BUILDING INDUSTRY APPLICATION

MagTech Pakistan (Pvt.) Ltd.

Introduction

First observations and scientific works on application of magnetic fields in the production of cement, ceramics, brick, casting forms, etc., were carried out in the former USSR, in 1962.

Other countries, including USA, almost did not participate in this field until 1980. However, convincing and irrefutable results were received by authorized Soviet and Russian scientists, including scientific-research institute "VNII Jelezobeton". These results were on the application of magnetic fields in construction industry and made scientists of America and other countries, change their views on magnetic technologies.

In the last few years, successful experiments that involved using magnetic technologies in construction industries were carried out. Experiments in other fields were also carried out by Baylor and Tulane Universities, by Standard Oil and Amoco Oil companies, by the Department of Defense USA and the Naval Construction Battalion Center. Obtained results allowed them to successfully use magnetic treatment of solutions.

Government of the Russian Federation, issued a decree No1058 on 14 October 1993 on a Federal Program "Application of magnetic fields in national economy", based on which, State Construction Committee of Russia, created a range of documents, ordering their organizations to use magnetic technologies. This decision was made in order to economize on cementing and ferro-concrete reinforcement, to increase cement product's strength, to increase life of constructions and to intensify various technological processes.

Brief description of the results, which are possible to obtain using magnetic technologies

HARDENING OF CEMENT CEMENT PRODUCTION

Additional advantages

In some cases, during production of cement and other construction materials, there is a deficit of fresh water. Many years' observations and practice show that application of our magnetic systems allows using salty and even seawater. When using magnetized seawater for cement kneading, cement strength increases by 30-40% and the economy on cement becomes 14%. However, application of seawater requires conducting certain procedures in order to eliminate incrustations in water-pipes and water-pump stations. Even though, this problem can be solved by additional installation of magnetic devices in water-supply system.

While transporting concrete mixtures on long distances, its plasticity decreases by 30-40%. This leads to concrete's inability to lay properly and increases energy expenses when electro-mechanical vibrators are used. In this case, it is wise to use our magnetic system, "KONMAG", designed for magnetization of ready-made concrete at industrial areas. One way of using "KONMAG" is shown on fig. 1. This technology allows not only to increase concrete's plasticity but, at the same time, allows to increase its resistance to pressure by 15-25% and tensile strength by 30-40%.

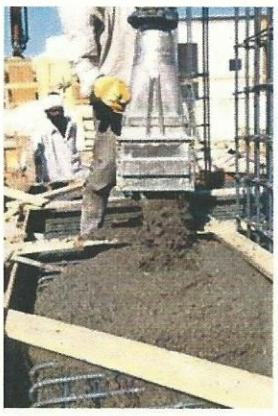


Fig.1. Magnetic system "KONMAG"

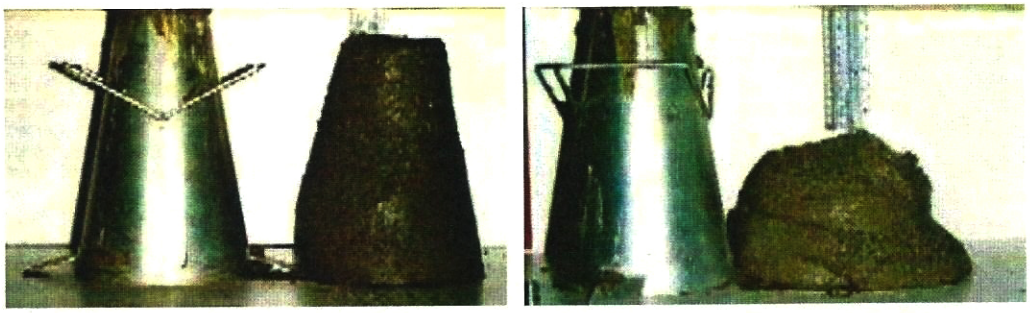
THEORETICAL MODEL OF IMPACT OF WATER, TREATED BY MAGNETIC FIELD, ON CONCRETE MIXING

One of the basic characteristics of magnetically treated water, which has major importance in concrete making, is its pertaining to colloidal particles and solutions. Like ion solution (colloidal cement solution is made with magnetized water), colloidal cement solution will contain colloidal particles, surrounded by a thinner dense layer of water mono-molecules as the number of mono-molecules drops at some regimen of magnetic treatment. Therefore, some reduction of water share in cement mixture is possible.

At the moment of fastening, there is a thinner hydrate layer between cement particles in magnetized water than in non-magnetized. Naturally, this thin layer will quickly react with the surface layer of particles, i.e. it will fasten quicker, but when hydrate layer is depleted, water diffusion inside particles stops due to lack of free water near the surface. At fastening the water, required for further hydration, water is forced out in the sample surface and from there its transfer to particles inside the sample gets very difficult. Due to this reason, cement (made with magnetized water), hardens quicker and gets strength faster on the initial stage. But, then, the speed of its hardening drops abruptly because it becomes difficult for water to reach particles. However, due to such process, porosity of cement rock reduces significantly and the final strength of concrete for compression and tension increases. Also laying of the concrete mixture becomes easier and significantly improves.

CEMENT PRODUCTION

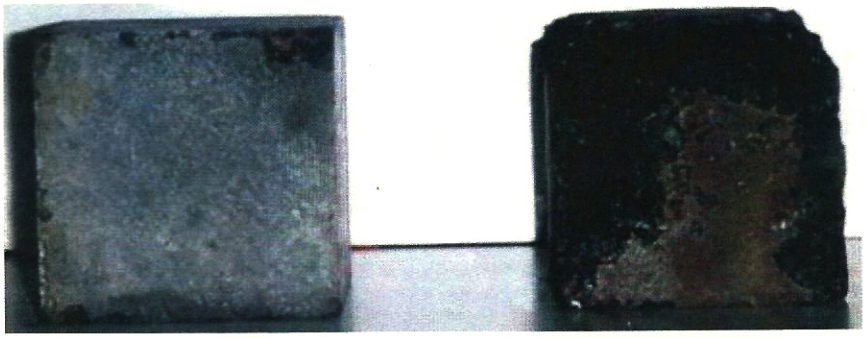
First of all, cement's plasticity increases when it is prepared using magnetic water. Plasticity levels depend on the qualities of cement glue and since magnetic treatment influences glue's qualities, then the level of cement's plasticity changes, as shown on fig. 1.



Cement prepared using normal water Cement prepared using magnetized water

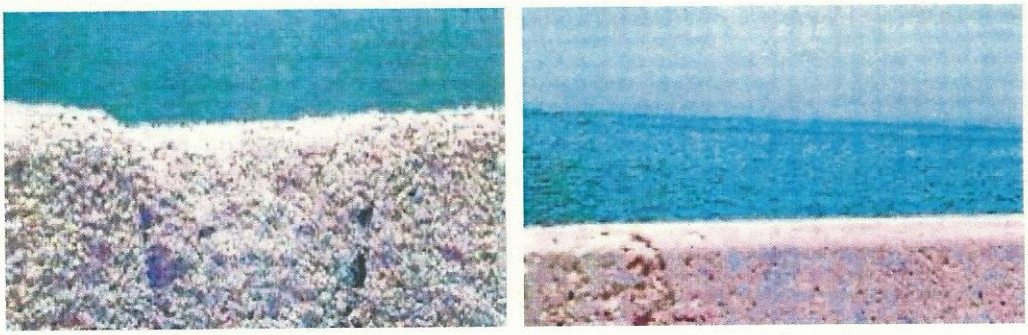
Fig. 1. Change in the plasticity level of cement.

When using magnetic water for kneading of cement, its strength increases by 10-20%, cement consumption decreases by 9-12%, and its mobility increases in some cases by more than 1,5 times.
Products made from cement, which is prepared using magnetic water, have higher resistance to outside forces, such as drastic temperature changes, humidity, salty and acidic environments, mechanical overload, etc.; as shown on figures 2, 3, 4, 5, 6.



Cement prepared using normal water Cement prepared using magnetized water

Fig. 2. Samples of cement after repeated freezing and de-freezing.



Normal technology Magnetic technology

Fig. 3. Change in the appearance of cement sea parapet after 5 years since it was installed. Black Sea, Sochi, Russia.

Made using normal water Made using magnetic water

Fig. 4. Highway precast pavement, 3 years old. Rostov- na-Donu, Russia.

Made using normal water Made using magnetic water

Fig. 5. Cement slabs on the highway, exposure to a wide range of temperature changes (summer - up to 40 C, winter - up to -40 C). One year after laying, Siberia, Russia.

Made using normal water Made using magnetic water

Fig. 6. Change in the structure of cement pavements, 5 years after it was made, Moscow, Russia.

CHOOSING MAGNETIC SYSTEM

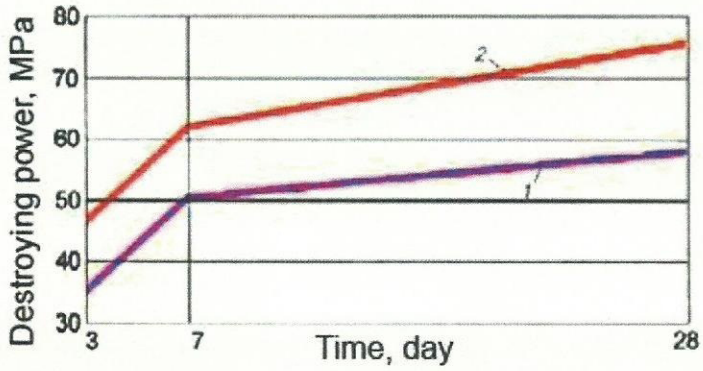
The choice of a magnetic system depends on the diameter of the water-pipe and the speed of water supplied to the dosing section of a concrete mixer of a factory. For example, if the diameter of a water-pipe is 2", and the speed of supplied water is not more than 20 liters/sec., then a device like KONMAG-2 should be used foe each dosing section of a concrete mixer.

Sequence of instalment

1. The chosen magnetic system should be installed vertically in the water-pipe that leads water to a serial measuring hopper of water.
2. During concrete mixture preparation, the system should be installed in the section of a water-pipe that supplies water to the mixer.

HARDENING OF CEMENT

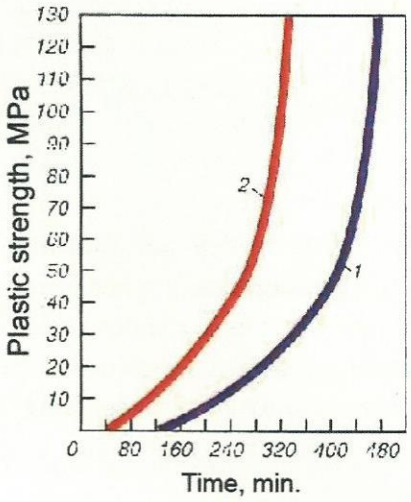
Using magnetic water in kneading of cement, results in a significant increase of rock's strength. Influence of magnetic treatment of water (used for kneading of cement), on rock's strength, while it is kept for long periods of time in normal temperature and humidity, shown on fig. 1.



1 - without magnetic treatment of water
2 - after magnetic treatment of water

Fig. 1. Influence of magnetic treatment of water on the increase of strength in cement rock.

1. As shown on fig.1, hardening process of cement rock significantly increases. This is due to an increase of speed formation of rock's plastic strength. Rock's plastic strength equals to the maximum tension of shear, based on the depth of metallic cone immersion in cement dough, as shown on fig. 2.



1 - without magnetic treatment of water
2 - with magnetic treatment of water

Fig. 2. Influence of water magnetization on the growth of plastic strength of cement rock.

2. Strength of cement rock depends on its structure. Examination of a 3-day-old cement rock under the electric microscope, showed that rock's structure in magnetic water, consists more of small grains, as shown on fig. 3.

Kneading by magnetized water Kneading by normal water

3. All of the above-mentioned changes that occur in cement rock change its physical and mechanical properties. Water resistance, resistance to cold and chemical resistance of rock, formed by using magnetic water, significantly increases.

SOME EXAMPLES OF MAGNETIZED WATER IMPACT ON CONCRETE MIXTURE

Impact of magnetized water on concrete strength at compressing

Water	Materials consumption, kg/m³				Water/cement ratio	Hardness, s	Cone settling, cm	Strength for compression after warm- humid treatment, mPa/%	
	Cement	Crushed stone	Sand	Water				1 day	28 days
Normal	400	1115	690	185	0.46	19	1.5	27.1/100.0	33.7/100.0
Magnetic	400	1115	690	185	0.46	11	2.5	27.7/102.0	40.7/120.8
Normal	460	915	725	230	0.5	16	6.0	24.5/100.0	35.3/100.0
Magnetic	460	915	725	230	0.5	9	12.0	26.6/108.6	41.6/117.8
Normal	405	1185	690	160	0.395	15	1.5	15.2/100.0	39.6/100.0
Magnetic	405	1190	690	154	0.38	15	1.5	20.0/131.6	44.0/111.1

4. Impact of magnetized water on concrete strength at tension

Water	Materials consumption, kg/m³				Water/cement ratio	Hardness, s	Cone settling, cm	Strength at 7 days, mPa/%	
	Cement	Crushed stone	Sand	Water				For compression	For tension at breaking
Normal	400	1170	680	164	0.41	12	-	39.5/100.0	2.48/100.0
Magnetic	400	1170	680	164	0.41	9	-	37.8/105.3	2.82/113.0
Magnetic	405	1185	690	158	0.39	11	-	39.0/108.6	3.17/128.0
Normal	385	1015	750	231	0.6	-	12.0	20.3/100.0	2.4/100.0
Magnetic	385	1015	750	231	0.6	-	14.5	21.9/108.0	2.7/113.0

5. As is seen from the above examples, tension strength is always higher than compression strength. In other words, ratio between tension strength at breaking and compression strength in concrete made with magnetized water increased by 25%. It can be explained by a more homogenous lattice of new formations of hydrated cement minerals, mixed with magnetized water. It is worth mentioning that the same phenomenon happens in ceramic materials. Increased tension strength of concrete leads to an extra effect of saving cement, additives and thermal energy when magnetized water is used for concrete, for which tension strength is vital.
6. But even when compression strength is the main factor for concrete, statistically relevant confirmation of increasing ratio of concrete tension and compression strength allows to increase calculated resistance of concrete at tension in standards for designing concrete construction. It would reduce rods' usage and the required value of their initial tension in elements of the first and second categories of crack- resistance. Requirements for horizontal rods, fixed as calculated for horizontal strength, for crushing and other cases would also drop. Reduction of rods' usage is approximately proportional to increasing of concrete tension strength.

Adverse effects of Salt on Concrete

Salt is hygroscopic. It attracts water. It can cause concrete to become more saturated than it would otherwise. The presence of extra water in freezing conditions within the concrete can spell trouble. As the additional water freezes as it expands, it creates pressure greater than can be with stood by the concrete.

In summer high concentrates of salt within the surrounding ground can also exaggerate the effect (Chemically), by producing more Alkali Silica Gel. Creation of the silica gel may initiate the concrete to crack but the greatest damage is caused by hydration of the silica/salt crystals expanding within the concrete.

Salt does not chemically react with hardened concrete. Salt does however lower the freezing point of water, attract moisture, and increase pressure of frozen water. Salt can also increase the freeze-thaw cycles if the temperature fluctuates between 15°F and 25°F. Concrete scaling can occur in the absence of salts too if there were problems at installation.
The better quality the concrete and placement, the less likely that salt's effects will have an adverse effect.

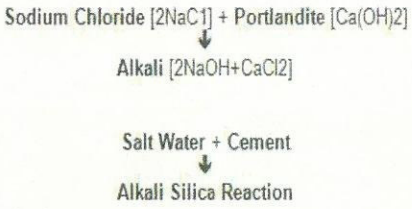


Fig.1 the Chemical Formula

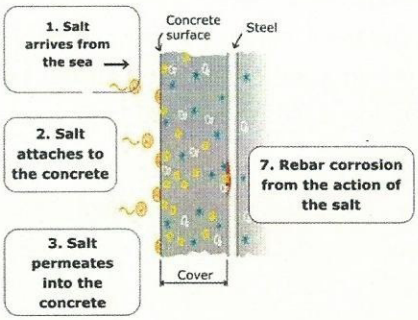


Fig.2 Salt arriving from the Sea or surrounding ground

A simplistic explanation of the chemical equation is:-

- When salt solution is mixed with the cement a reaction occurs.
- Cement produces an alkali solution.
- The aggregates used in the concrete may contain a reactive salt or silica.
- As a result a chemical reaction occurs, which is known as Alkali Silica Reaction.
- This reaction forms an Alkali Silica gel.
- Rain water is the next contributing factor.
- Silica gel is essentially porous sand.
- The silica gel absorbs water, expands and in turn can crack the concrete.
- Silica gel can absorb about 40 percent of its weight in moisture.
- Once these cracks reach the surface they provide channels for more water to penetrate deep into the concrete.
- The pressure created by the expanding silica gel is greater than both the aggregate and cement paste which form the concrete, therefore blast it apart.

Conclusion

Consequently excessive saturation of salt within the surrounding ground can potentially affect new and old concrete both in winter freezing conditions and during the summer with wet and dry conditions.

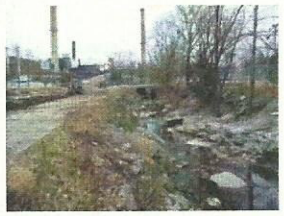
The potential benefit of desalination is that by removing a heavy concentrate of salt crystallisation from within the ground is beneficial to the Construction Industry and enables the safe use of concrete installations susceptible from premature corrosion attack by the presence of both a saline solution and salt crystals. Both Concrete and its metal reinforcing is at great risk from salt concentrates, which initiate concrete corrosion within footings, drainage, piles, and platforms, roads, pathways and ponds and swimming pools.

Flushing Contaminated Ground

We are presently experimenting with the flushing of contaminated ground with the magnetised water system.

Contaminated ground within brown field sites such as old industrial sites, waste disposal sites, flood polluted sites, tsunami inundated land, backfill and land reclamation sites and previous reclaimed mining and quarry sites, are all potential agricultural productive facilities or green field amenity areas or sporting playfield facilities or domestic gardens within urban and rural domestic or community developments.





Figs: Brown Field Sites

With the ever increasing demand for land for development and rehabilitation and the need for effective and fast reclamation, whether caused by industrial accident, land neglect, floods, tsunami or poor waste management, contaminated land counts for an ever increasing area of wasted prime land for agricultural or domestic use.




Figs: consequences of polluted grounds

In order to neutralise contaminates or imbalances within soils left by industrial use, wasted dumping, floods, storm surges or tsunamis, the established method is either to ignore and avoid, dig out and remove or indeed persevere with poorly inadequate very slow vegetation recovery only; or alternatively by policy leave the land fallow for decades, allowing the ground to naturally flush with rain waters with only partial results; all methods are costly and inefficient and potentially dangerous to human and animal health in the long term and do not meet the needs of environmentally friendly urban and rural re-development or post disaster recovery. In fact many of the contaminates are never released from within their 'dumped' state and remain contained within the soil.




Figs: flood & tsunami contamination consequences

Fig: Japan Tsunami engulfing greenhouses and agricultural land with surge of contaminated debris

The Solution

However we anticipate that with the use of the 'magnetic technologies' system of flushing procedures with magnetised water, the contamination is more effectively dissolved and dissipated, enhancing and speeding up the decontamination process multi-fold, releasing the valuable land for alternative environmentally friendly and green use and the sought after construction redevelopment decades before the previously normal expectations.

It is proven that Magnetised water penetrates soil faster, more efficiently and during the process we anticipate it will directly breaks down aggregates of contaminate molecules held within the ground, similar to the breaking down of salt crystallisations. The controlled and systematic flushing process with alternate dousing with magnetised modified water and non-modified water is expected to be far more efficient in purification of the ground and ground contents. Normal water, with its molecule suspension properties, is used to 'carry away' the broken down aggregates of contaminate molecules. In laboratory tests, magnetised water was observed to pass through soil faster and leaving less water retained within the soil; taking advantage of this fact, this combined alternate flushing process with both water types is anticipated to create an accelerated flushing of contamination away from the upper usable ground levels.

Consideration of the design of the setting up of the 'flushing' system is recognised as crucial, as it is necessary to avoid 'dumping' flushed contaminated water into clean water courses or drinking water sources. This can be controlled and monitored with prior ground investigations and initial land preparations. The advantages of proactive decontamination still remain enormous economically as opposed to traditional extended methods of dealing with the contaminated land.

Conclusion

The 'MagTech' system of ground decontamination

- Is environmentally friendly with no additives, detergents or chemicals, creating no side effects;
- It allows for a much faster process of decontamination;
- it is potentially a mobile system with devices having continued life span within phased decontamination of multiple sites;
- the apparatus can be converted to an irrigation system that equally benefits the growth of plants multi-fold [see the Agricultural applications data and the desalination brief above];
- it allows construction activities to proceed unimpeded from potential salt corrosion
- it is cost effective releasing land for environmental redevelopment years in advance;
- it is operational by any workforce with a planned systematic application programme.
- Brackish water can be use effectively and safely with additional benefits over sweet water
- saline contaminated water is systematically flushed during irrigation with magnetised water

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