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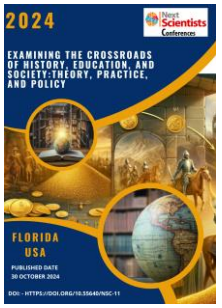

RECYCLING SATURATED ALKANOLAMINES AND REDUCING THEIR ENVIRONMENTAL IMPACT

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ABSTRACT

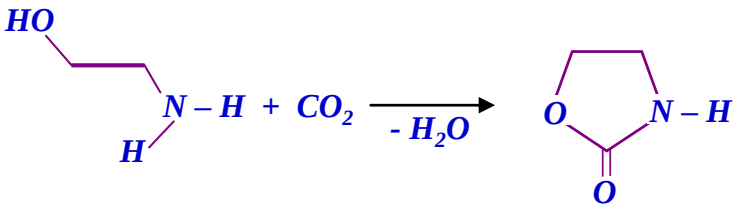
The use of gases as raw materials in the chemical industry requires purification from various toxic compounds. 25-30% aqueous solutions of diethanolamine or methyldiethanolamines are used to purify natural gases from toxic compounds. As a result of repeated use of these solutions in the gas purification process and repeated regeneration at high temperatures, its operational and physicochemical properties deteriorate, the amines are polymerized and become unsuitable for gas purification.

When we analyzed the amines used in gas purification, we found the following: A solution of ethanolamines absorbs toxic compounds well, but it also absorbs oxygen well. Oxygen absorbed in solution as a result of regeneration of the absorbent at high temperatures oxidizes ethanolamine and leads to its polymerization.

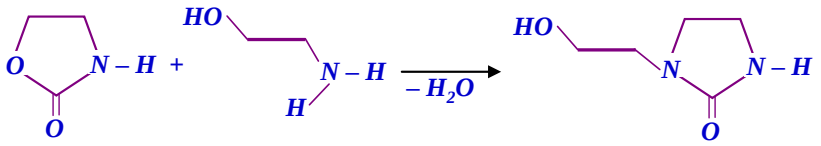
KEYWORDS: Gas purification, operational and physicochemical properties deteriorate.

INTRODUCTION

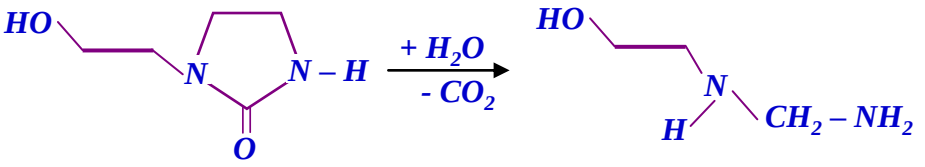
Most of the non-regenerable products in the used alkanolamines are heterocyclic compounds, It is based on the formation of DEA as a result of CO2 reactions: it was determined that the reaction processes take place in different stages, and reaction schemes were suggested. This results in the formation of heavy viscous compounds. Under the influence of temperature, ethanolamine and CO2 form a compound. In the first stage, oxazolidone-2 is formed[1].



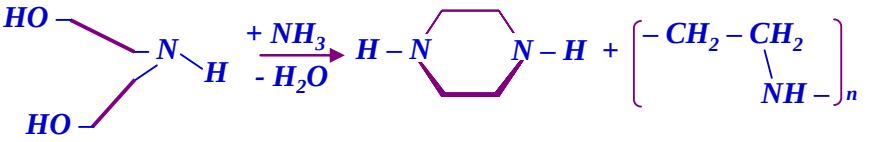
The formation of a reactive 2-oxazolidone with basic properties in the working solution leads to chemical transformations of many other heterocycles. For example, 1-(2-oxyethyl)-2-imidazolidone is the reaction product of 2-oxazolidone with another molecule of DEA in the reaction medium:



N-(2-oxyethyl)-ethylenediamine molecules in the used amine are formed by hydrolysis of 1-(2-oxyethyl)-2-imidazolidone:



The metal and metal oxides in the composition can serve as hydrogenation catalysts and participate in the transition of diethanolamine to piperazine and polyethylenepolyamine in the presence of N2[2]:



It should be noted that the presence of polyethylene polyamines in the composition of the used alkanolamines increases the viscosity and foaming properties of the solutions along with quenching the operational activity of absorbents. For this reason, it is necessary to separate the thermal degradation products of amine from the maximum solution composition.

These heavy compounds not only drastically reduce the working properties of the absorbent, but also cause corrosion of the devices. Natural gas supplied for absorption treatment contains toxic gases, as well as oxygen and nitrogen, which lead to the formation of high-temperature (thermostatic) salts. H2S is present in solution, and CO2 in the form of anions. If we take into account that amines exhibit an alkaline property (pH = 10.8), as a result of regeneration of absorbent solutions at high temperatures, the anions in the solution react directly with the amines to form salts resistant to high temperatures.

These salts alter the molecule of amines, causing the formation of bitsin, sarcosine, and other amino acids. The mechanism of formation of high temperature resistant salts is as follows:

"Free amine" + sour gas → cation "bound amine" + anionic acid amine +RCOOH → amine H + + RCOO–

amine + acid → bound amine + High temperature resistant salts.

When we analyzed the amines used in gas purification (Table 1), we found the following:

TABLE 1.Results of analysis of used MDEA solution

Composition of used $(HOCH_2CH_2)_2NCH_3$solution	Unit of measurement	The amount in solution	Note
Concentration $(HOCH_2CH_2)_2NCH_3$ 30 %			
Free $(HOCH_2CH_2)_2NCH_3$	%	23,07	
Connected $(HOCH_2CH_2)_2NCH_3$	%	6,93	
Anions of heat-resistant salts	ppm	2608	2.5 times higher than normal
Heat-resistant amine salts	%	0,51	above the norm
Heat-resistant salts (total content of amines)	Mol / mol	0,013	above the norm
Strong cations	ppm	71	above the norm
Amino acids	ppm	4373	Dangerous level
Glycols	ppm	641	1.3 times higher than normal
Acetates	ppm	452	above the norm

Bitsinlar	ppm	1663	2.8 times higher than normal
Oxalate	ppm	507	2 times higher than normal
Salt of iron	ppm	127	24 times higher than normal
Sedimentary particles	mg / l	98	above the norm
H_2S	mg / m^3	15–17	norm
CO_2, %	%	2,1	norm

As can be seen from the table, the content of high temperature resistant salts is -2533 ppm, the recommended level is 1000 ppm, which means that their amount is 2.5 times higher than the norm. (HOCH2CH2)2NCH3recovery is carried out at a temperature of 125-1450C. These salts are not removed from the amine solution during reconstitution of the MDEA solution and do not leave the "bound" amine. They are more stable at high temperatures [3].

The amount of bound DEA (tar-like substances) in the working solutions of the absorbent decreased from 7.6 g/l to the minimum concentration of 0.5 - 0.7 g/l, the amount of additives of different types should not exceed 1% in the normal operation of gas cleaning devices.

Based on the above, it can be concluded that for long-term performance ofethanolamine solution, high absorption capacity and good gas purification, the absorbent solution requires purification from the compounds listed in the table above.

Thus, 60-65% of the DEA solution, which is disposed of as a technological waste, was technically verified, which could be reused in the gas purification process, and the remaining 35-40% cubic meters could be used as demulsifiers in oil and gas extraction and dewatering.

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