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OBTAINING INSULATOR FOAM FOR AMMONIA WHICH COULD BE USED IN CASE OF AMMONIA TANK ACCIDENTS

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ABSTRACT
Preventing environmental pollution trough safety measures and intervention in case of technological process accidents is world wide actuality problem.
Ammonia obtained in fertilizer industry, before his use in various technologies, is stocked under pressure in special ammonia tanks, their constructive and operating mode is enough complex to be expose to different types of damages that could produce a major chemical accidents.
This paper presents the researches for technology elaboration in obtaining of insulator foam for ammonia tanks in case of their damage and to establish the diffuser type and proper installation for foam dispersion.
The use of this protective foam on ammonia tank increase exploitation safety and remove, in case of damage, the losses in human life.
Keywords: insulator foam, ammonia, depollution, safety, ammonia tank accidents

1. INTRODUCTION
Preventing environmental pollution trough safety measures and intervention in case of technological process accidents is world wide actuality problem.
The primary responsibility of the management of a hazardous chemical site is the prevention of accidents resulting in harm to human health, the environment or property [1].
Ammonia obtained in fertilizer industry, before his use in various technologies, is stocked under pressure in special ammonia tanks, their constructive and operating mode is enough complex to be expose to different types of damages that could produce a major chemical accidents [2, 3].
Present protection systems in our country in case of a major emergency are not very efficient, consisting mainly in a concrete protection tank witch include in the middle a gasometer and a watering system. This protection way doesn't resolve ammonia atmospheric emission in case of important storage tank damage.
Foaming systems used in these cases could reduce at minimum ammonia atmospheric emissions. For stopping these emissions the foaming system must fulfil the conditions:

- long time stability;
- to provide a thermal insulation;
- chemical inert with intended substance.

Foams could be considered special colloidal solutions and unique in properties in compare with most common substances. These properties are the results of molecules and ion agglomeration in characteristic associations called micelles.

The description of the interfacial phenomena, next to the study of micelles making mechanism, represents a theoretical basis for scientific interpretation of these product properties.

The major foam component is surfactant agents witch induce o significant change in liquid superficial properties in which it is dissolve. Molecular structure is asymmetric and is formed from two parts with fundamental different properties; one is polar or weak polar (hydrocarbons based on) and the other strong polar (ionisable or non-ionizable) [4].

The aim of this research is the obtaining of insulator foam for ammonia. In receipts elaboration was used specific literatures who present technical data about foams used in fire fighting and gases toxic emissions insulation [5].

For toxic gases and liquids resulted from various accidents an insulator foam is prepared from mixes in ratio 1:1 between alkyl sulphates ($MeOSO_2OR$, R= C_{10}-C_{20}, alcoxy, alkylenoxy, alkylaryloxy, alkylpolyether) or sulphonat ($MeOSO_2R^1$, R^1= C_{10}-C_{20}, alkylen, alkylaryl, metal cation) and carboxylates (R^2COMe, R^2 =C_8-C_{30} alkyl). Typical composition contains 4% sodium olefinsulfonate, 3.6% stearic acid, 0.71% potassium hydroxide, 91.96% water. Obtained foam could be use in open spaces for stopping toxic emissions [6].

The ammonia emissions emanated from different sources could be blocked by foam composed by a 1-25% polyvinylacetate, 5-40% polycarboxylic acid [7].

This paper presents the researches for technology elaboration in obtaining of insulator foam for ammonia tanks in case of their damage and to establish the diffuser type and proper installation for foam dispersion.

2. MATERIALS AND METHODS

The objectives of experimental researches were:

A. obtaining insulator foam;
B. establish the diffuser type and proper installation for foam dispersion.

A. Obtaining insulator foam, for ammonia tanks damage, consist in two solutions preparation: one containing a gelling agent (A) and the other the foaming agent and additive substances (B), followed by strong air mixing of this two solutions and new form foam dispersion over the evaporation surface of ammonia.

The receipt for this foam is presented in table no 1.

Table 1. The receipt proposed for insulator foam

	Solution	Components	Concentration, %
1.	A.	polyvinilic alcohol	6.3
		metyl glycol	20.06
		water	73.64
2.	B.	sodium stearate	1.08
		sodium tetraborate	0.3
		diethanolamine	5.87
		water	92.57

B. For establishing the diffuser type and proper installation for foam dispersion, tests was made with existing dispersion systems in ammonia and fertilizer plants on Piatra Neamt and Bacau chemical industrial platform.

3. OBTAINED RESULTS

Obtaining insulator foam for ammonia tanks damage.

On base of the obtained results a forming foam process was elaborated.

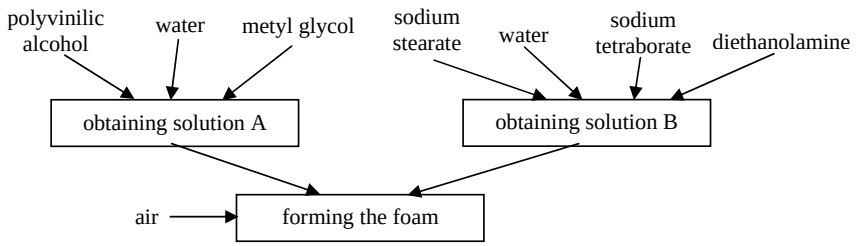

Figure 1. Flow chart of insulator foam obtaining processes

Specific consumption

For 1 m^3 of insulator foam the specific consumption are presented in table no 2.

Table 2. Specific consumption for 1 m^3 of insulator foam

	Components	Quantity	
		Kg	m^3
1.	polyvinilic alcohol	6.3	-
2.	metyl glycol	20.06	-
3.	sodium stearate	1.88	-
4.	sodium tetraborate	0.3	-
5.	diethanolamine	5.87	-
6.	water	166.2	-
7.	air	-	1.5

The technological flow description

For obtaining insulator foam, for ammonia tanks damage is necessary the operations:

- obtaining the solution A witch contain the gelling agent;
- obtaining the solution B witch contain the foaming agent;
- mixing the two solutions;
- forming the foam in strong air flow.

The preparation tanks for the two solutions represents in the same time the storage tank for these. The mixing regulator must be set in order to obtain a foam agent water dilution up to 3.5%. The resulted solution is taken over by a high pressure pump to ejectors in witch the foam is generated. Under the liquid and air pressure the foam flow rapidly across distribution pipe to neutralization point.

Insulator foam properties

Insulator foam for ammonia properties are:

- expansion ration 4.5%;
- density 0.165 g/cm^3;
- stability: satisfactory protection for 16 hours.

Establish the diffuser type and proper installation for foam dispersion

The proposed ammonia tank protection with foam is presented in figure no. 2. The dispersion of foam could be made in the same time on top of ammonia tank and in protection channel for isolation of liquid leakage.

The performances of system are:

- density of foam 0.165 – 0.2 g/cm^3;
- air pressure 10 – 15 ata;
- air flow 2500 – 3000 m^3/hour
- work pressure for foam agent 13 ata.

Foam agent tank and pump system must be in close space, heated in winter time.

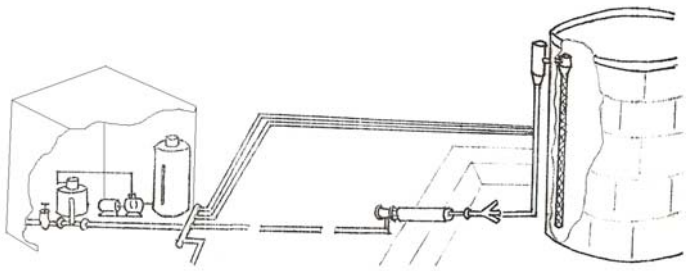

Figure 2. Foam distribution system

The protection foam installation must not interfere with maintenance tank installation. The entire foam distribution equipment must be protected inside addition structure, separated from maintenance ammonia tank installation.
The described foam protection system is doubled by a mobile foam dispersion system formed by 2 – 4 mobile guns witch are supplied by the same production foam system.
The mobile system enters in action in moment when the fix distribution foam system is damage. Foam distribution could be done using a ring pipe fixed around ammonia tank with 6 – 8 foam distributors (figure no 2) witch allows foam distribution in the same time on top of ammonia tank and in protection channel.

4. CONCLUSIONS

The technology for obtaining the insulator foam, for ammonia tanks damage, consist in two solutions preparation: one containing a gelling agent and the other the foaming agent and additive substances, followed by strong air mixing of this two solutions and new form foam dispersion over the evaporation surface of ammonia.
Referring at dispersion foam installation for more efficiency and safety is necessary to construct a double redundant system using a fix dispersion system around ammonia tank and a mobile one formed by 2 – 4 mobile guns witch are supplied by the same production foam system.
The performances of system and foam properties are:

- density of foam 0.165 – 0.2 g/cm^3;
- expansion ration 4.5%;
- stability: satisfactory protection for 16 hours;
- air pressure 10 – 15 ata;
- air flow 2500 – 3000 m^3/hour;
- work pressure for foam agent 13 ata.

Using this protection for ammonia tank increase the exploitation safety of this and remove, in case of major damage, the losses of human life an environmental pollution.

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