International Journal of Applied Research 2020; 6(5): 353-357

ISSN Print: 2394-7500
ISSN Online: 2394-5869
Impact Factor: 5.2
IJAR 2020; 6(5): 353-357
www.allresearchjournal.com
Received: 25-03-2020
Accepted: 28-04-2020

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Development of technology for producing magnesium hydroxide from dry mixed salts of Karaumbet Lake

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Abstract
The results of studies of the processing of solutions containing sodium chloride and sodium sulfate and magnesium obtained from the dry mixed salts of Lake Karaumbet to magnesium hydroxide are presented. The processes of neutralization of the purified solutions with sodium and calcium hydroxides, precipitation and filtration of magnesium hydroxide were studied. Optimum technological parameters were established, a basic technological scheme and norms of the technological mode of magnesium hydroxide production were developed.

Keywords: Dry mixed salts, neutralization, sodium and calcium hydroxides, sedimentation, filtration, magnesium hydroxide

Introduction

Magnesium connections are used in many industries [1, 2]. In the absence of own manufactures of magnesium connections in Republic the requirement for them is completely provided at the expense of import. The requirement of Republic for magnesium connections makes about 100 thousand т to per year. Uzbekistan has huge stocks of raw materials for reception of magnesium connections. One of such kinds of raw materials are the dry mixed salts (DMS) Karaumbet [3].

Despite the big requirement for magnesium connections, presence of a powerful raw-material base they in Republic are not made because of absence of comprehensible technology for domestic raw materials. Therefore the researches directed on working out the technology of processing DMS Karaumbet with reception of magnesium connections are very actual.

For the purpose of involving DMS of Karaumbet lake in industrial production there are conducted researches in order to establish optimum technological parameters of reception magnesium hydro-oxide with passing extraction of accompanying components.

Objects and methods

For experiments are used DMS of Karaumbet lake, structure, (weights. %): Na_2SO_4 - 58,13; NaCl - 18,81; $MgCl_2$ - 15,30; $MgSO_4$ - 0,42; $CaCl_2$ - 0,31; н.о. - 6,98; H_2O - the rest. The chemical analysis on the maintenance of the basic components in solutions, distillated liquids, growth solutions and a firm phase are conducted by known techniques [4-6].

Results and their discussion

Earlier were influence of technological parameters on process dissolution DMS in water depending on parity T: J and duration of process is investigated, at temperature 25°C, in constant speed of hashing. The solutions: containing chlorides and sodium and magnesium sulphates are received and studied allocation process of mirabilit from solutions by a method freezing [7].

In view of the high residual maintenance of sulphates after sedimentation and a filtration mirabilit (1,56-1,96%) solutions have subjected to additional cleaning from sulphates in distillated liquid - with a withdrawal of soda manufacture of structure (weights %): Na^+– 2,18; Mg^{2+}– 0,007; Ca^{2+}– 3,03; $C1^-$– 8,74; SO_4^{2-}– 0,03.

Processes of additional cleaning of solutions from the residual maintenance of sulphates with the help of distillated liquids are studied at stoichiometric to norm on sedimentation of sulphates as a dihydrate calcium sulphate. The cleared solutions are as a result received, which the chemical and salt structure are resulted in table 1.

Table 1: Structure of the cleared solutions of the dry mixed salts used for reception hydro-oxide of magnesium

Chemical compound, weights %					Salt structure, weights %			
Na^+	Mg^{2+}	Ca^{2+}	$C1^-$	SO_4^{2-}	$MgC1_2$	NaC1	$CaSO_4$	$CaC1_2$
3,43	0,87	0,09	7,80	0,06	3,41	8,70	0,09	0,26

Further are conducted research on sedimentation hydro-oxide of magnesium from cleared solutions DMS hydro-oxides of sodium and calcium. The obtained data is resulted in drawing 1.

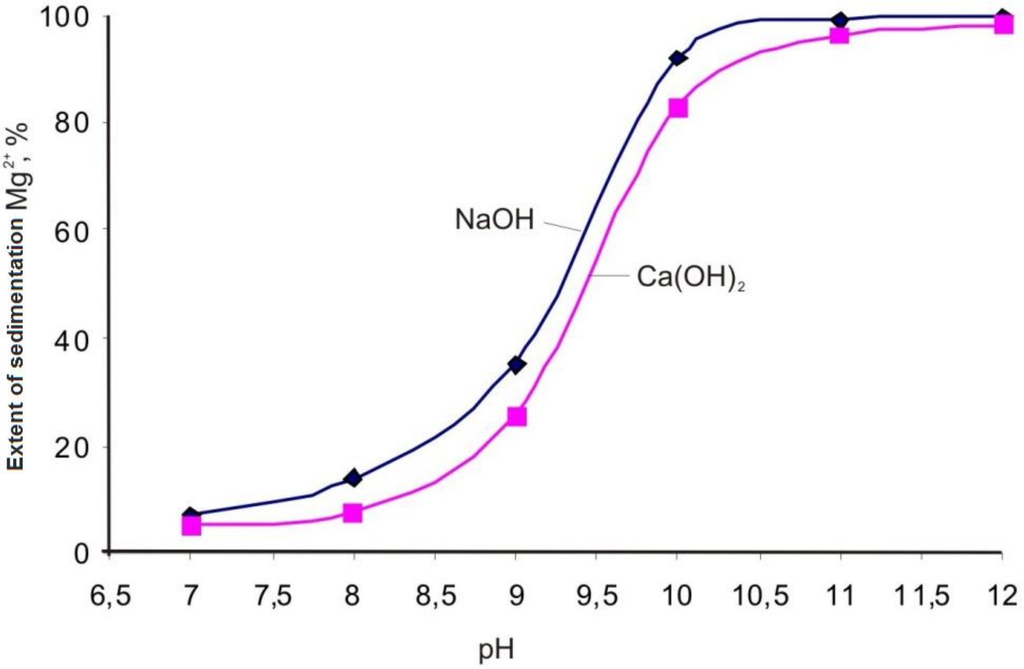

Fig 1: Influence pH environments on degree of magnesium sedimentation

Under production conditions to supervise norm of the expense hydro-oxides of sodium and calcium is easier on pH. Therefore influence pH on sedimentation degree of magnesium hydro-oxide is studied. Experiences on sedimentation of magnesium hydro-oxide from the cleared solutions are performed at temperature 25 °C and constant hashing within 10 minutes.

Apparently from drawing, at increase pH environment to 8 quantity of the magnesium which has dropped out in a deposit does not exceed 10-12 %. With increase pH to 10 in a deposit passes more than 80 % of magnesium from the initial maintenance. The maximum degree of magnesium sedimentation is observed in limits pH 10, 5-11.

Are studied rheological properties of solutions before and after magnesium hydro-oxide sedimentation with hydro-oxides of sodium and calcium. The data on density and viscosity of solutions depending on temperature is presented in tab 2.

Table 2: Rheological properties of desulfurized solutions DMS before and after branch magnesium hydro-oxide

No	Sediment reagents	Density, g/sм^3			Viscosity, мPa·c		
		20 °C	40 °C	60 °C	20 °C	40 °C	60 °C
1	-	1,1824	1,1688	1,1650	2,1051	1,5831	1,2911
2	NaOH	1,1604	1,1568	1,1540	3,5519	2,4822	1,6369
3	$Ca(OH)_2$	1,1571	1,1564	1,1490	4,4439	3,3908	2,0210

With the rise of temperature from 20 wasps to 60 wasps of density desulfurized solutions DMS change from 1, 1824 to 1, 1650 g/sm3 of Density of solutions after sedimentation of magnesium hydro-oxide with hydro-oxides of sodium change with 1, 1604 to 1, 1540 g/sm3, and at sedimentation with hydro-oxide of calcium about 1, 1571 g/sm3 to 1, 1490/sm3 Sedimentation and branch magnesium hydro-oxide lead to density decrease of growth solutions. At 20 °C viscosity of solutions after sedimentation and branch magnesium hydro-oxide raise with 2,1051 мPa·c to 3,5519 мPa·c and to 4,4439 мPa·c for hydro-oxides sodium and calcium, accordingly. Temperature rising to 40 °C promotes to decrease viscosity of DMS solutions to 1, 5831 мPa·c and to 1, 2911 мPa·c at 60 °C, to 2, 4822 мPa·c and 1, 6369 мPa·c in case of sedimentation sodium hydro-oxide and to 3, 3908 мPa·c and 2, 0210 мPa·c calcium hydro-oxide. All these solutions possess good rheological properties.

In drawings 2 and 3 the block diagramme of complex processing DMS and the basic technological scheme of reception magnesium hydro-oxide from solutions DMS, after branch mirabilit are presented.

According to the technological scheme (fig. 2) a solution received from DMS is pumped over in saving capacity (poses. 2) by the submersible pump (poses 1). A distillated liquid from «the white seas» is pumped over in saving capacity of distillated liquids (poses. 5) by the submersible pump (poses 4).

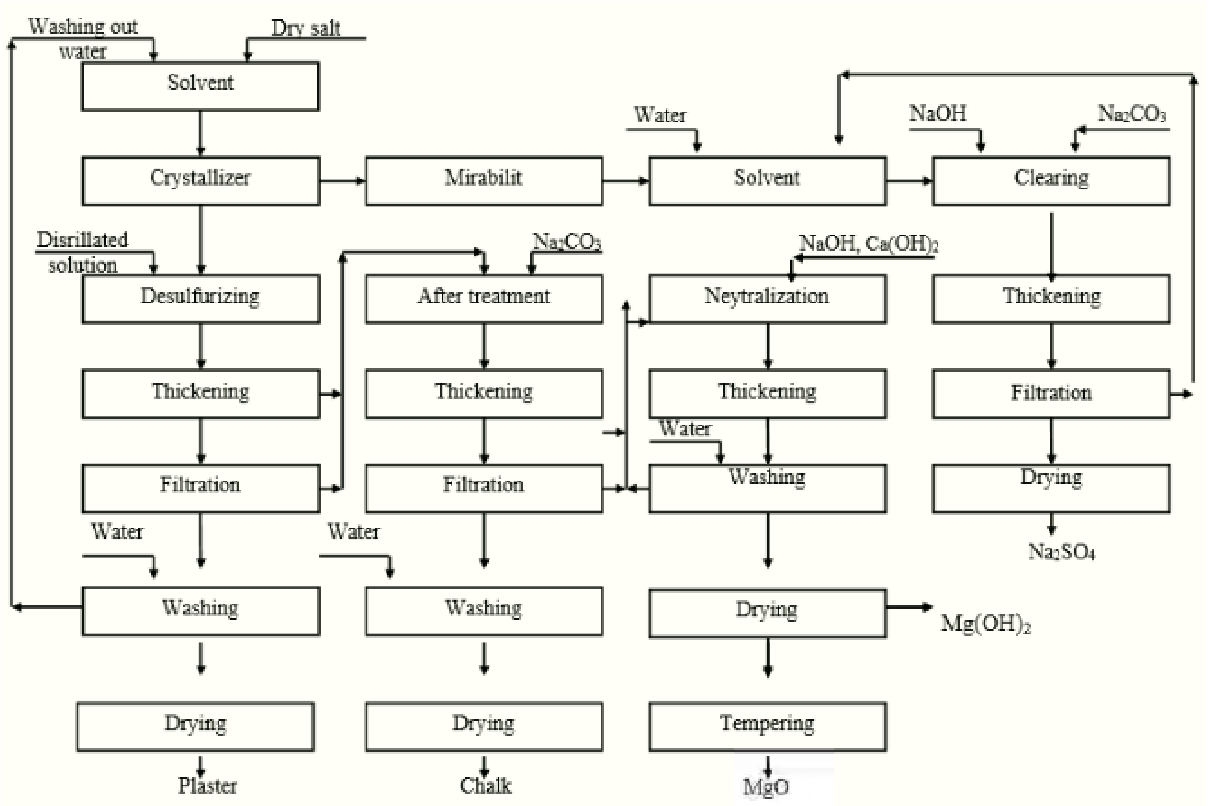

Fig 2: The block diagramme of complex processing DMS

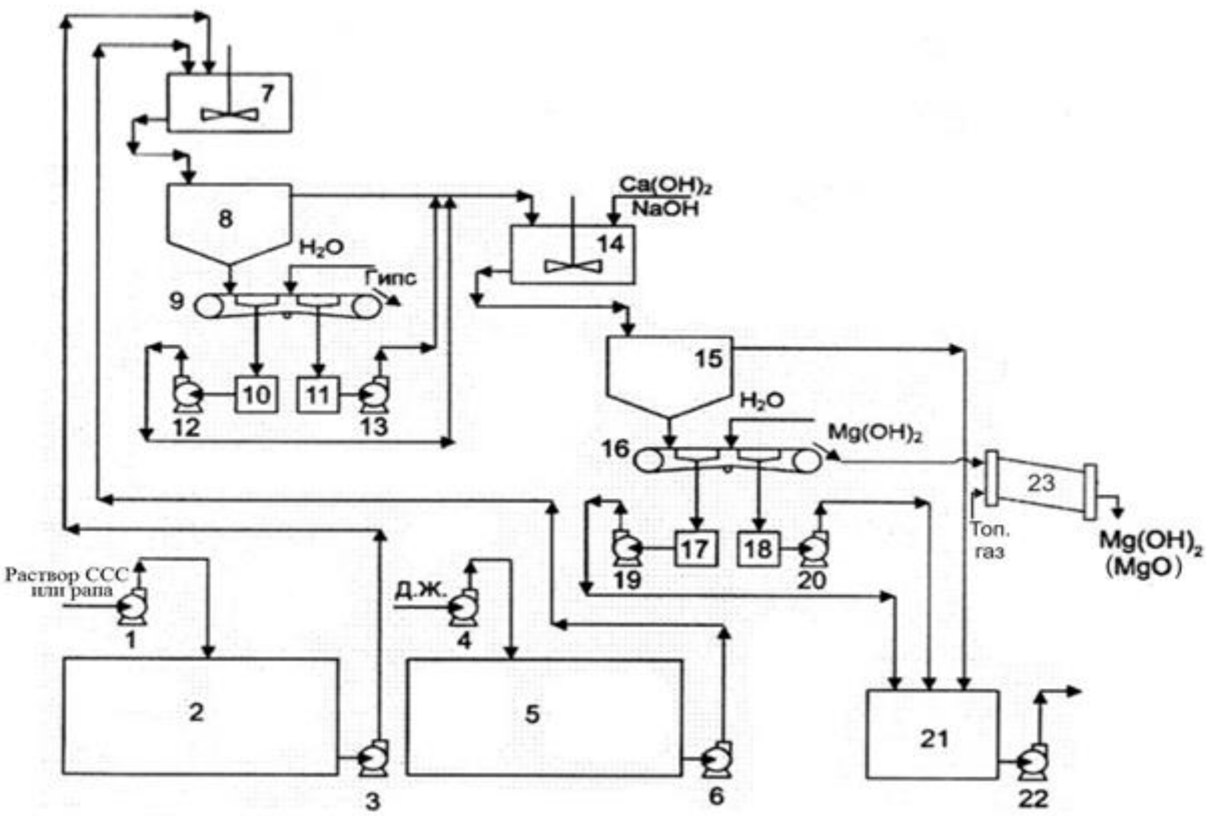

Fig 3: The basic technological scheme of manufacture magnesium hydro-oxide from the solutions received from DMS Karaumbet

From saving capacity (poses 2) DMS solution after allocation mirabilit with the help of centrifugal pump (poses 3) it is pumped over in the reactor desulfurized (poses 7), the representing device of capacitor type supplied with a mixer. There with the centrifugal pump (poses. 6) is moves distillated liquid from saving capacity (poses 5). In the reactor occurs the process of desulfurizing from the desulfurization reactor (poses 7) suspension goes to a sediment bowl by gravity - a thickener of conic type (poses. 8). Suspension of plaster from a conic part of a sediment bowl - a thickener (poses. 8) moves on tape vacuum-filter (poses 9) where there is a division of phases. Suspension is well filtered. Speed of a filtration on a dry deposit makes 600-800 kg/m2.ch.

The basic filtrate gathers in the collection (poses. 10). Plaster on the filter is washed out by a condensate in juice steam in the ratio plaster: water = 1:1. The basic filtrate from the collection (poses 10), washing waters from the collection (poses 11) by centrifugal pumps (poses. 12, 13) are moved in the reactor-precipitator (poses. 14), There also moves the clarified part of a solution from a sediment bowl-thickener (poses 8). In the reactor (poses. 14) happens a sedimentation of ions of magnesium as a magnesium hydro-oxide with hydro-oxides sodium or calcium.

Suspension of magnesium hydro-oxide from a conic part of a thickener moves on tape vacuum-filter (poses 16) where a division of phases is took place. Speed of a filtration on a dry deposit makes 75-100 kg/m2.ch. The basic filtrate gathers in the collection (poses 17). Magnesium hydro-oxide on the filter is washed out by water at a ratio hydro-oxide of magnesium: water = 1:1 and moves in airing drum (poses 23). Washing waters after a filtration gather in the collection of washing waters (poses 18). The basic filtrate from the collection (poses 17) and washing waters from the collection (poses 18) centrifugal pumps (poses 19, 20) are delivered to the collection of a solution of sodium chloride (poses 21) where also is delivered the clarified part of a solution from a sediment bowl-thickener (poses 15). Further a brine of sodium chloride from the collection (poses 21), by the pump (poses 22) is sent to evaporator station for reception of sodium chloride or to manufacture calcined soda, for reception of the brine of sodium chloride cleared from impurity.

Performed experiments on опытно-промышленной installation which simulates working conditions and norms of the expense and technological parameters of process of processing of lake Karaumbet DMS on magnesium hydro-oxide are established. The received results are presented in table 3.

Table 3: Norms of the expense and technological parameters of process of processing of Lake Karaumbet DMS

Stages and flow reagents	Technological indexes			
	Expense, of production t/t	Temperature °C	Duration min	Other indexes
Dissolve of lake Karaumbet DMS				
Expense of lake Karaumbet DMS	10,71			
Expense of water	32,13			
Ratio J:T				3:1
Dissolve processing		20-30	20-30	
Cooling and filtration suspension				
Cooling process		20-40	15-20	
Speed of filtration				150-230 kg/m^2*h
Exit NO.	0,75			
Refrigeration of solution				
Refrigeration process (mirabilit)		-5 - +5	30	
Filtration mirabilit				
Filtration speed in hard phase				4234-5486kg/m^2*h
Exit of mirabilit	11,996			84-86%
Exit of solution ($MgCI_2$, NaCI and etc)	30,094			
desulfurized solution				
Molar ratio Ca^{2+} / SO_4^{2-}				1,00-1,05
Expense of distillated solution	16,52			
Process of desulfurized		20-30	15-30	
Standing and filtration of suspension				
Stand process		20-30	10-20	
Filtration process of thickened part				650-750 kg/m^2·h
Exit of chemical precipitating plaster	1,05			
Precipitation of hydro-oxide magnesium				
Expense of NaOH	1,38			
molar ratio Mg^{2+} / $2OH^-$				1,00-1,05
precipitation process of hydro-oxide magnesium		20-30	30-60	pH - 10,5-11,0
Cooling and filtration suspension				
Cooling process of hydro-oxide magnesium		20-30	90-120	
Filtration Speed of thickening part				200-300 kg/m^2·h
Exit of hydro-oxide magnesium	1,0			
Exit of solution containing NaCI	45,95			

Reception process of magnesium hydro-oxide consists of stages:

- Preparation of solution DMS.
- Branch of the insoluble in water rests.
- Allocation and a filtration mirabilit.
- Additional cleaning of solutions DMS from sulphates.
- Sedimentation magnesium hydro-oxide with hydro-oxides sodium or calcium.
- A suspension condensation of magnesium hydro-oxide.
- Deposit branch magnesium hydro-oxide.
- Drying and casing magnesium hydro-oxide.

During tests optimum technological parameters of process have been established and experimental batches magnesium hydro-oxide are received, a chemical compound (weights %): Mg (IT) 2-93,90; SO_4^{-2} - 0,05, F_2O_3 - 0,012; CaO - отс.;

н.о. - 0,01; the rest at crops on a sieve with a grid № 014К - 0,04. The product corresponds to all requirements of norm of GOST.
Thus, the conducted researches have allowed to obtain the scientifically-proved data and to develop technology of processing of lake Karaumbet DMS on magnesium hydo-oxide with passing reception chemically besieged dehydrate sulphate and a calcium carbonate (plaster and a chalk) and a table salt solution.
The solution of table salt received after sedimentation $Mg(OH)_2$ with the help of NaOH, it is possible to use for manufacture of calcined soda as a brine by a method of Solve that allows to increase degree of sodium chloride using and to lower the expense of water on manufacture calcined soda. A solution received after sedimentation magnesium hydro-oxide with hydro-oxide of calcium, containing sodium and calcium chlorides, is returned on a stage desufurized initial solution DMS.

Conclusion
Thus, the conducted researches have shown basic possibility of processing of lake Karaumbet DMS with reception of the solutions of sodium chlorides and magnesium which are cleared of impurity, suitable for the further processing on magnesium hydro-oxide and its other connections. For this purpose it is necessary to finish cleaning DMS solution from the residual maintenance of sulphates distillated liquid at stoichiometric norm, to separate dehydrate calcium sulphate, to neutralise a solution with hydro-oxides sodium or calcium, to separate magnesium hydro-oxide.
Optimum technological parametres of process of reception magnesium hydro-oxide from desulfurized solutions are established, norms of a technological manufacture mode are established the block diagramme and the basic technological scheme of complex processing of lakes Karaumbet DMS is offered.

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