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METHODS AND TOOLS OF CEMENT PRODUCTION PROCESS (COMPARATIVE ANALYSIS), POTENTIAL OF UZBEKISTAN IN THIS AREA

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controllability of optoelectronic devices and increases the sensitivity of such devices by several orders of magnitude.

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METHODS AND TOOLS OF CEMENT PRODUCTION PROCESS (COMPARATIVE ANALYSIS), POTENTIAL OF UZBEKISTAN IN THIS AREA

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Abstract: *the article describes the history of cement use, its initial appearance, cement composition and its physicochemical structure and properties, types of cement and classifications of cement. Cement production processes, technological methods used in production, advantages and disadvantages of the methods and technological stages of the*

production process by the drying method of cement production are covered. A study of the cement industry and processes in the country was conducted, which summarized the most priority methods and processes of cement production based on the natural resources, climate and potential of Uzbekistan.

***Keywords**: cement, ground volcanic alloys, calcined raw gypsum, pazzolon, lime, carbonate, aluminosilicate components, iron-containing additives, strength, corrosion resistance, frost resistance, wet method, drying method, combined method.*

Cement is a general term that refers to a powdery mixture that binds various mineral fragments or parts together as a whole. Cement is divided into many types depending on which joints are used in the cementing process. When used for construction purposes, the term "cement" refers to the bonding of stone, brick, sand, gravel, building blocks, etc. These types of cement mixtures are based on lime binders and are widely used in the construction industry and the general public during construction work (Figure 1) [1].

Figure 1. Appearance of construction cement.

The use of cement has a long history. The ancient Egyptians used calcined raw gypsum. On the other hand, the Greeks and Romans first used calcified limestone and later added water, sand, pieces of stone and marble to it. Mixes with added water have been used to add volcanic ash and ground volcanic alloys to the cement to prevent it from spilling into wet or watery areas after use. This was one of the first concrete performances. Examples include the arena of the Colosseum in Rome, the Pantheon, and the ruins of Pompeii, which were built in ancient times and have survived to this day (Fig. 2) [2].

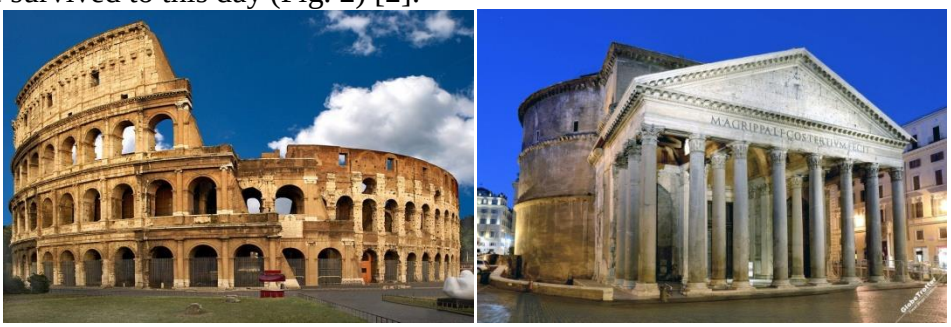

Figure 2. Arena of the Coliseum and the Temple of the Pantheon.

In the Middle Ages, the quality of the concrete mixes used decreased, and the demand for them began to disappear. This process continued until the middle of the 18th century, when a component of cement and aggregate processes was discovered. In 1756, John Smeaton was tasked with rebuilding the Eddiston Lighthouse on the Cornish coast. Then, while preparing the cement mixture, he suddenly discovers that the mixture of pazzolon and lime has the property of sticking (sticking together). John Smeaton was the first to understand the chemical properties of hydraulic cement.

Portland cement is a mixture of gypsum and other additives added to ground clinker formed with water in relation to a binder that hardens both in water and in air. Portland cement clinker is a fired raw mixture that has carbonate, aluminosilicate components, iron-containing additives and corrective elements, and the finished product contains calcium silicates (70-80%), aluminate and aluminoferrite phases (20-30%). ... Based on this, the following physicochemical process of mineralization occurs:

$$CaCO_3 + Al_2O_3 \cdot nSiO_2 \cdot mH_2O + Fe_2O_3 \xrightarrow{450^o} CaCO_3 + Al_2O_3 \cdot nSiO_2 + Fe_2O_3 \xrightarrow{900^o} CaO + Al_2O_3 + nSiO_2 + Fe_2O_3 \xrightarrow{>1200^o} 2CaO \cdot SiO_2 + 3CaO \cdot Al_2O_3 + 4CaO \cdot Al_2O_3 \cdot Fe_2O_3 \xrightarrow{1300-1450^o} 3CaO \cdot SiO_2 + 2CaO \cdot SiO_2 + 3CaO \cdot Al_2O_3 + 4CaO \cdot Al_2O_3 \cdot Fe_2O_3 = C_3S + C_2S + C_3A + C_4AF$$

The demand for cement in the modern construction industry is high, and the challenge is to make it easy to use even in cold, hot and dry, sandy and watery and other adverse weather conditions, and these include:

- **Strength -** a sample of a cast cement mix is determined by mechanical strength. The sample consists of ¼ cement and ¾ of pure quartz sand. The strength of the sample is checked using a measuring device for the action of a mechanical force measuring 10x10x10 cm;
- **Thickening time (pumpability)** - this is the time during which the cement slurry can be pumped and displaced into the annulus (i.e, the slurry is pumpable during this time). The slurry should have sufficient thickening time to allow for mixing, pumping and displacement before the cement sets and hardens in the annulus. Generally 2-3 hours thickening time is enough, including a safety factor to allow for delays and interruptions in the cementing operation [3, 4].
- **Corrosion resistance -** the ability of the hardened concrete to resist aggressive chemicals and hydroxides. To increase corrosion resistance, polymer components are added during the production process, which reduce the porosity of concrete;
- **Cure time** - a characteristic that depends on the cure rate, especially at low temperatures. Added gypsum and other additives to speed up the curing process;
- **Frost resistance** - wood mixtures or sodium abietate are added to the cement to increase the number of freeze and thaw cycles[5].

Various additives are added to the cement depending on the above required functions. For this, the composition of cement is divided into several grades, classes and types, depending on the place, condition and purpose in which it is used.

Cement is produced in grades M200 - M600, depending on its strength. This value is mainly determined by the effect of a force in the range of 100-600 kg / cm² (10-60 MPa) on a half of the cement alloy prism sample (Table 1).

Three types of technological processes are used in the global cement industry today:

- wet method;
- drying method;
- combined method.

1 Table.

Classification and marking of cement

Class	Grades	Boundary point	
		MPa	kg / cm²
B7,5	M100	7,5	100
B15,0	M200	15,0	200
B22,5	M300	22,5	300
B32,5	M400	32,5	400
B42,5	M500	42,5	500
B52,5	M600	52,5	600

It should be noted that the drying method technology is mainly used in foreign countries such as Egypt, Turkey and China. In the Russian state, the predominantly wet method is in the lead. Local cement plants use wet method and drying method technology. For example, the Jizzakh and Sherabad cement plants of the Almalyk MMC, opened jointly with the Turkish government, use a drying method based on modern technologies.

Cement production technology by drying method. The main advantage of this technological process is that this production process differs from other technological processes, mainly from the wet method, by the energy savings in the production of clinker. Figure 3 below shows all technological stages of the drying method.

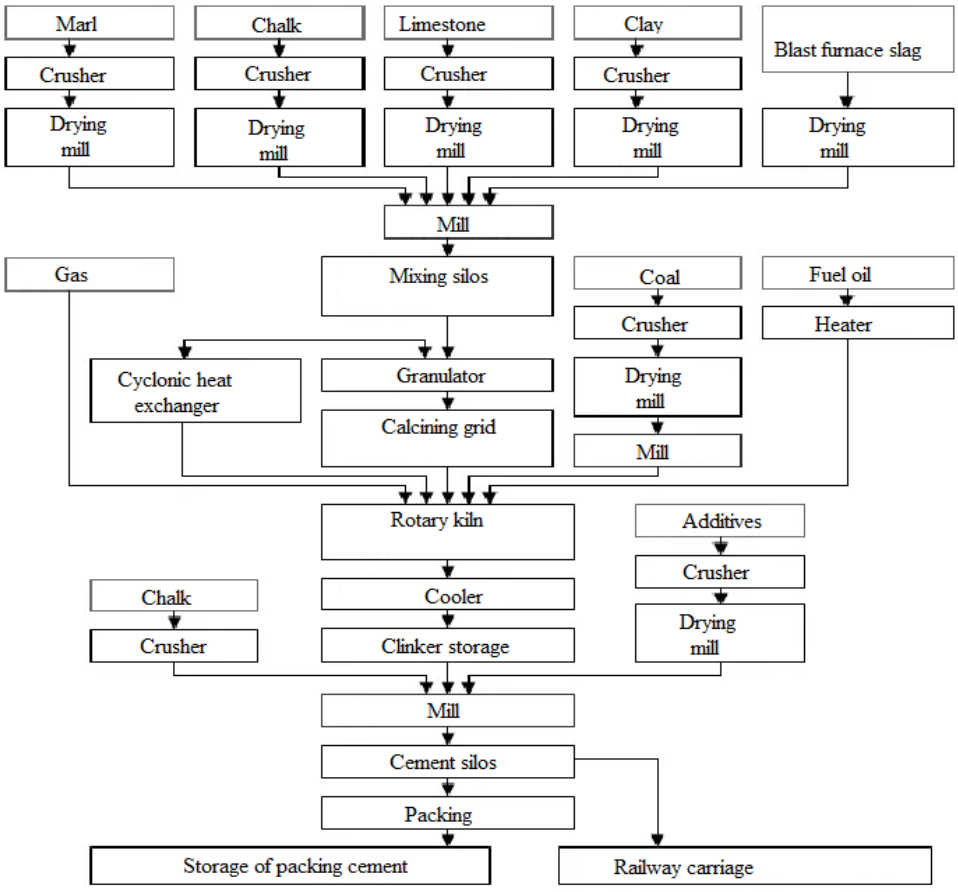

Figure 3. Technological stages of the drying method.

The main advantages of the drying method:

- energy saving for clinker burning - within 2900-3700 kJ / kg;
- due to the fact that the gas volume of the furnaces is 30-40% less, energy saving and energy saving during drying is ensured through its use in the production of secondary clinker when drying raw materials;
- no need for water;
- due to the high productivity of the furnaces used in this technological process, they have a production capacity of 3000-5000 tons of cement per day, which is 1-2 times higher than the production capacity of the wet production technology.
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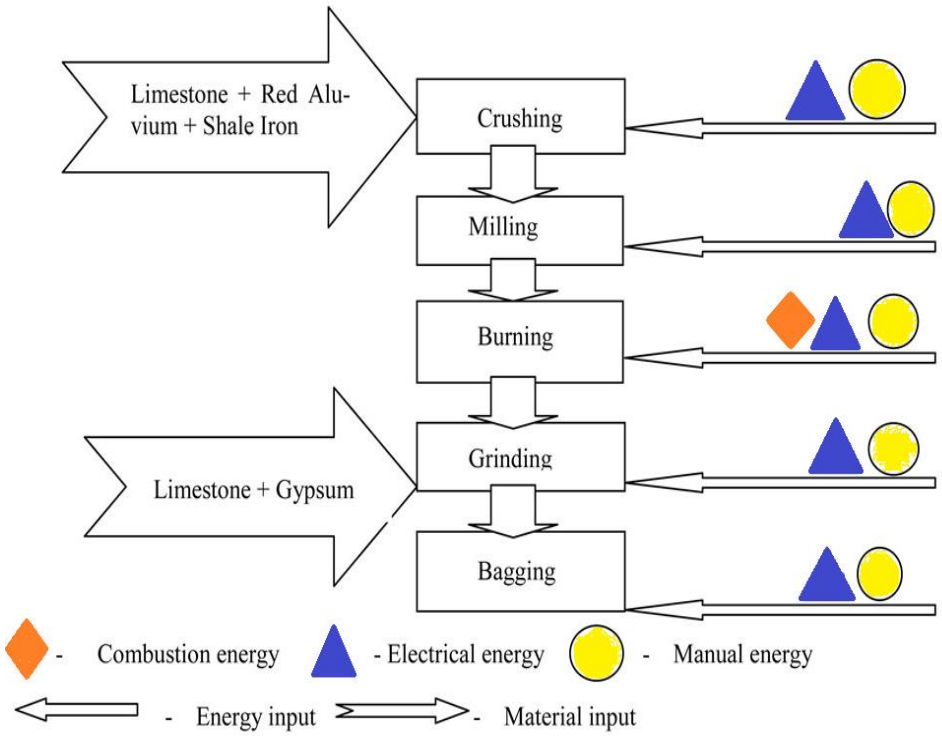

Figure 4. Energy consumption of cement production process.

The rate of human growth on the planet is increasing, which, in turn, leads to an increase in the need for spontaneous consumption of resources. One of the global challenges facing humanity today is the wise use of resources. Therefore, the emphasis is on savings across the board. Not only savings in the industry, but also product quality. Much attention has also been paid to raising the level of production, and a number of advances have been made in increasing the ratio of production with less resource consumption.

In the field of cement production, the most optimal and efficient solution is the construction and operation of cement plants, the technology of which is based on the drying method, based on sonar and resource reserves of Uzbekistan. The main advantages of this method are that it does not require large reserves of water (it allows to build factories even in problem areas without water), and the demand for energy fuel is much lower.

Of course, this provides a significant saving of state reserves of resources. The biggest disadvantage of cement processing plants based on this method is the dust they release into the environment. Of course, this can be partly harmful to the environment, but judicious use of filtration systems will help reduce the damage done. As is the case with the environmental requirements of many industrial plants and factories, it is desirable to have cement processing plants using the drying method, of course, further away from residential areas.

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