AIX 7.0

REHABILITATION AGENT

acid-free
chloride-free
non-corrosive

pH NEUTRAL

AIXTRACTOR® 7.0

REMOVAL OF BIOMASS

- Crystalline concentrate ready-to-use
- No corrosive impact, applicable on all well construction and screen materials
- Continuous process control and result verification on site according to latest technical standards of DVGW, German Gas and Water Association e.V.
- Short reaction time of 60 minutes per screen section
- Immediate confirmation of restoring original water quality by simple measure-ments
- Water Hazard Category 1 (0 non-existent)
- Safe and environmentally friendly handling on site
- No neutralization or treatment of waste water required
- Simple application during workflow (non-liquid consistency)
- Calculation of dissolved incrustation quantities and agent effectiveness by mass balancing
- Easy disposal by sewage, seepage or irrigation outside water protection zones
- Successful implementation worldwide since 2007

cleanwells®
REHABILITATION TECHNOLOGY

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1. DESCRIPTION

AIXTRACTOR® 7.0 is a fast, highly reactive and efficient chemical agent for the oxidization of biomass from tanks, reservoirs, water conducting systems and water wells including the screen, the gravel pack and the adjacent geological formation. The working principle of the agent is based on the degradation of organic materials of microbiological origin by the formation of oxygen. AIXTRACTOR® 7.0 dissolves the structure of hydrogels transforming the organic material in a pumpable, slightly viscous suspension. As AIXTRACTOR® 7.0 reacts in a pH range of 5.0 – 7.0 and does not contain chlorides, it can be applied on all types of well construction and screen materials such as stainless steel, zinc-coated steel, copper, resin bonded preglued gravel and laminated plywood. AIXTRACTOR® 7.0 is classified in Water Hazard Category 1 (0 does not exist).

Micro-organisms in biomass have a capability of becoming resistant to high dosages of oxidizing agents. If the chemical treatment is not carried out as thoroughly as possible and remains of dead biomass adhere on surfaces, a rapid microbiological recontamination can occur due to a selection of single resistent bacteria and the entry of new microorganisms.

A thorough mechanical cleaning and/or a hydraulic rehabilitation (gravel wash or high pressure jetting) of the well interior prior to any application of AIXTRACTOR® 7.0 is a prerequisite for the benefit of an effective outcome using the chemical agent. As the spatial distribution of incrustations along the screen is heterogeneous, a CCTV camera inspection is required to identify heavily contaminated and/or incrusted areas which then may be treated more intensively.

A successful chemical rehabilitation is always based on a geochemical analysis of the well incrustation to identify its exact chemical composition. Subsequently a matching agent can be selected ensuring the highest level of dissolving capacity and the best result will be achieved. AIXTRACTOR® 7.0 is not suitable for the removal of ochre, carbonates, aluminium hydroxides or drilling muds due to its chemical characteristics. In any case, the specific electrical conductivity of the groundwater is to be measured and recorded prior to starting the rehabilitation work on site.

2. PREPARATION OF THE REHAB SOLUTION

AIXTRACTOR® 7.0 is delivered as a ready-to-use crystalline concentrate. It is diluted in clean groundwater prior to the injection in the well screen in a concentration of 100 g per liter of the total cylinder volume of the borehole diameter multiplied by the screen length. When mixing AIXTRACTOR® 7.0 with water, protective clothing, goggles and safety gloves must be worn at all times. It is also imperative to comply with the requirements of the Material Safety Data Sheet.

The rehab solution is to be prepared and mixed shortly before its injection in the chosen screen section. As the agent is very soluble up to a concentration of 500 g/l water, the mixing ratio of 2 to 3 litres water to 1 kg AIXTRACTOR® 7.0 is recommended. For safety reasons the the preparation using a mixing unit including a small pump, must take place outdoor, preferably with tailwind. Specially important is to make sure no chemicals get in contact with skin and eyes. The agent is added slowly into the circulating water in order to prevent clumping. As soon as the solution is pumpable (make sure no layer settles on the bottom of the mixing unit), it is injected in the screen section. Please note that a slight turbidity and potential odour can occur.

WARNING:
Never dissolve AIXTRACTOR® 7.0 in any kind of acidic substance (e.g. hydrochloric or sulphuric acid) or reducing agents (AIXTRACTOR® 1.0/2.0). This does not lead to more effectiveness, but instead would cause the decomposition of the agent and as consequence develop toxic gas.

3. INJECTION OF THE REHAB SOLUTION AND PROCESS MONITORING

The most effective chemical rehabilitation is conducted using a multi-chamber gravel washer with a circulation capacity of 30 m³ to 150 m³ per hour between the chambers depending on the size of the borehole diameter. The treatment of the screen starts at the top and proceeds, section by section, towards the sump. After its injection in the screen section to be treated, the rehab solution circulates between the chambers of the gravel washer with a reaction time of 60 minutes in order to induce the agent as far as possible into the pore channels of the formation. At the same time the continuing circulation prevents its drifting off in the aquifer.

Within 60 minutes the chemical reaction is completed and the injected rehab solution depleted. A longer duration in the screen section does not increase the effectiveness of the agent. Instead, it might only drift off and lengthen the clear pumping at the end. The process of dissolution in the individual screen sections is controlled and monitored by continuous measurements of the specific electrical conductivity and the turbidity in the return flow of the depleted rehab solution. Simple measuring equipment and analytical test strips have proven sufficient.

The chemical treatment is to be repeated in any screen section showing high remaining concentrations of reaction products until the specific electrical conductivity and the turbidity have reached their initial values. Monitoring the specific electrical conductivity also allows the detection of any significant migration of the rehab solution in the aquifer during the reaction time. The power consumption of the gravel washer changes during the reaction time due to the increase of the circulated water volume (s. pump curves), which can used as an additional monitoring tool.
Any injection by airlifting is counter productive.

4. DISCHARGE OF THE DEPLETED REHAB SOLUTION

The discharge of the depleted rehab solution takes place immediately after the reaction time of 60 minutes. The pump should be placed as low as possible in each treated screen section and operated at a rate corresponding approximately to the maximum capacity of the well. Both the duration and the rate of the pumping are to be recorded.

The specific electrical conductivity and the turbidity are to be measured and documented during the discharge in regular intervals of 15 minutes. This clear pumping is completed by cleaning the well sump as some rehab solution may have settled due to its higher density.

The duration of the clear pumping varies from well to well and therefore can only be estimated. However, the pumping is finished when the specific electrical conductivity and the turbidity have reached their initial values. It is recommended to pump the well overnight at the highest possible rate.

5. DISPOSAL OF THE DEPLETED REHAB SOLUTION

There is no formation of chemically or microbiologically critical secondary substances or reaction products during the dissolution process. The depleted rehab solution contains oxidized biomass, hydrogen sulphate ($NaHSO_4$) and oxygen only. Sodium hydrogen sulphate is used in food industry, metal finishing, cleaning products and to lower the pH of water for effective chlorination in swimming pools and hot tubs. The initial oxidizing substance is completely depleted within the reaction time due to its chemical characteristics. Therefore the disharged waste is is free of any remnants.

As with any other type of rehabilitation agent the depleted rehab solution shows increased salt content. It originates from the ions of sodium which occur here in a higher concentration than in the aquifer. The salt content is not only influenced by the quantity of the rehabilitation agent applied but also by the volume of discharged water (dilution). It is determined by measurements of the specific electrical conductivity. As the discharged water is neutral with a pH value of around 7, it does not require any neutralization. It may have a certain turbidity due to loosened particles of sand and oxidized particles. The process parameters of specific electrical conductivity and the turbidity are measured and documented in regular intervals of 15 minutes.

The depleted rehab solution from potable water wells has to be disposed outside the Source Protection Zones I and II. The first gush from each treated screen section (1 m³) is pumped into a container in order to allow for possible reaction products to settle on the bottom. The depleted rehab solution from process water wells can be disposed at a distance of at least 50 m from the well beneath the flow direction of the groundwater by seepage, irrigation, sprinkling or sewage and in accordance with the local water authority.

All discharged clear water is disposed untreated by seepage, irrigation, sprinkling or sewage outside the Source Protection Zones I and II. It is recommended to comply with the FAO limit value of 3000 µS/cm or with the German Drinking Water Ordinance limit of 2790 µS/cm which is considered unproblematic.

As AIXTRACTOR® 7.0 does not contain organic substances it cannot cause any microbiological contamination. Prior to any rehabilitation measure and irrespective of the technique and agent it is imperative to clarify with the local water authority whether the depleted rehab solution can be disposed via seepage, irrigation, sprinkling or sewage.

6. CONTROL OF RESULTS

Well yield:
When evaluating step-ischarge tests the original yield of the new well at commissioning should be taken as the 100% value for an objective comparison. Intermediate step-discharge tests allow the verification of effectiveness of individual working steps.

Condition of well interior:
As the structural condition of a well is often revealed after the removal of incrustations only, it is recommended to carry out a second CCTV camera inspection following the mechanical cleaning or hydraulic rehabilitation. A clean well interior is not necessarily proof of successful treatment – decisive and the main factor is the cleanliness of the pore channels in the gravel pack and in the annular space.

Condition of well outside screen:
Comparative examinations by means of borehole geophysics extend the success control down to the otherwise hidden gravel pack, annular space and adjacent geological formation. As oxide incrustations reduce the pore volume and increase the density of the gravel pack, geophysical methods have proven to be particularly accurate as they provide valuable data on the porosity and the degree of density.

Quantity of dissolved incrustations:
Concentrations of dissolved and/or suspended biomass determined by mass balancing on site. The quantity of dissolved incrustations is calculated by multiplying their concentrations (e.g. mg/l) at the time of the sampling with the pumped volume of depleted rehab solution (e.g. litres) during the measurement period.

Effectiveness of rehabilitation agent:
As the total amount of rehabilitation agent is known, its effectiveness can be determined by mass balancing also, i.e. which percentage reacted with incrustations and which did not.