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OBTAINING DETERGENTS FOR TECHNICAL PURPOSES BASED ON «SUPER-ALKALI» AND ACTIVE ADDITIVES

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Abstract

The optimal formulations of technical cleaners are determined. Experimental data of the article allow us to conclude that alkaline solutions containing surfactants contribute to the removal of oily stains, since under their action fats are «saponified».

Keywords: super-alkali, surfactant, sodium metasilicate, ammonium polyphosphate, ammonium monophosphate, detergents and cleaning products, alkaline.

Today in the world, the use of modern technologies in acceleration of the development of industry, the solution of environmental problems, the production of competitive and environmentally friendly substances is becoming an actual problem. In recent years, on the basis of new developments, innovative approaches, there has been an increase in the production of products necessary for industry.

One of the main directions of economic development of Uzbekistan is the development of natural resources, their integrated use and the creation of competitive import-substituting products based on local raw materials. The chemical industry is the base industry, which is in close relationship with all sectors of the economy. Therefore, the development of the chemical industry is a priority task for the modern development

of the economy of the Republic of Uzbekistan. One of the chemical products is powdered detergents (PD), the need for which is steadily increasing due to the development of industries of the national economy that consume detergents. The market for detergents and cleaning products includes the following segments of the market of household chemical goods: synthetic detergents (SD), bleaches and products that complement the action of laundry detergent, as well as cleaning products.

The effectiveness of a detergent and the quality of cleaning a metal surface largely depends on the properties of the treated surface - its roughness, sensitivity to the corrosive effect of the detergent, the presence of oxides on the surface, its homogeneity [1].

In order to reduce corrosivity and increase the detergency of prepared compositions of PD for technical purpose, active additives were added to the «super-alkali» ratio of $\text{Na}_2\text{CO}_3:\text{NaOH}=6:4$ as which sodium metasilicate, surfactant and ammonium phosphates

were used (table 1). The amount of 40% sodium metasilicate varied from 10.0 to 68.0%, surfactants from 2 to 8%, and the ammonium phosphate solution (containing 15% P_2O_5) ranged from 0 to 20%.

Table 1 Formulation detergents for technical purposes

Sample numbers	The content of components in the formulation, %				
	Sodium metasilicate	Super-alkali	Surfactants	Ammonium polyphosphate	Monoammonium phosphate
1	68	30	2	-	-
2	30	68	2	-	-
3	20	78	2	-	-
4	10	88	2	-	-
5	30	66	4	-	-
6	30	62	8	-	-
7	10	88	2	5	-
8	10	88	2	10	-
9	10	88	2	20	-
10	10	90	-	-	-
11	10	90	-	5	-
12	10	90	-	10	-
13	10	90	-	20	-
14	10	90	-	-	5
15	10	90	-	-	10
16	10	90	-	-	20
17	20	78	2	-	10

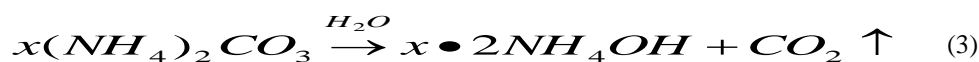
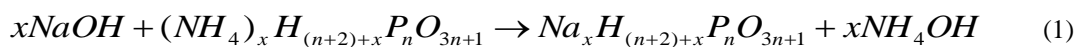
The study of pH dependence on the formulation and solution concentration shows that with increasing solution concentration from 1 to 20% in all formulations, pH values increase from 8.2-9.72 to 10.07-11.93; For samples PD 1-4 (table 1), an increase in the content of sodium metasilicate from 10 to 68% leads to a decrease in pH from 9.2 to 8.2 ($\Delta\text{pH}=1$) for a 1% solution. This pattern is preserved for all concentrations of solutions.

Increasing the content of surfactants in the compositions of samples 4-6 from 2 to 8% also leads to a decrease in pH from 9.2 to 8.63 in 1% solution. The reason for lowering the pH of solutions for technical use

of PD are low pH values of initial solutions of sodium metasilicate and surfactants (7.0 and 4.4 respectively).

When the content 0-20% of ammonium polyphosphates in samples 4, 7, 8 and 9 the pH 1% solution rises from 9.2 to 9.64; 9.66; 9.72 respectively.

The effect of polyphosphate additives on the pH of the formulation is more evident when preparing a 20% solution of samples 4, 7, 8 and 9. With an increase in the content of the polyphosphate additive in the solution from 0 to 20%, the pH increases by 0.52-0.63. This is explained by the following chemical reactions occurring with the addition of polyphosphates with the formation of products that increase the alkalinity of the medium:



Studies on the effect of PD on the foaming process (table 2) showed that an increase in the content of sodium metasilicate from 10 to 68% leads to a decrease in the height of the foam from 7.3 to 4.2 mm at a 1%

solution concentration. With a higher concentration of solution, the height of the foam increases to 5.2 and 9.0 mm, respectively, for samples 1 and 4.

Table 2

Functional indicators of samples depending on the composition of the formulation and the concentration of solutions at a temperature of 40°C

Table sample numbers 1	pH					Foam height, mm					Detergency, %				
	Concentrations of solutions														
	1	5	10	15	20	1	5	10	15	20	1	5	10	15	20
1	8.20	8.63	9.09	9.56	10.07	4.20	4.40	4.70	4.90	5.20	22.50	24.80	27.28	30.01	33.01
2	8.34	8.78	9.24	9.73	10.24	4.80	5.10	5.30	5.60	5.90	38.75	42.50	44.75	46.20	46.20
3	8.74	9.20	9.68	10.19	10.73	6.40	6.70	7.10	7.50	7.90	41.25	43.40	43.70	45.00	46.65
4	9.20	9.68	10.19	10.73	11.30	7.30	7.70	8.10	8.50	9.00	46.13	47.38	48.63	49.88	52.05
5	8.79	9.25	9.74	10.25	10.79	12.00	12.60	13.30	14.00	14.70	39.50	40.33	41.15	41.98	42.80
6	8.63	9.08	9.56	10.07	10.60	15.40	16.20	17.10	18.00	18.90	40.25	42.10	43.95	44.68	45.80
7	9.64	10.07	10.53	11.00	11.49	17.20	18.10	19.10	20.10	21.10	53.50	56.63	59.75	62.14	65.75
8	9.65	10.16	10.70	11.26	11.85	18.00	18.90	19.90	21.00	22.10	71.73	74.86	78.00	81.03	79.64
9	9.72	10.23	10.77	11.34	11.93	19.30	20.30	21.40	22.50	23.70	58.37	59.96	61.41	63.72	65.48
10	9.17	9.44	9.83	10.51	10.78	7.00	8.10	8.80	9.40	9.70	36.75	39.50	41.75	44.80	44.80
11	9.51	9.93	10.35	10.89	11.24	4.10	4.90	5.60	6.40	7.10	40.40	42.00	44.05	45.15	47.80
12	9.60	9.98	10.24	10.87	11.29	5.20	5.70	6.10	6.80	7.60	37.50	42.50	44.80	48.15	54.28
13	9.64	10.17	10.57	10.88	11.04	6.40	7.00	7.50	8.30	8.70	38.40	40.19	42.75	44.20	46.20
14	9.22	9.63	10.04	10.56	10.90	4.30	5.20	5.90	6.80	7.50	53.87	56.00	58.73	60.20	63.73
15	9.31	9.68	9.93	10.54	10.95	5.50	6.00	6.50	7.20	8.10	50.00	56.67	59.73	64.20	72.37
16	9.35	9.86	10.25	10.70	11.01	6.80	7.40	8.00	8.80	9.20	51.20	53.59	57.00	58.93	61.60
17	8.83	9.30	9.79	10.30	10.84	12.10	12.70	13.40	14.10	14.80	41.67	42.55	43.41	44.29	45.15

With an increase in the content of surfactants in the formulation, the height of the foam doubles. For example, with increasing surfactant content from 2 to 8% (samples 4-6) the height of the foam increases from 9.0 to 18.9 mm at a 20% concentration of solutions.

Polyphosphates contribute to a still greater increase in the height of the foam (three times) - from 9.0 (sample 4 of table 2) to 23.7 mm (sample 9 of table 2).

Their washing ability also depends on the composition of PD. The increase in the content of sodium metasilicate in the composition of PD from 10 to 68% reduces their washing ability, and the concentration of solutions increases. For example, the cleaning abilities of samples 4 and 1 are 46.13; 47.38 and 22.5; 24.8% respectively, at a concentration of solutions of 1 and 5% (table 2).

A similar dependence is observed for sample 3, whose washing ability increases from 41.25 to 46.65% with an increase in the concentration of the solution from 1 to 20%.

Polyphosphates have a more complex effect on the detergency of PD (samples 2, 5 and 6 table 2). With an increase in the content of polyphosphates in these samples up to 10% increases washing ability. When the concentration of polyphosphate is reached up to 20%, a decrease in detergency is observed, the values of which are almost identical with those of 5% polyphosphate.

An increase in the surfactant content has practically no effect on the washing ability (samples 2, 5 and 6 of table 2).

Thus, the experimental data allow us to conclude that alkaline solutions containing surfactants contribute to the removal of oily stains, since under their action

fats are «saponified». Usually, chemical bleach acts on the spots of plant origin and its effectiveness increases with increasing temperature and concentration of the activator-bleach.

But in the studied formulations there is no chemical bleach, however, the combined action of the component components exhibit high detergency (table 2) and at the stage of soaking remove colored stains (coffee, herbs) [3].

In our experiments (table 2), samples containing sodium metasilicate and phosphate compounds exhibit enhanced detergency and, at the soaking stage, remove various stains. It should be noted that when using sodium metasilicate, the antiresorption ability of the formulation appears better (samples 1-7) than when using phosphates (samples 7-9, 11-16).

Thus, the optimal compositions of technical detergent correspond to samples 7, 8, 9 and 15.

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