STUDY OF THE FORMATION OF DEGRADATION PRODUCTS IN AMINE SOLUTIONS OF NATURAL GAS PURIFICATION

Nazarov U.I.
Umarova M.B.
Salikhova O.
Tashkent Institute of Chemical Technology.
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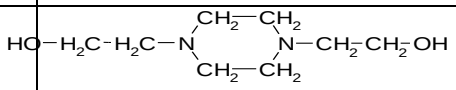
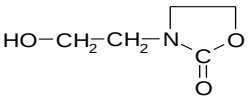
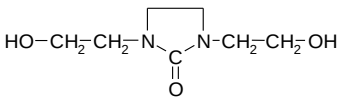
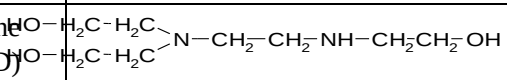
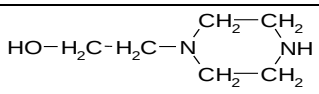
Currently, a significant amount of produced gas (natural and associated petroleum) contains acidic components – hydrogen sulfide and carbon dioxide. The content of these substances in gases from different deposits varies widely from fractions to tens of percent. Hydrogen sulfide is a toxic substance, its maximum amount in the gas supplied to the main pipelines is regulated. Hydrogen sulfide, as well as carbon dioxide, forms acids in the presence of water, which cause chemical and electro chemical corrosion of metals. Under certain conditions, hydrogen sulfide is the cause of sulfide cracking of metals. The presence of a significant amount of carbon dioxide in the gas reduces its heat of combustion, which is also regulated. These reasons have led to the development and industrial implementation of many methods for purifying hydrocarbon gases from acidic components. In Uzbekistan, as well as in foreign practice, alkanol amine technology is used to purify gas from hydrogen sulfide and carbon dioxide. The main advantages of this technology are: A high and reliable degree of gas purification, regardless of the partial pressure of hydrogen sulfide and carbon dioxide, low viscosity of aqueous absorption solutions, low absorption of hydrocarbons, which guarantees high quality of acid gases, which are raw materials for the production of sulfur. The use of amine solutions in purification processes has a number of disadvantages, the main of which are foaming of the absorbent, and in some cases, a decrease in its absorption capacity over time [1]. Investigation and improvement of the stability of the adsorption capacity is an urgent task of gas purification. The main reason for the difficulties encountered during operation is the thermochemical decomposition of absorbent solutions in interaction with carbon dioxide contained in the purified gas, which forms degradation products - nitrogen-containing organic compounds. Their presence in amine solutions worsens the operational properties of the absorbent, i.e. increases the viscosity of the solution, reduces absorption properties, and significantly increases the foaming of the solution. Eliminating these negative factors is a top priority, as they directly affect the performance of the amine system and the quality of the products produced. The study showed that the intensity of amine decomposition depends on the composition of the gas, the mode of operation of the absorber and desorber, and the presence of impurities in the amine solution itself [2]. As a rule, several decomposition products are identified in amine solutions at once. Of the acidic components (H2S and CO2), the effect of carbon dioxide on the decomposition of amines is more significant. One of the main products of the side reaction of DEA with CO2 is N,N-di(2-oxyethyl)-piperazine (OP). OEP derivatives are non-corrosive and have an absorption capacity against acidic components. During the regeneration of the spent amine solution, the thermal decomposition of amines without carbonic acid proceeds to a small extent and

increases with increasing temperature and degree of saturation of amines with CO2.
Losses of DEA under the action of CO2 are insignificant at a temperature of 100 ° C and a pressure of 1.2 MPa and reach more than 90% at a temperature of 175 °C and a pressure of 4.1 MPa. Carbonates or carbamates are probably formed by the interaction of CO2 with amines, which are converted into oxazolidone-2, then into oxy-ethyl imidazolidone-2. The rates of adverse reactions are usually low, the products of which accumulate in the system during prolonged circulation of the solution. The scientific novelty in this work is the study and analysis of the degradation products of amine solutions, which have not yet been adequately studied and determined. The study of the characteristics of by-products of gas purification, processes of purification of amine solutions from them, as well as the development of optimal technology for cleaning solutions is an urgent scientific and applied task, the solution of which will significantly improve the technical and economic performance of the process of gas purification from hydrogen sulfide and carbon dioxide. To determine the composition of the degradation products of diethanolamine, a qualitative and quantitative analysis of the cubic residue of the vacuum distillation of the working solution of diethanolamine was carried out, and its physico-chemical properties were determined under laboratory conditions, which is of great interest for this work.

Table 1 shows the main degradation products of DEA, as well as the mass concentration of PD.

Table.1

Component	Chemical formula	Mol.m	weight,% by weight.
DEA, linked in the form of traffic regulations, total, incl.:		-	100,0
diethanolpiperazine (DEP)		174	33,3
N(hydroxyethyl)oxazolidone (GEODE)		103	18,9
N bis(hydroxyethyl)-imidazolidone (BGES)		146	6,7
tris(hydroxyethyl)- ethylenediamine (THED)		192	6,3
N hydroxyethyl piperazine (GEP)		130	7,8
other			27,0

Today, there are several technologies in the world aimed at solving the above problems [3]:
- vacuum distillation;
- filter system;
- electrodialysis;

- the use of inhibitors;
- the use of ion-exchange resins.

In our opinion, the most promising of the above methods is the use of ion-exchange resins. In this work, the use of ion-exchange resins for purification from degradation products of an amine solution is proposed.

Used literature:

1.Technology of processing natural sulfur dioxide Text: Handbook/A.I. Afanasyev, V.M. Stryuchkov, N.I. Podlegaev et al. — Edited by A.I. Afanasyev. -M.: Nedra, 1993. 152 p.
2. J. Price list Economical purification of an amine solution Text. // Oil and gas technologies. 2006. No. 1-2. - pp. 58-59.