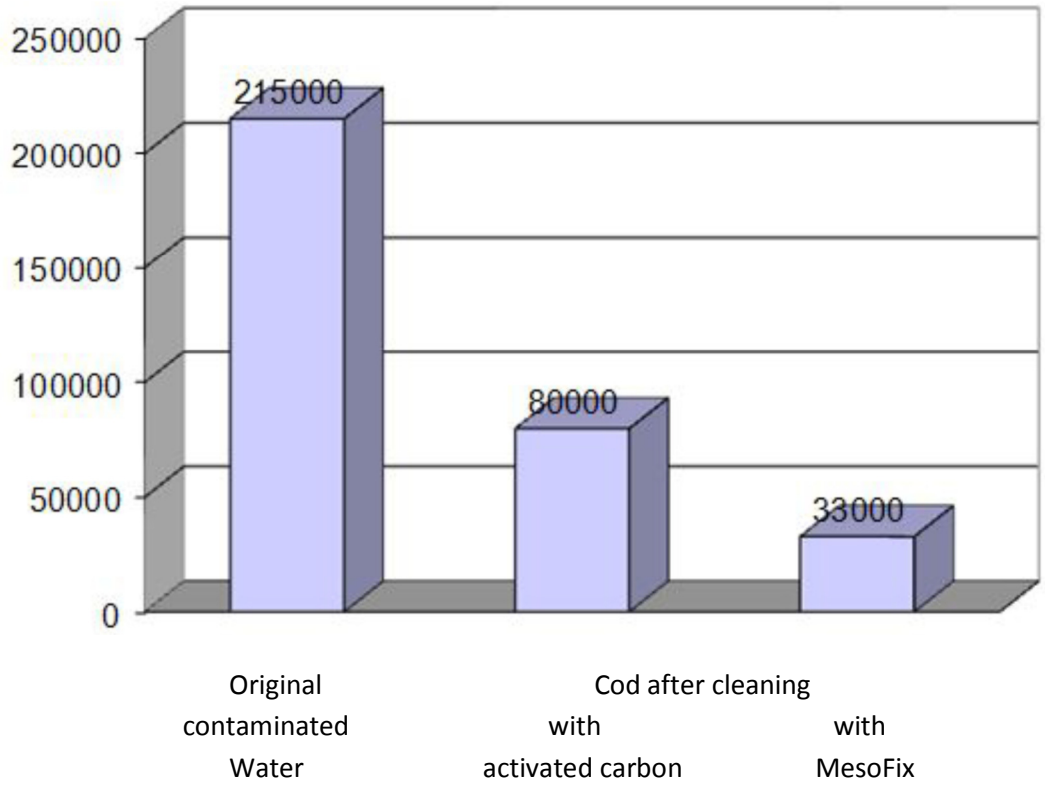
In addition, it is capable of absorbing further lipophilic substances and thus significantly increases the spectrum of eliminable substances. The lipophilic test substance of MesoFix was particularly well adsorbed in the tests by the Institute of Environmental Process Engineering. The laboratory tests for oil elimination also showed that the adsorbent PolycarbonPlus proved to be the most favorable filter material for both emulsions without and with surfactant addition to A-carbon.

Since the MesoFix is far more effective in the cleaning performance than the conventional activated carbon, less material is required for absorbing oil, as is necessary with activated carbon. This results in the advantage that the adsorbent MesoFix can be used more cost-effectively according to current estimates. Thus regeneration is not necessarily the basic prerequisite for an economic application. Rather, the loaded adsorbent can be thermally utilized as an energy supplier with an energy potential of 20-40MJ / kg with an ash residue of at most 0.3% of the starting mass without slag attack. This means that no fogging or pre-drying is required as with the water treatment by means of activated charcoal.

MesoFix and COD

A significant problem with wastewater is the meat industry in particular. Sewage treatment in slaughterhouses and meat-processing plants is characterized by the problems of high loads of fat, solids, COD and BOD5, as the loads often exceed the legally stipulated limit values for sewage water. Exceeding these values often results in very high fees for heavily polluted sewage.

Small and medium-sized meat processors are required to calculate the total parameters CSB / BSB5 as much as possible, while larger slaughterhouses must undertake extreme efforts to reach the minimum limits for them. If these values are reached, considerable costs can be saved for wastewater disposal. In achieving this goal, MesoFix can make a significant contribution. Water contaminated to determine the degree of purification with a COD of 215,000mgO2 / l. was treated for direct cleaning with activated carbon and MesoFix in a filter unit. The original sample, which had been purified by activated charcoal, still had a COD of 80,000 mgO2 / l. , Which corresponds to a COD residue of about 37%. The sample purified using MesoFix had only a residual COD of 33,000 mgO2 / l. , Which corresponds only to a COD value of approx. 15%.



Attachments

PolycarbonPlus

Measurement data of the binding capacity for pollutants and chemicals

Firma UmweltSchutz Ingenieurbüro Bonn, Dipl.-Ing. H. Fischmann, Bonn

Substance	Absorption g/g PolycarbonPlus	Substance	Absorption g/g PolycarbonPlus
Acetone	**3.42**	**Olive Oil**	**3.21**
Ammonia concentrated	**2.10**	**p-Cresol**	**2.20**
Formic acid	**3.01**	**1,2 Propanediol**	**2.26**
Gasoline N	**5.33**	**Paraffin**	**3.21**
Gasoline S	**6.40**	**Pyridine**	**4.09**
Butyl acetate	**3.55**	**Vegetable Oils**	**3.16**
Butanol	**2.57**	**Dibutyl Phthalate**	**3.15**
Diesel	**4.58**	**Rapeseed Oil**	**4.02**
1,4 Dioxane	**3.69**	**Castor Oil**	**4.44**
Acetic Acid	**2.68**	**Crude Oil Döbern**	**4.04**
Ethyl Acetate	**4.83**	**Crude Oil Tauer**	**3.45**
Ethanol	**3.04**	**Crude Oil Lütow**	**4.38**
Ethyl Glycol	**2.99**	**Crude Oil Russian Blend**	**4.02**
Ethylene Glycol	**2.95**	**Lubricating Oil**	**3.74**
Glycerine	**2.33**	**Soybean Oil**	**3.98**
Fuel Oil	**4.34**	**Sunflower Oil**	**2.20**
Linseed Oil	**3.20**	**Hydrochloric Acid concentr.**	**2.58**
Methanol	**3.37**	**Nitric Acid**	**2.67**
Machine Oil BP	**4.01**	**Sulfuric Acid**	**5.38**
Machine Oil new	**4.57**	**Tar Oil**	**4.20**
Machine Oil used	**4.08**	**Tall Oil/Transformer Oil**	**4.35**
n-Propanol	**3.18**	**Tetrahydrofuran**	**5.46**
Sodium Hydroxide 33%	**2.99**	**Solvent Mixture**	**6.10**

PolycarbonPlus is a granulate/pellet, which can be conditioned according to the pollutants.

Based on the large surface area created in this way the product features an excellent binding capacity for a variety of pollutants. The product locks these substances mentioned above up so that they do not evaporate anymore. The disposal is carried out in a combustion system due to its high energy content.

- **Is environmentally friendly**
- **Binds all oils, solvents, and the like**
- **Is removed easily from surfaces**
- **Binds oil-rubber mixture spheres, and the like**

Packaging units: **Bags with 20 kg on pallet (500kg) or big bags**
Applications: **Water and exhaust air purification**

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