

RESEARCH ON OBTAINING A SECONDARY PRODUCT OF THE SODA ASH PRODUCTION PROCESS FROM MIRABILITE OF THE TUMRYUK MINE - AMMONIUM SULFATE SALT

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<https://doi.org/10.5281/zenodo.6815729>

Abstract. The process of obtaining soda on the basis of Mirabilit is a technology without waste, as a result of the conversion, ammonium sulfate is formed. Ammonium sulphate is an excellent fertilizer for folk remedies. This mineral fertilizer, which holds nitrogen and sulfur in itself, dissolves well in water and prolongs well from the roots of the usimites and does not wash away as a result of rain.

Keywords: mirabilit, sincinized soda, conversion, ammonium sulfate, mineral fertilizer, technological scheme.

ВТОРИЧНЫЙ ПРОДУКТ ПРОЦЕССА ПРОИЗВОДСТВА КАЛЬЦИНИРОВАННОЙ СОДЫ ИЗ ТУМРЮКСКОГО МЕСТОРОЖДЕНИЯ МИРАБИЛИТ. ИССЛЕДОВАНИЕ ПО ИЗВЛЕЧЕНИЮ СОЛИ СУЛЬФАТА АММОНИЯ

Аннотация. Процесс получения соды на основе Мирабилита - это технология без отходов, в результате конверсии образуется сульфат аммония. Сульфат аммония - отличное удобрение для народных средств. Это минеральное удобрение, которое удерживает в себе азот и серу, хорошо растворяется в воде и хорошо вытягивается из корней усимитов и не смывается в результате дождя.

Ключевые слова: мирабилит, кальцинированная сода, конверсия, сульфат аммония, минеральное удобрение, технологическая схема.

ТУМРЮК КОНИ МИРАБИЛИТИДАН КАЛЬЦИНАЦИЯЛАНГАН СОДА ИШЛАБ ЧИҚАРИШ ЖАРАЁНИНИНГ ИККИЛАМЧИ МАХСУЛОТИ - АММОНИЙ СУЛЬФАТ ТУЗИНИ ОЛИШ ТАДҚИҚОТИ

Аннотация. Мирабилит асосида кальцинацияланган сода олиши жараёни чиқиндисиз технология бўлиб, конверсия натижасида аммоний сульфат ҳосил бўлади. Аммоний сульфат халқ хужалиги учун муҳим ўғит ҳисобланади. Ўзида азот ва олтингугурт тутган бу минерал ўғит сувда яхши эрийди ва усимликлар илдизи томнидан яхши узлаштиради ва ёмғир натижасида ювилиб кетмайди.

Калит сўзлар: мирабилит, кальцинацияланган сода, конверсия, аммоний сульфат, минерал ўғит, технологик схема.

INTRODUCTION

An analysis of the research data makes it possible to conclude that the optimal conditions for the transformation of mirabilite into sodium bicarbonate and ammonium sulfate are as follows: ammonium bicarbonate rate - 100-105%, concentration of circulating ammonium sulfate solution – 0-10%, the temperature 30-40°C, L : S – (2,5-3):1. Under these conditions, the conversion level is above 85% and the concentration of the obtained ammonium sulfate (31-36%) is considered sufficient for its processing into a dry product.

To obtain pure salt $(\text{NH}_4)_2\text{SO}_4$ in the working solution, the ratio $(\text{NH}_4)_2\text{SO}_4 : \text{Na}_2\text{SO}_4$ must be at least 8 : 2, also the amount of water H_2O should not be less than 55% (Figure 1). Under these

conditions, pure $(\text{NH}_4)_2\text{SO}_4$ and a working solution containing E_0 circulating in the conversion process are obtained.

MATERIALS AND METHODS

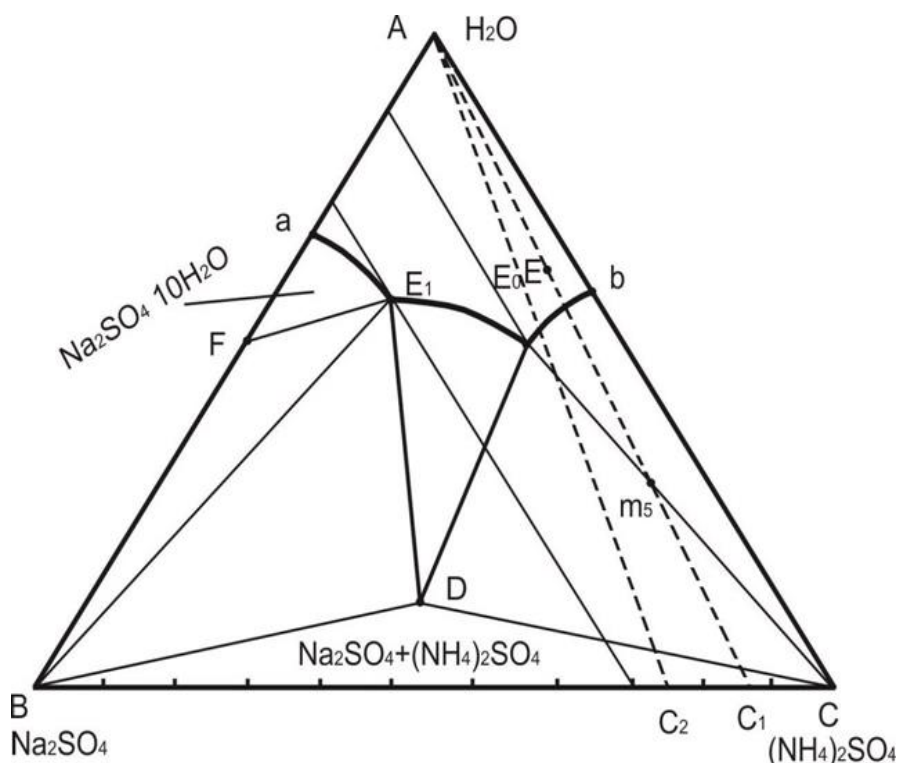


Figure 1. Na_2SO_4 - $(\text{NH}_4)_2\text{SO}_4$ - H_2O system solubility isotherm

Based on the above, to determine the effect of technological parameters on the evaporation process, samples 1 and 7 given in Table 2 were used, where the amount of ammonium sulfate in the working circulating solution is 0 and 10%. The level of evaporation in relation to the initial mass is from 10 to 60%, the chemical composition of the liquid and solid parts, as well as the rheological properties of the suspension after evaporation, are determined (Table 1)

Table 1

Chemical composition of the liquid and solid parts after the evaporation process

№	Evaporation level, %	Solid Part Components, %		Liquid Part Components, %			
		SO_4^{2+}	NH_4^-	SO_4^{2+}	NH_4^-	CO_2	Na^+
Concentration of the circulating solution 0%							
1	10	77,10	28,91	34,93	13,13	5,84	4,18
2	20	69,65	26,47	32,78	11,25	6,74	4,82
3	40	70,30	26,72	33,21	10,66	10,23	7,32
4	60	71,04	26,42	25,33	9,52	15,12	16,39
Concentration of the circulating solution 10%							
1	10	77,12	29,58	34,41	16,45	6,07	4,79
2	30	78,10	29,53	34,95	16,05	10,51	8,29
3	50	71,06	27,01	38,24	17,54	16,71	15,33

RESULTS

With an increase in the level of evaporation when using the 1st sample, the ratio L : S decreases from 81.51 to 0.37, and in the 7th sample, the ratio of liquid and solid phases changes in the range of 1.27-18.05. In the liquid part, the amount of NH_4^- decreases, the amount of Na^+ and CO_2 increases. The solid part mainly consists of ammonium sulfate.

The mineralogical composition of crystals formed by physicochemical analysis has been determined. Roentgenographic method determined intense lines ($d = 3,05; 3,86; 4,37; 2,986$), peculiar only to ammonium sulfate (Figure 2).

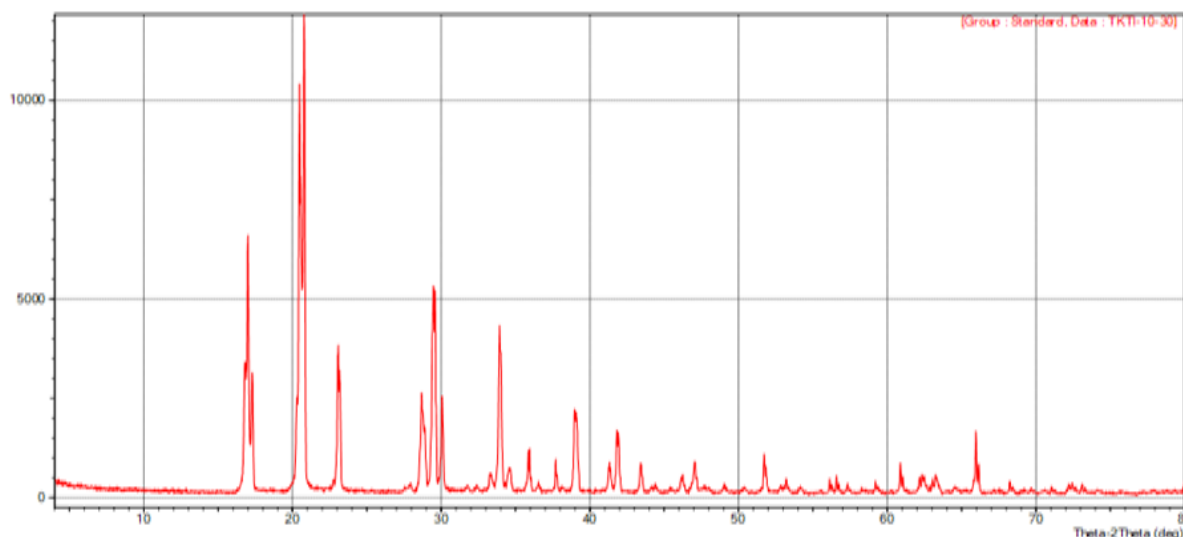


Figure 2. Roentgenogram of ammonium sulfate crystals obtained as a result of evaporation

The rheological properties of the suspension obtained in the conversion of a solution of purified sodium sulfate with ammonium carbonate salts, temperature, the ratio of the liquid and solid phases of sodium sulfate salting with soda ash in a wide range during the evaporation of the working solution, technological parameters depending on the concentration of the liquid part were studied. The compliance of the rheological properties and filtration of the resulting suspension in the studied intervals with the technological requirements was determined.

DISCUSSION

To dissolve mirabilite in water, it is placed in the reactor (1). The process lasts 20-30 minutes at a temperature of 35°C. The obtained solution is sent to a drum filter (2) for cleaning from insoluble waste and sand. Purified saturated sodium sulfate solution is subjected to conversion in the reactor (5) with ammonium bicarbonate from the absorber (3) and carbonization column (4). The conversion process lasts 40 minutes at a temperature of 25-35°C. The suspension formed during the conversion process consists mainly of sodium bicarbonate and ammonium sulfate, as well as sodium and ammonium carbonates. This suspension is sent to a drum filter to separate the solid part from the liquid part (6). The separated solid part (7) is repulped with clean water, and sodium bicarbonate is formed, purified from sodium sulfate and ammonium salts. The liquid part formed during the conversion process consists mainly of an ammonium sulfate solution and partly of a sodium sulfate solution. The liquid part is evaporated to 35-45% in the evaporator(9). In the drum filter (10), solid ammonium sulfate crystals are separated, which are sent to the warehouse as a finished product.

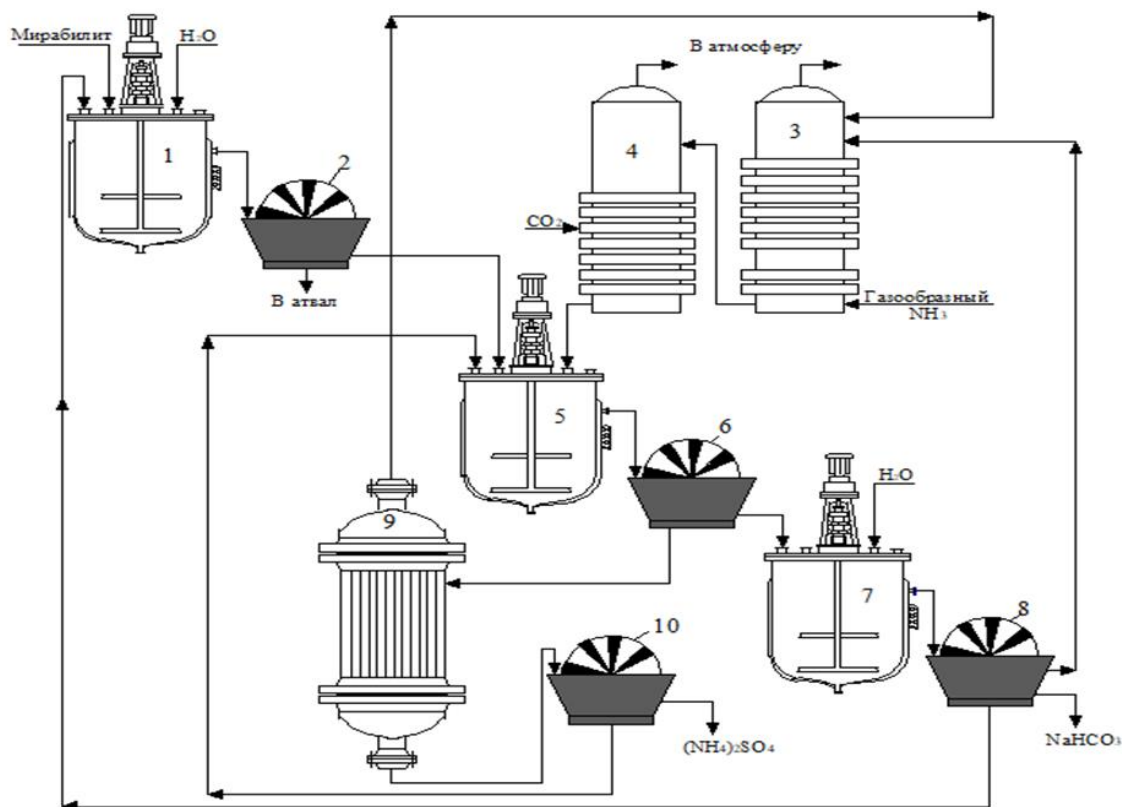


Figure 3. Technological system of mirabilite conversion.

1, 5, 7 – reactors; 2, 6, 8, 10 – drum filters; 3 – absorber column; 4 – carbonization column; 9 – evaporator.

CONCLUSIONS

On the basis of laboratory studies and the results of experimental production, favorable factors of the process were identified, a technological scheme was proposed, the material balance and economic efficiency were calculated.

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