SIR Publishers
CENTER FOR INTERNATIONAL SCIENTIFIC PUBLICATIONS
JOURNAL OF AGRICULTURE AND LIFE SCIENCES
ISSN(Online): 2984-6706
SJIF Impact Factor | (2023): 5.988 |
Volume-6, Issue-4, Published | 20-11-2023 |

METHODS OF OBTAINING BOTH CEMENT AND ELEMENTARY PHOSPHORUS FROM PHOSPHORITES

https://doi.org/10.5281/zenodo.10206469

Egamberdiev M.S
Department of Hydrology and Ecology
Professor

ABSTRACT

Fertilizers are very useful for agricultural crops, they are well absorbed; secondly, both the anion of the acid (in the form of a nitrogenous compound) used in the decomposition of phosphates, as well as the microelements contained in phosphates, are included in the composition of the fertilizer, therefore, in the mentioned method, so to speak, no waste is produced.

Key words

yellow phosphorus, phosphorus sulfide, phosphorite ores, hypophosphate, clay-soil cement, bauxite, coke, nitrogen, potassium, trace elements.

Full and effective use of natural resources is considered one of the important issues of modern science and technology. Especially in new industries, using raw materials consisting of mixtures of many components, it creates complex industrial waste. The amount of the main useful part is very small compared to that of the waste (about 1-30%). Phosphorus, aluminum, nickel, copper and other industries are examples of this.

As we mentioned above, for 15 years now, in the chemical industry, superphosphate, especially phosphorus, has been obtained on a large scale from low-phosphate ores by the thermal method. The removal of phosphorus from phosphate ores during the electrothermal process has become an economically viable method for the production of yellow phosphorus. Yellow phosphorus is widely used in various sectors of the national economy. It is the main raw material in the production of red phosphorus, phosphorus anhydride, phosphorus sulfide, chlorine compounds of phosphorus, hypophosphate, special pure phosphorus, organic compounds, concentrated secondary and enriched superphosphate, etc. This method is widely used because almost all phosphorite ores can be processed. But the amount of waste is increasing accordingly. For each ton of yellow phosphorus produced, 12-15 tons of rock waste is produced. Clearing the factory yard and organizing the rock collection will increase the price of each ton of elemental phosphorus.

JOURNAL OF AGRICULTURE AND LIFE SCIENCES
ISSN(Online): 2984-6706
SJIF Impact Factor | (2023): 5.988 |
Volume-6, Issue-4, Published | 20-11-2023 |

Let's consider the reaction of thermal separation of elemental phosphorus in the presence of reducing carbon from natural phosphates, ignoring additional reactions:

$Ca3(PO4)2+5C=P_2\uparrow+5CO\uparrow+3CaO$ (1)

As a result of the reaction, a gas mixture and a solid residue - calcium oxide are formed. This reaction is endothermic, an irreversible reaction that absorbs most of the heat. It is also heterogeneous. As a result of the interaction of solid rocks, solid and gaseous products are formed.

The reaction starts at a temperature above 1100°C. The reaction rate increases as the temperature increases and the particle size of the starting material decreases. In addition, the reaction depends on what reducing agent is used. If coke is used, the reaction is faster than with anthracite under the same conditions. The essence of this is that the coke crystals are smaller than in anthracite.

The solid calcium oxide formed during the reaction reacts with silicon oxide at high temperature to form calcium silicate (tricalcium silicate) in the form of a liquid rock:

3CaO+2SiO2=Ca3Si2O7 (2)

In addition, the main reaction proceeds faster in the presence of silicon (IV) oxide. Therefore, there should be enough of this substance in the refrigerator.

First of the additional reactions, we will consider the reaction based on the presence of fluorine in the crystalline form of fluorine apatite. Fluorine apatite decomposes under the influence of carbon, forming calcium phosphate and calcium fluoride, which reacts with silicon oxide:

2SaF2+SiO2 = 2SaO +SiF4 (3)

Silicon fluoride is the starting material from which various fluorine compounds are obtained. The raw material contains iron oxide Fe2O3. Iron is released during this process

Fe2O3+3S=2Fe+3SO (4)

and after interaction with phosphorus, liquid ferrophosphorus occurs, which does not mix with rock:

SIR Publishers
CENTER FOR INTERNATIONAL
SCIENTIFIC PUBLICATIONS
JOURNAL OF AGRICULTURE AND LIFE SCIENCES
ISSN(Online): 2984-6706
SJIF Impact Factor | (2023): 5.988 |
Volume-6, Issue-4, Published | 20-11-2023 |

4Fe+R2=2Fe2P. (5)

In factory conditions, efforts are usually made to obtain as much phosphorus as possible with little energy per product unit, to speed up the process, and to use by-products appropriately.

The temperature at which phosphorus is released from the compound is optimal. What determines temperature? The process is carried out in electric furnaces - the frost is heated due to the flame of the electric arc and the resistance of the frost. The steel shell of the furnace is lined with acid and refractory materials, coal blocks and refractory bricks. It is desirable for the furnace to work for several years without major repairs, and if the temperature rises above 1500...1600°C, the furnace will fail quickly.

The oven is a continuous operating device. At certain times, the slurry is brought in, as well as occasionally rock and ferrophosphorus, and the gas is constantly discharged. This gas is about 25% phosphorus, the rest being carbon(11) oxide and impurities, particularly silicon tetrafluoride. At the same time, only a small amount of dust comes out of the oven. The temperature of the gas coming out of the oven is close to 400°C.

Prepare raw materials and fuel in this case, as in other heterogeneous processes ash: consists of grinding and sorting of flakes of certain sizes (no more than 25 millimeters). In this, small and large pieces are separated.

By the way, the widespread use of electrothermal method of phosphoric acid production was hindered by high consumption of energy. How is the issue of relative reduction of energy consumption being solved? Isn't it possible to partially replace the relatively expensive electricity with heat from fuel combustion? It is preferable to preheat the charge using the heat generated from the combustion of SO, a byproduct of the reaction. In this, moisture evaporates, carbonate and organic matter decompose, that is, an endothermic reaction takes place, absorbing a large amount of energy. Another way to reduce the relative consumption of electricity is to increase the size of the ovens. The power of the current furnaces is 70 MW, and the planned ones are up to 100 MW (compare these numbers with the power of power plants). Due to the preliminary preparation of the slag and the enlargement of the furnaces, the electric energy used to obtain 1 ton of phosphorus has decreased by almost one and a half times, making 12.5 kWh.

How to isolate pure phosphorus? Undoubtedly, first of all, it is necessary to thoroughly clean the gas from dust in electric filters. In order to keep phosphorus from condensing, electric filters are heated from the outside with furnace gas - the combustion product of carbon 11 oxide. Cleaned gas is cooled directly with water to 60°C. Condensed phosphorus is placed in special gas-collecting containers, and a

JOURNAL OF AGRICULTURE AND LIFE SCIENCES
ISSN(Online): 2984-6706
SJIF Impact Factor | (2023): 5.988 |
Volume-6, Issue-4, Published | 20-11-2023 |

water jacket is put on it, from which water flows continuously. About 92% of phosphorus is obtained.

Concentrated carbon 11 oxide is not only a good fuel, but also a valuable chemical raw material. Ferrophosphorus is used in metallurgy.

It is known that stone is a waste product of several technological processes that take place at high temperatures. Not all types of rocks are used enough. At present, the blast furnace rocks of the coal metallurgical industry are used more.

The possibilities of using the stones of the smelting and non-ferrous metallurgical industries have not yet been fully explored. Rocks formed during electrothermal phosphorus production are almost not used. These rocks are very similar to the rocks that form in the domna in terms of their properties and characteristics. We are sure that such stones will be useful and cheap materials for construction.

In the future, large-scale plants for electrothermal fertilizing of phosphorus will be launched in southern Kazakhstan, for example, in the cities of Shymkent, Jambul, and Turkestan. Currently, the last turn of the Shymkent and Jambul factories has been commissioned.

We have developed the technology of obtaining portland cement clinker simultaneously with phosphorus from Karatog phosphorite and poor phosphorites of Uzbekistan.

It is known that the electrothermal driving of phosphorus and the formation of portland cement clinker is carried out at 1400...1500°C. The uniformity of temperature and the mixture of raw materials, i.e., the ability to change the chemical composition of the resulting stone, made it possible to obtain the stone in the form of portland cement clinker, encouraged our scientists to conduct research in a completely new way. Based on the same way, a complex technology of taking phosphorus and cement together was developed. According to this technology, phosphorite is obtained instead of limestone, which is one of the main components of Portland cement. Calcium oxide released as a result of driving phosphorus forms portland cement minerals with silicon and aluminum oxides. Coal soot was used as a reducing agent, and Portland cement clinker was obtained, which was very strong in a hermetic high-temperature laboratory furnace at 1300...1500°C. Having studied the composition and properties of this portland cement in various ways, it was found that it is very similar to ordinary portland cement. This work requires a lot of research. As they say, if you find lime, the snow will burn, so the properties of using phosphates can be increased 10 times.

Phosphorus captured in flue gas is indistinguishable from gas captured by existing phosphorus technology. Thus, it was found that both Portland cement and phosphorus can be obtained from phosphorites at the same time. Thus, two major

JOURNAL OF AGRICULTURE AND LIFE SCIENCES
ISSN(Online): 2984-6706
SJIF Impact Factor | (2023): 5.988 |
Volume-6, Issue-4, Published | 20-11-2023 |

industries, the phosphorus and portland cement manufacturing industries, were working together. Now the phosphorus furnace has also become a "home" for cement. Stone, which is a synonym of waste, garbage and waste, has become a valuable material - clinker.

Metallurgists, energy workers and chemists, we can say with full confidence that it will not take long for our country to produce not only metal, electricity and chemical products, but also high-quality cement along with the main product.

One method uses apatite concentrate, bauxite and coke, which are formed during the enrichment of natural apatites to obtain clay cement and phosphorus. When frost melts in an electric furnace, phosphorus is reduced and released. The rest of the clay rock has a percentage of R2O5 and 0.7 % will be F. The quality of the resulting cement does not differ from that of standard giltuprock cement.

Therefore, integration of the cement industry with other sectors is effective and promising.

REFERENCES:

1. Atakuziev TA, Tadzhieva DF, Mirzaev FM, Use of sulfate-containing additives for obtaining high-strength cement stone. Thesis doc. Republican meeting "Status, prospects of development and application of chemical. Additives for concrete in conditions of Uzbekistan». Tashkent, 1982.

2. Atakuziev TA, Iskandarov MI, Khasanov RS, Mirzaev FM. Tampon expanding cement based on sulphoaluminate-silicate (SAC) clinker. DAN UzSSR, 1982, No. 2.

3. Egamberdiev M.S., The influence of sulfoclinker additives on the properties of Portland cement, Finland Academic Research Science Publishers, 2023,
652-658 c.

4. Chemistry and technology of special cements (I.V. Kravchenko, T.V. Kuznetsova, M.T. Vlasova, B.E. Yudovich. M.: Stroyizdat. 1979.

5. Kuznetsova T.V. Aluminate and sulfoaluminate cements. Moscow: Stroizdat, 1986.

6. Atakuziev T.A. Physico-chemical research of sulfate-containing cements and development of low-temperature technology for their production. Tashkent: Science, 1983.

7. Atakuziev T.A. Mirzaev F.M. sulfomineral cement based on phosphogypsum. Tashkent: Science, 1979. 152 p.

8. Atakuziev TA, Mamazhanov R., Mirmuminov M. M., Yusupov R. Tension cement based on sulfoaluminate-silicate clinker. "Construction and architecture of Uzbekistan", 1979, No. 7.