MONITORING EQUIPMENT FOR THE IRRIGATION WATER QUALITY AT SOURCE

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Abstract - In order to establish the features of the watching, system on water for irrigation at source it must be specified:

- The dim of the monitoring equipment accomplishment.
- The location for the equipment carrying out.
- Indicators describing the quality of the water for irrigations.
- Measurement frequency of these indicators values
- Human and financier resources needed to carry and the monitoring.
- Destination of the data obtained by monitoring and their use.

The dim of carrying out the monitoring

Monitoring on – line the water quality at source allows recording in due time the indicators max.. Admissible limits, these describing the water for irrigation physical – chemical characteristics, in order to take the right division on the decliner process to the irrigation device.

Keywords: Electrical conductivity _ monitoring equipment for the irrigation water quality at source

The location for the equipment caring out the monitoring

The equipment monitoring the water for irrigation quality at source will be placed in a room of the pumping station haring the flooring min. requirements;

- The necessary plan to plan the equipment: 1500 x 700 x 400 [mm]
- Power supply: 220 [Vac], 50 ÷ 60 [Hz]
- Parading conditions to drown and transport the sample at the level of the hydraulic circuit for the equipment measurement.

The indicators used to analyze / assess the water for irrigation quality

Next we are aging to make a brief presentational these factors and also same notes on quality in order to hare the image about the of their presume may have over the plants grow.

Electrical conductivity is the measure of the total / the overall salt contents from the water for irrigation (physically it represents the opposite of the electrical resistivity) and is measured in [dS /m]. This as the water electrical conductivity is higher the hair salt content is.

pH-ul (the acidity and the basicity of the water for irrigation) is the indicator providing information about the acids presence. The acids mixed with ionized water in contains of hydrogen (H+) and in associated anions.

As the acid is more powerful the ionization process is more intense. The pH shows the water ions of hydrogen concentration.

Chlorine ion (Cl-) is often present in the water for irrigation. Assessing its concentration allows assessing the water total acidity and also the toxic possible influence over the sensible crops. Sodium ion (Na+) is often present in the water for irrigation its concentration overpasses generally 0,1 [%].

Sodium is responsible for the problems connected with the water for irrigation salinity mostly in connection with the chlorine anion.

The water for irrigation salt high level is one of the most important problems negatively affecting the crops, damaging the land and polluting the phreatic waters. The salt allowed content filter water for irrigation must have the level from low the medium meaning on electrical conductivity between 0,6 ÷ 1,7 [dS/ m].

The water with medium salt content may be used with medium filtrations. High-level salinity water (EC > 1,5) must not be used for irrigation. It may be used only (under certain specific conditions connected to the land permeability, type of drainage) as supplement when there are other sources of water for irrigations.

Under these conditions are very important a good management and a rigorous control of the used quantities. It is important to know that an hectare of irrigated agricultural land is used each year about 10000 [t] of water, the equivalent of spreading on the same surface 2 ÷ 5 [t] of salt each year.

Even in the conditions of removing a port by natural washing, on that surface will remain by on important quantity of salt within the land.

The relation between the effective salt concentration (C) and the electrical conductivity (EC) is by a good approximation, C = 640 * EC.

Turbidity as a measure of the total solid quantity in suspension (TSS) within the water for irrigation in [mg /l] it is another important indicator being directly responsible for the sedimented processes in the irrigation canal.
The measurement frequency of this indicators value

The equipment monitoring the irrigation water quality at source will accomplish the above mentioned indicators value measurement and also data acquisition in two ways:

- ongoing, in real time for a period of time designed according the answer speed of the most slow sensor (min. 1 [s]).
- pre-established periods of time shaped according the application type

Human and financial resources needed for monitoring

At the pumping station is necessary the presence of an operator. Thinking to the financial resources needed, evolved in the equipment operation will be carried out a further estimation.

Data processing and the way they are used when are provided by the equipment

The equipment accomplishes processing, memorizing, ongoing digital display and also the orders, at a pre – selected time level, of the thermal printer for registering on paper sand the monitored quality parameters values.

The equipment makes this data assessment (comparions with pre – established standardized values) and carries out the audio – visual alarming of the critical situations appeared (indicators max. admissible over limits describing physical – chemical characteristics of the irrigation water on exceeding the limit values for the specific parameters used to measure the process on the equipment – pressure, flow, temperature ).

Decision makers are informed by the operator and decide the max. admissible limits for the indicators describing the irrigation water physical – chemical characteristics, stopping, going on or starting again the water delivery to the irrigation arrangement.

The equipment components

The equipment monitoring the irrigation water quality at source includes the following parts:

- Hydraulic measurement circuit connected to the equipment sensors to measure the parameters describing the water quality, pressure, flow and temperature transducers.
- Pressure flow and temperature transducers
- Equipment operating elements (thermal printer, pumps or electrically operated valve for adjusting the flow in the measurement circuit and the ON /OFF valve.
- Devices for carrying out the connection of the water quality sensors and pressure, flow and temperature transducers at the measurement hydraulic circuit.
- Sensors connections with sensors - transmitters block
- Sensors - transmitters block
- Main unit connected to the power supply module, quality sensors - transmitters block, transducers block, controller module, thermal printer, alarming module, with serial outlet RS 232 for PC or laptop connection
- Metallic case (it is preferred this solution for a better protection of the equipments parts) or a panel on the wall to fixing the equipment
- Hydraulic circuit for water recycling needed to clear the sensors
- Water recycling pump (for filtering and stocking the water for sensors cleaning process)
- Tank collecting the filtered water (with stocking capacity about 100 [1])
- Level transducer
- Filter for the evacuated water from the measurement circuit

The main technical characteristics of the equipment

The main technical characteristics the equipment should have taking into consideration the plan specific according to the future location are:

- The plug to take of the water sample in the pumping station tub (5 ÷ 7 [m] under the level of the tub pumping station floor)
- PVC pipe or water hose of 1” fixed on the wall (aprox. 20 [m] from the equipment plug placed in the pumping station this tub to the equipment)
- The equipment fixed in a metallic case or on the panel fixed on the room wall where the equipment has being placed (assured against vandalism).
- Sensors (4 chemical - for electrical conductivity measurement, pH, chlorine ions Cl -, sodium ions Na+ and a physic one for turbidity measurement) are pleased according the operating requirements and are addicted by fiability and maintenance within a closed hydraulic circuit by same specific connection accessories.
- The technical characteristics the sensor within the equipment should have are:
Monitoring Equipment for the Irrigation Water Quality at Source

- For the sensor for electrical conductivity:
  - mechanical robustness
  - measurement carried out on the inductive principle for electrical conductivity values between 0 ÷ 5 [dS/m]
  - connection with the thread or the flange
  - assembly kit for easy maintenance

- For pH sensor:
  - usable in environments with high content of suspended particles
  - robust construction
  - high accuracy
  - calibrations for long time periods
  - wide field of the working temperatures (provides the possibility of temperature correction by including a thermostats)
  - easy to maintain
  - measurement domain: 0 ÷ 14 [pH]

- For chlorine ions sensors Cl⁻ and Na⁺:
  - high measurement accuracy
  - short time to answer
  - easy to use
  - measurement domain:
    - for sensor ions Na⁺: 0 ÷ 0.9 [g/l]
    - for sensor ions Cl⁻: 0 ÷ 0.1 [g/l]

- For the turbidity sensor:
  - robust construction
  - not sensitive when air bubble are present in the measurement area or when parasite reflections at the level of the pipe wall occur
  - easy assembly and maintenance
  - measurement domain: 0 ÷ 2.5 [g/l]

- It will be used the transmission without self display designed according to the output signal provided by each sensor fixed on the rail within the equipment electronic block.
- It is used a central unit with microcontroller with a specialized software facilitating:
  - data acquisition:
    - o permanent, in real time for a designed period of time according the answer of the most slow sensor (min. 1 [s])
    - o pre-established periods of time sized according to the application type
  - processing, memorizing and data display (table or diagram)
  - data analyze (comparisons with standardized pre-established values)
  - audio-visual alarm for the critical situations (pre-established limit values of the water quality parameters or the monitored process parameters - pressure, flow, temperature).
  - automat control for interrupting of the water pumping by the station (to be discussed if this is automate or not)
  - thermal printer control for registering on paper the quality parameters values monitored at preselected time periods
- the equipment main unit may have serial RS 232 communication with hand–terminal or notebook
- to be avoided:
  - the equipment exposure to direct solar radiation
  - the equipment operation without water
  - overpressures (pressures over 1 [bar] in the measurement hydraulic system)
  - the exhausting pipe must have the exhausting part free and preferably to a lower level of the equipment plane setting.
  - a system of pipes made of PVC or rubber tubes are used to take out and make the sample run.
  - compact system for measuring in real time the monitored parameters set
  - data acquisition and analyze.
  - designed measurement periods as wide as possible.
  - are used standard sensors easily maintained
  - the sensors may be fixed and taken off easily allowing an easy cleaning
  - data on magnetic support (up to 64 [kB]).
  - transmitters used within the sensors – transmitters block are characterized by:
    - designed and very flexible measurement periods
    - temperature influence compensation desired according to the sensor and automate carried out
    - keys with pre-established calibration functions
- provides signalization with LED-s processes (calibration, measurement) of the dysfunctions or stability
- controller outputs: a relay output limit type
- analogue outputs:
  ✓ unified signal in current: 4 ÷ 20 [mA]
  ✓ unified signal in tension: 0 ÷ 5 [V])
- serial interface: RS 232, for designing and download the memorized data on PC or notebook.
- power supply: 15 ÷ 24 [Vac]
- the environment temperature: 0 ÷ 50 [°C]
- sizes: 22,5 x 99 x 114,5 [mm]

- the sensor-transmitter block includes a display unit with the following technical characteristics:
  - simultaneous display up to 8 values
  - serial output: RS 485
  - memorizing data (64 [kB])
  - two virtual channels (for secondary parameters)
  - two relay outlets: max. 125 [Vac], 60 [Vcc], 30 [VA]
  - by using the PC or notebook and a specialized software included.
  - power supply: 15 ÷ 24 [Vac] or [Vcc]