MAGNETIC PROCESSING of WATER

Vladislav Konovalov

Abstract

In the article the in-depth arguing is given, that takes place at magnetic processing of water.

The first information about influence of magnets to properties of water go from medicine, since XIII centuries (Geneva physicist de Gersu). The most classified information are obtained since the 30-th years XX centuries Dgordgio Pikkardi, which one on the basis more than 250 thousand observations has installed statistically reliable connection between activity of the Sun and rate of sedimentation in water of sol of an oxychloride of a bismuth (gained by a hydrolysis, of a trichloride bismuth). In 1945 the Belgian engineer T. Vermaer has licensed a method of strife with a scale deposit by means of magnetic processing of water containing hardness salts. This method - one of the most reproduced and effective practical appendices of magnetic processing, therefore it is fullestly learnt. In a basis of effect improvement requirements of dropout of crystals of hardness salts from heated water not on solid walls, and in water volume. Thus in 5 times the number chips is incremented and in as much time their size is diminished. The size, certainly, can not decrease in as much time, in how many of time the number of chips was increased, a deficit of total mass of allocated chips differently will appear, so the thermodynamic equilibrium of response will vary, that is improbable. This inconsistency is possible will be removed by that after magnetic processing from water fall out the chips not of a calcite, and aragonite (on data A.M Krapivina etc.). In this case estimation of a regularity of data is not so relevant, since the sufficient quantity of contradictory experimental data will below be given. In most cases good results are gained, if the water concerns to a calcium-carbonaceous class.

After discovery of Vermaer of starts indeed "magnetic boom" in medium "applyers". The practical results have not slowed to have an effect, but at the same time idea of magnetic processing of water discredited itself in ever more to eyes of the scientists, as in absence of scientific explanation of apparent effects in the literature occurred contradictory from a scientific point of view experimental data. Now business has reached that everyone can receive by means of magnetic processing that him is necessary. I shall give some examples.

1. Frequently already after contact before a having been available scale deposit with magnetized water the scale deposit starts to be dissolved and to fall off walls, and on data of Tatarinov the magnetic processing accelerates dissolution in 5 times, and on data of Scorobogatov the velocity of dissolution $MgSO_4$ is incremented in 120 times. It contradicts above mentioned data from which one follows, that the magnetic processing promotes not magnification, and diminution of a dissolubility of hardness salts. Escaping of mentioned inconsistency, apparently, in poor "purity" of experiments concerning absorption by system in a run time of extraneous gass (in this case CO_2). So for example, the merging of a solution of nitrate lead with a solution of caustic potassium gives in formation of lead hydroxide, and after magnetization of lead salt - to formation of lead carbonates because of increase concentration CO_2 in a solution. The truth, is not known, it is possible the writers in the second case took "old" caustic potassium, which one, as is known, absorbs CO_2 from air with formation of potash. At the same time there are independent data (Korukin, Klassen) about magnification of the content of oxygen and carbon dioxide in processed water, for example, because of magnification of concentration O_2 in magnetized water, the oxidation rate of pyrite FeS_2 in water will increase on 20%. However, dissolubility of gases, as the quantity

thermodynamic should not vary and consequently the indicated effects should be viewed as magnification of velocity of dissolution of gases in processed water. Then it is possible to draw a conclusion, that magnetized water in itself accelerates dissolution of matters including gases, and the diminution of a dissolubility of hardness salts is bound to influence of the enlarged content CO_2 in waters processed for preventing of a scale deposit.

2. It is discovered, that the wetting power of water after processing is diminished. But for surfaces containing silicon it is incremented. By Klassen sets, that dedusting ability (rock dust and the coal) processed water in 3 times is higher, that contradicts him data on aggravation of a wetting power of processed water. At water injection in a seam of coal it is spread there almost twice further, i.e. the wetting power of water is meliorated. From this inconsistency yet it is not visible of an exit.

3. Grebnev, Klassen etc. have ascertained that the magnetic processing heightens velocity adsorptions of surface-active substances on solid surfaces and on partition water - air. Soloshenkin etc. have ascertained that the adsorption of dyestuffs on a fibre is incremented by 42 %, and Tatarnikov etc. have found, that magnetized water on 40 % accelerates washing out of a fiber from dimethylformamide. Liakumovich considers, that magnetized water washes materials from impurities better. Too unsolvable experimental inconsistency.

I shall give still brief examples showing as knotty problem in result of which experimenters is "reach" that to what tend, solving, frequently, opposite problems by the same expedient.

At extraction of watered oil in tubes put magnets, in result the deposition of salts is diminished at 6-12 of time, and the old depositions fail. At tempering cement by magnetized water the strength it is incremented, more fine grained structure in 2.5 times is gained the gas permeability of a cement rock is diminished.

The processing increases strength of the sandy-argillaceous shapes for a casting and simultaneously increments their gas permeability.

The processing of water on which one gets mixed up mass for molding of a brick increments its strength and reduces porosity.

The processing of pulp at floatation increments extraction of copper and gold, sorptive capacity of ion exchangers is incremented, on 20-30% will increase capacity absorption of sulfonated coal.

Verishskay has found, that the velocity of interaction of acids with metals will increase approximately in 2 times after processing, but at some magnetic intensity the interaction is retarded sharply.

By production of caustic the degree of causticization is incremented by 6 %.

The unit discharge of diamonds is reduced in 3 times at grinding; the stability of oil-water emulsion is many times over incremented.

Skalozubov, Kukoz and Chernov have found even, that by production of soda salt in 2 times the equilibrium constant varies with diminution in 2 times of concentration of soda salt in the clarified solution, that generally is difficult for believe, since it contradicts thermodynamics.

The necessity of eduction of the rather reliable test data and prime for the analysis of systems streams from viewing all now obtained by experimental "kasha":

1. The magnetic processing promotes dissolution in water of carbon dioxide and oxygen, picks up speed dissolutions of matters.

2. The processed water biologically is active.

3. The coagulative processes are accelerated.

In the second case the system is so complicated, that it is necessary to draw a conclusion only that the magnetized water by something differs from customary.

Let's transfer to a problem on what requirements are indispensable for development of effect. Thus also we shall reject all some doubtful or single data.

1. Presence of impurities.

For water alone the effects are not watched. Generally change of properties of water after magnetic processing will increase with magnification of an impurity concentration in some limits. The major role is played by character of impurities. Duhanin has come to a deduction, that the information is born with water, and the ions boost or attenuate shown effect. A blanket deduction on 1 point while we shall make such: or the

properties of water on themselves vary, and the ions as determine that these changes, or these changes of water are possible only at presence of ions, or the water is nothing play a role only ions.

2. Stream of processing system in a magnetic field.

If no travel concerning a field effect is not watched. At stream arise only of Lorentz forces. A blanket deduction on 2 point. The activity is exhibited only in those systems, where can arise of Lorentz forces (dipoles, ions, charged colloid particles etc.).

3. Speed of flow.

For development of effect in full measure optimum rate of flow is necessary. With magnification of velocity the effect is incremented and then falls. This point is very relevant on the informative value, since displays, that for development of effect the rather major run time of processing is necessary. The deduction of the first point remains only in edition Duhanin, as it is known, that the chemical reactions between ions in a solution go practically instantaneously. But here it is necessary to add, that macro transference of ions under activity of Lorentz forces requiring of a long time can not also give a curve with a maximum. From a deduction of the 2 point there is an activity of Lorentz forces on dipoles of water (for a pure solution) and ions in the sense that they can as influence behaviour of dipoles.

4. Frequency of change of a field.

Low-frequency processing strongly operates on water: unities or tens hertz (it just corresponds to a stream with velocity of 1 m/s in a backlash of length 10 cm). The deduction till item 4 same, as till item 3: for formation омагниченной of magnetized water is necessary time.

5. Field strength.

The effect of processing in dependence from a field strength is in polyextreme dependence and, at all events, nonmonotone. On the one hand, it could be explained to that during processing there is, at any rate, one interfering factor. On the other hand, the coagulative processes, for example, not monotonically depend on concentration of a coagulable electrolyte. Let's remind that the reliable effect of activity of a magnetic field is by and large bound to coagulative processes in processing system.

6. Relaxation time.

The spontaneous returning of aqueous systems after magnetic processing in a reset state takes on time a gamut from several tens minutes about several day on data of the miscellaneous writers. The magnification of temperature accelerates process of a relaxation. From here it is possible to draw a conclusion, that called in the control system thermodynamically are not stable, but the process of a relaxation meets considerable kinetic handicappings.

As the theory of a phenomenon is not present, we shall transfer to viewing present now hypotheses, the deficiency of which one is not present.

1. "Colloid" hypotheses. In their basis the activity of a magnetic field on colloid particles possessing a rather major magnetizability (a para- or ferromagnetic) and always lies present in water. Therefore water alone not magnetization.

Against this kind of hypotheses speaks that fact, that the magnetized water gradually loses the properties, i.e. the effect reversible, at the same time, the colloid processes are nonreversible.

2. "Ionic" hypotheses in which one the basic liability is laid on ions taking place in water. In a basis the activity of a magnetic field on moving ions lies. The majority of the supporters underline a major role of influence of a magnetic field on a hydration of ions (hydration is diminished). In the proof give magnification on 20-40% of sorptive capacity of ionites. By a method NMR (on waist of linewidth of a signal the NMR of water) is shown, that the hydration of ions is diminished after magnetic processing. By the way, the supporter of these hypotheses is Klassen.

Against ionic hypotheses the energy factor, as the energy of a hydration of ions is comparable to potential of ionization of the relevant atoms. At the same time, the energy conferred to water by a magnetic field by intensity 1000 oersteds on 5-6 orders is less than energy of heat motion of water molecules. By the way, it is the basic argument of critics completely negating on its basis any effects at magnetization of water. Imagine house of cards, dying from slightest puff, which one stands calmly at

hurricane - approximately so the relation between energy obtained by molecules of water at magnetization and a thermal energy of molecules of water looks.

3. "Water" hypotheses justifying activity of magnetic fields on naturally water. They are grounded on an opportunity of change of properties of water depending on a degree and character of association of its molecules.

For example, Kirgincev has advanced a hypothesis about dispersive activity of a magnetic field on aggregates of molecules of water. The change of aggregate sizes does not call considerable change of a free energy of water, signifies does not require an expenditure of major energy. The mechanism of dispersive activity is not uncovered. Many researchers speak about "structural memory" the water which has visited in a magnetic field.

Unfortunately, the present now hypotheses are so fuzzy, that they cannot be tested in requirements "of major hazard" and, therefore, while it is impossible trusty to confirm or to deny.

Methods of verification of a degree magnetization of water very much indirectly. More or is less lighter for interpretation the aqueous-alcoholic test of Shahov, fixing a degree of diminution of volume of an intermixture of water and alcohol as contrasted to in their individual volumes. Under his testimony magnetization of water volume of an intermixture of water and alcohol considerably diminish. By the way, if this observation is trusty, it indicates such changes, which one are possible only at external pressure on an intermixture in hundred thousand atmospheres.

Hypothesis of the author.

Let's consider now my hypothesis about influence of a magnetic field at aqueous systems.

The colloid particles are enclosed by a solvate layer by thick, order 300 Å formed by oriented dipoles of water. This layer will be formed only at presence of a small amount of ions in a dispersion medium, which one, being adsorbed on a surface of a particle, condition for a thermodynamic stability of a solvate layer (potentialdefining ions). The counterions are adsorbed by a lamina on a surface of a solvate layer, which one has such properties, that they do not dive to a surface of a particle. It is possible to judge strength of this layer that at a coagulation (sticking of particles) colloidal solution, the coming together of kerns is prolonged a long time (in some cases months and years). The counterions are arranged by a part in a solvate layer, and part in adjacent to a particle a solution. At a Brownian motion of a particle, the slipping surface lies inside a layer of counterions, therefore particle appears by charged (more often negatively), having some electrokinetic potential. In whole such particle is termed as a micelle. The solvate layer represents "third phase" of colloid system (see figure 1).
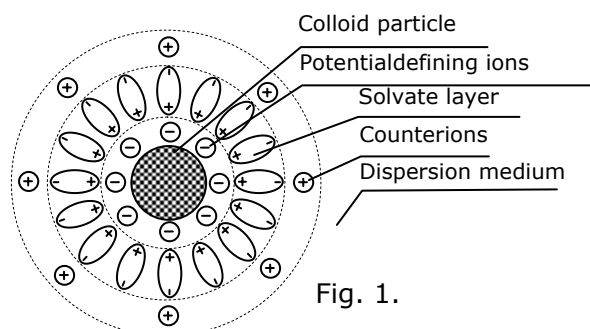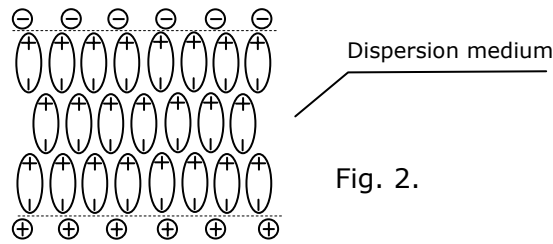

Fig. 1.

In magnetized to water under activity of force of the Lorentz the plate domains of oriented molecules of waters stabilized by ions (fig. 2) will be formed.

Thus it is necessary to mark essential circumstance: the magnetic field not "works", and only instigates formation of these domains, i.e. plays a role of "trigger" (on such role of a magnetic field the academician Vonsovsky indicated). At formation of domains (it is better them to term aquacellas to not confuse to magnetic domains) energy is allotted. After removal of a field aquacellas, as "the third phase" are gradually dissolves, and can be, are aggregated among themselves with descending of counting concentration them.

Fig. 2.

Let's give some calculations, using the circumscribed model.

1. We compare electrorheological effect to a solvate layer. The colloid particles have ζ-potential $\sim$ 150 mV, and in a hypothetical case without counterions of the order 300 mV or 0.3 v. Thickness of a solvate layer $\sim$ 300 Å, from here electric intensity at which one the solvate layer becomes thermodynamically stable will make 10^7 v/m. The electrorheological effect is exhibited at a field strength 10^6 v/m and has property of saturation at strengths of the order 10^7 v/m. Thus, the electrorheological effect is called by turn of dipoles in a solvate layer of colloid particles.

2. We shall count up, what there should be a magnetic field to call effect at a level electrorheological.

At electrorheological effect on one double charge of a dipole of water the orienting force $4 \cdot 10^{-15}$ newtons, and force of the Lorentz operates at magnetic processing (1 m/s, 1000 oersteds) $3 \cdot 10^{-20}$ newtons. Thus, it is necessary in 10^4-10^5 times to strengthen a magnetic field to receive effect at a level electrorheological. Completely to simulate structure of a solvate layer a magnetic intensity it is necessary to strengthen in 10^6 times. Here it is necessary to add, that the solvate layer of colloid particles will be formed in time from several minutes till several o'clock, the time is necessary to maintain system at activity of an exterior magnetic field. Thus the processed aqueous system should "to harden" - the mechanical characteristics of a solvate layer of colloid particles are so high. At electrorheological effect on one double charge of a dipole of water the orienting force $4 \cdot 10^{-15}$ newtons, and force of the Lorentz operates at magnetic handling (1 m\s. 1000 э) $3 \cdot 10^{-20}$ newtons. Thus, it is necessary in 10^4-10^5 times to strengthen a magnetic field to receive effect at a level electrorheological. Completely to simulate structure of a solvate stratum a magnetic intensity it is necessary to strengthen in 10^6 times. Here it is necessary to add, that the solvate stratum of colloid particles will be derivated in time from several minutes till several o'clock, the time is necessary to maintain system at activity of an exterior magnetic field. Thus the handled aqueous system should "to harden" - the mechanical characteristics of a solvate stratum of colloid particles are so high.

3. We shall discover energy of formation of a solvate layer from heat of wetting of disperse bodies $\sim$ 60 cal/g. If to accept particles $\sim$ 1 micron, the thickness of a layer 300 Å, is gained $\sim$ 12 kcal/mole. The same energy is allotted and at magnetization of water.

4. We shall estimate concentration aquacellas at usual conditions of magnetic processing, considering, that at processing the magnification of temperature is inconspicuous and is comparable to its magnification from friction at a motion in a magnet gap ($\sim0.1^0$C). 0.01% weight is gained. The actual concentration can be and it is less than that, though the countable concentration of aquacellas, depending from their size can be very major at their small size.

Let's conduct quality estimate of a hypothesis.

1. Presence of impurities.

In a hypothesis the very relevant role is played by ions in water. The completely water alone contains hydrogen ions and hydroxyl in concentration, quite sufficient for development of effect of "memory", but also the ions of impurities, since concentration, order 10^{-8} mole/l promote origin of effect. On the other hand, too great many of ions at concentrations about a threshold the coagulation of colloids can, but not always to give in disappearance of "memory". From a hypothesis it is clear, that in absence of impurities the water will be instantaneous to relax at removal of a field. At presence of impurities of a field stabilizing aquacellas all the same remains. In dependence naturally and impurity concentration the effect will be different.

2. Stream of processing system in a magnetic field.

This is apparent and indispensable requirement for orientation of dipoles of water. The ideal case - maximal flow rate and is possible major length of a magnet gap.

3. Rate of flow.

The above velocity, is better, but at maintenance that of a dwell-time of system in a field. In magnets of the final sizes at high speeds the run time will be too little for formation aquacellas.

4. Frequency of change of a field.

Ideal case, when the field does not vary at all, but at present constructions of magnets it while is impossible, possible frequency therefore is indispensable minimally.

5. Field strength.

From a magnetic intensity the polyextreme dependence is watched. It is called by that at formation of aquacellas ions hinder, since of Lorentz force theirs moves not there, where it is necessary. Therefore ions are better for importing after formation of aquacellas, but here small relaxation time non-stabilized aquacellas hinders. Nevertheless, Sokolov watched, that the effect is almost identical if to import salts iron to processed water up to or after processing, and Shahov etc. have found, that the introduction in water of a coagulant is more useful after processing. Apparently, in both cases in systems already there was some of stabilizing ions. Besides under activity of Lorentz forces there is an accumulation opposite charged ions so, that there is an electric field orienting ions in the side, opposite to a magnetic field. And, at last, already formed aquacellas can be turn in a magnetic field bodily and to fail as on dipoles the orienting moment in one side and on stabilizing ions in another operates. From here polyextremeness of effect from field strength is not surprising.

6. Relaxation time.

The different relaxation time is stipulated by different stabilizing activity of ions depending on their concentration and nature. In solvate layers of colloid particles in absence of coagulation this time is not restricted, i.e. the layer thermodynamically is inconvertible. It is known, that many nonsoluble in water of matter, specially, of high molecular weight (for example, polyethylene) "are dissolves" globularly, forms not a molecular solution, and highly dispersive colloid dredge. The similar matters should steady magnetized water. Besides it is improbable, that aquacellas represent flat or filiform aggregates because of a high surface energy. Their existence in the view, contracted in a sphere is more probably. Then they will represent a precise duplicate of a colloid particle without a solid core at centre.

7. Poor reproducibility of experiments.

Apparently it is called by that initial for processing the object contains miscellaneous quantity of aquacellas germs. In completely pure from aquacellas to system in a run time they can not be formed at all by analogy, for example, with the super cooled fluid in which one will not be formed of chips in absence of germs or of phase interface. This moment plays, probably, very major role, allowing from above-stated, that the present expedients of processing are very far from an ideal.

There is one more essential factor sharply lowering reproducibility of experiments with "memory" of water. The process of mutual amplification of orientation of molecules in aquacella and adsorption of ions on its surface accrues, as snow-ball, therefore the slightest change of exterior requirements is strong on it influences. Besides at a Brownian motion of aquacellas their almost each coming together gives in a tightening in space between them is of the same name of charged ions (because of influence of counterions). At removal of aquacellas from each other between them it appears again born aquacella that of a sign of a charge, i.e. aquacellas are capable to be propagating itself in favorable requirements. This effect for biology has the very relevant value, since alive organisms, in basic, consist of water and have permanently effective generators of aquacellas as particles of a blood and other colloid particles.

The dilution of a solution containing aquacellas can under the relevant requirements not only not reduce their quantity in a solution, but the concentration them can even grow, if the dilution happens enough slowly, that the water could properly "to remember" the structure. In this connection there are understandable some completely surprising experiments, bound with "memory" of water. Some biologically active substances, being diluted in water solutions maintain the activity. All would be

anything, but cunning the experimenters so have diluted a solution, that in a vessel did not remain of any molecule of matter... and the activity has remained! The water "has memorized", that of it was diluted.

Experiment of the author.

Thus, as a first approximation, the magnetized water can be imagined as suspension mechanically of strong plates of aqueous associates (aquacellas) with that feature, that these associates, sticking together among themselves is opposite by charged surfaces, in the beginning are consolidates, then "are diluted". The presence of aquacellas, apparently to detect by filtering of magnetized water is easiest. The effect magnetization should be exhibited in diminution of filtration rate at pores clogging of the filter by aqueous associates.

In the described below experiments the filters "a cyan strip", beforehand wetted in distilled water within one half-hour were utilized. The town water was withstood with day at room temperature and magnetized (1 m/s, 1000 oersteds). In particular time took from a portion (100 mls) and filtrated. Filtration rate scored in 2 minutes after a beginning of a filtration. On a figure 3 the results of three parallel experiments in a time dependence the after magnetization are shown. By triangles mark results of a filtration of a town water missed through a magnet gap in absence of a current in an electromagnet (the check). Each point on the diagram corresponds to filtering of a new portion of water through the fresh filter.

From a figure it is visible, that immediately after processing will be formed aquacellas with the size less than 1-3 microns freely transiting through the filter, which one are aggregated and in 10 minutes after processing reach the sizes sufficient to block pores of the filter, that gives in sharp diminution of filtration rate. In further aggregates become or too major (do not dive into pores of the filter) or, on the contrary, very small owing to fracture. The filtration rate again will increase. By results
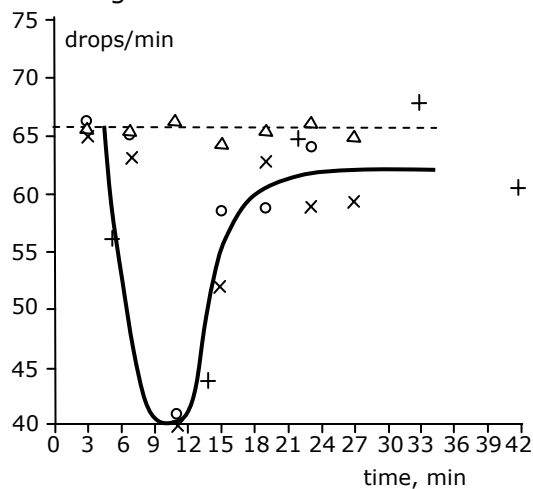

Fig. 3.

of this experiment it is possible to estimate counting concentration of aquacellas, forming the after magnetization of water, by accepting their size equal 1x1x0.1 microns. It has appeared not less than billion aquacellas in 1 cm^3.

Such experiment was realized also: immediately after processing the town water is filtered, thus the filtration rate has decreased all on 6% (in limits of an error of experiment), then the filtrate after 5-7 minutes again was filtered. The filtration rate has decreased already on 34 %, apparently, at the expense of enlargement aquacellas, past through the filter at the first filtration.

Resume

The magnetic field not "works", and only instigates formation of aqueous associates, i.e. plays a role of a trigger. At formation of aquacellas the energy is not spend, and is exude. The constitution can to itself be presented them as a solvate layer of colloid particles unfolded in a plane or contracted in a sphere. After formation aquacellas

coagulates, are enlarges, the stabilizing charge on their surface is neutralized the oriented structure of aqueous associates becomes labile and gradually aquacellas fail.

Because of low-level concentration aquacellas such properties of magnetized water, as viscosity, density, latent heat of vaporization etc. practically do not vary. At the same time, contained in it aquacellas will render clout on processes, bound with formation of new phases, adsorption, coagulation, and also in biological systems.

The author hopes, that the enunciated hypothesis will help the interested researchers to govern concentration of aquacellas in water from maximal up to zero, i.e. to learn secrets of "alive" and "dead" water.

References:

http://www.new-physics.narod.ru