FILTER MODELING METHODS AND STABLE AND UNSTABLE BEHAVIOR OF GROUNDWATER IN AQUIFERS

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Abstract: *This article filtering modeling mainly used hydraulic and electrical analogies implemented in solid and lattice models. Rigid hydraulic models represented by various types of filter trays have been used in hydrogeological calculations.*

Keywords: *Hydroisogypsum, perpendicular, drainage, radius, aquicular, concentration, electrolytic.*

Hydroisogypsum maps are used to determine the direction of groundwater movement. They show the "relief" of the groundwater level in the form of isolations.

Flow lines - erpendiculars to the hydroisogypses directed to the direction of lower elevations are said to indicate the direction of movement of underground water.

Groundwater flows are divided into straight and radial according to the mutual location of hydroisogypses and flows. In a flat flow, hydroisogypses are parallel straight lines in plan and form a rectangular network when the flow lines intersect.

A flat stream may appear at intervals;

- between a parallel flowing river and a drain;
- treatment of underground water in horizontal ditches.

In radial flow, hydroisogypsums express their system of curves, and the flow lines have the shape of a radius. The most obvious example of radial flow would be the flow of water into a well or well during heavy mining. Radial flow can be divergent and converging. The width of the diversion increases with the flow in the direction of its movement and decreases as it approaches.

A graph of changes in the content of chlorine ions in groundwater when determining the actual flow rate

The speed of movement of underground water can be determined in several ways. One of them is based on adding table salt to water. Before the start of the experiment, the amount of chlorine is determined in the experimental and observation work. Then a salt solution is introduced into the test case, in which the concentration of chlorine ions is 2000 times higher than that of underground water. Of course, the salt injection time (t_1) should be recorded. Water samples are taken from the observation well every 10 minutes and chlorine content is determined using silver nitrate. The analysis data is plotted on a graph and the peak transit time (t_2) is found. Actual speed

$$\grave{e} = \frac{l}{t_2 - t_1} \qquad (1)$$

Here l is the distance between works, m.

This method is very convenient, but it cannot be used when the natural amount of chlorine in the water is more than 500-600 mg/l and the waterproof layer is sharply uneven. In the first case, it is difficult to detect changes in the chlorine content by analysis, and secondly, a solution of table salt heavier than water can remain in the aquicular spaces.

You can also use organic dyes, whose presence in water is detected in insignificant concentrations (up to 10-6%). For this, use fluorescein, methylene blue dye, etc., which has a greenish-yellow color in low concentrations. To determine the content of dye in water, a fluoroscope is used - a set of glass tubes with different concentrations of dye. By comparing the color of the water in the samples with the color of the reference tubes, it is easy and quick to determine the dye content in the water sample. Then a graph of the time change of the dye content in the water is drawn and the speed of movement of underground water is determined, similar to the method described above.

The rate of groundwater movement can also be determined by the electrolytic method. For this, an electrolyte is introduced into the test well and the change in electrical conductivity between the test and observation wells is observed. For this purpose, a milliammeter is used, according to which a graph of the change in current strength over time is drawn.

Recent advances in physics and chemistry allow the use of "labeled atoms" - isotope tracers. The high sensitivity and simplicity of radioactive measurements allow recording the minimum number of isotopes in groundwater.

Groundwater movement is considered stable if water table levels and all other elements are constant over time. If the water level at the same points changes over time, then such movement is called unstable.

Most formulas for calculating groundwater dynamics are based on the assumption that the conditions of groundwater recharge and drainage are constant. In fact, these conditions may vary depending on natural or artificial causes. Natural causes include changes in precipitation and evaporation, snowmelt, and floods. Among the artificial causes, water extraction, irrigation, construction of reservoirs, etc. are of great importance.

If the aquifer has the same lithological composition along its entire length, it is called homogeneous. If the lithological composition of the aquifer varies horizontally or vertically, then the aquifer is called heterogeneous.

The main role in the development of groundwater filtration modeling methods belongs to continuous and network electrical models based on the use of the method of electrohydrodynamic analogies, the essence of which is clearly expressed by comparing the basic laws of water flow. filtration current and electric current:

Darcy's Law and Ohm's Law

$$Q = K\hat{o} \square F \square \frac{dH}{dx} \text{ and } I = c \square S \square \frac{dU}{dl} \qquad (2)$$

here

Q- flow rate; F - cross-sectional area of the flow;

H- pressure; x - distance; I - current strength; c - specific conductivity, $c = \frac{1}{p}$; p - resistance; cross-sectional area of the conductor;

SHE IS- electric potential, l - the length of the conductor.

The above formulation of Ohm's law is obtained by simple transformations

$$I = \frac{U}{R}; \qquad R = \frac{pl}{S} \tag{3}$$

where R is resistance.

The specificity of writing Darcy's and Ohm's laws is obvious. They correspond to physical properties - filtering coefficient and specific permeability c, power properties - head H - potential U - dynamic similarity, and finally, flow rate Q and flow power.

In continuous EGDA models, the filtration flow is modeled by a continuous electric field that is geometrically similar. Conductive paper and electrolytes are used for this. Conductors are produced with a resistance of 100 to 100,000 Ω/cm depending on the carbon black and graphite content of the paper.

Field areas of different rock permeability are modeled with pieces of paper of different specific permeabilities. Between them, sections of the model are attached with a special conductive adhesive.

Electrolytes are also widely used as sample materials and are usually salt solutions, with common salt and aqueous solutions of copper sulfate being the most common. In addition, superconductive paints, adhesives, superconductive cardboard, plaster, etc. can be applied.

In EGDA models, the detection of reduced potential is carried out using a bridge measurement circuit.

When compiling grid models, the current is divided into separate blocks, the centers of which are connected by electrical resistors. In such models, the geometric similarity of the model and the object is not maintained.

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