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STUDY OF THE ANTI-CORROSION PROPERTIES OF ALKANOLAMINE ABSORBENTS

I.A.Anvarova
" oil and gas work and technology of their processing"
Assistant Teacher of the Department (KSTU)
D. Sh.Shukurova
is a student of the 2nd stage of the technological direction
of the petrochemical industry

Abstract: Alkanolamine absorbents exhibit low corrosion activity during desulfurization, but acid gases absorbed by amines have a significant effect on equipment corrosion. Currently, a lot of research is being carried out on this issue, recommendations have been developed taking into account the experience of using desulfurization plants, compliance with which allows you to reduce the consequences of corrosion processes.

Keywords: Alkanolamine, absorbents, acid gases, corrosion, anti-corrosion, desulfurization, amines, corrosion processes.

Introduction: MEA solutions are the most corrosive in terms of corrosive activity, followed by DEA and then MDEA [1].

However, in practice it is possible exceptions to this rule, which are determined by specific characteristics - the composition of the gas, the presence of impurities. As an example, Table 1 provides data on the effect of temperature and composition of acidic gases on the rate of corrosion of carbon steel in a 20% DEA solution [2]. Hydrogen sulfide reacts with iron to form a protective film of ferrous sulfide, which reduces corrosion of the equipment. Carbon dioxide dissolves in water to form carbonic acid, which in turn reacts with iron to form soluble iron bicarbonates.

When bicarbonates are heated, CO_2 is released, and as a result, insoluble iron carbonates precipitate. The amine solution dissolves more iron after re-saturation with CO_2, which precipitates in the form of iron carbonate [3]. The following types of corrosion have been noted in alkanolamine gas treatment facilities: general, electrochemical, alkaline, intergranular, erosive, corrosive cracking, Hydrogen [4].

In general, cleaning facilities that use MDEA as an absorbent are less likely to suffer from corrosion than factories that use MEA or DEA. MDEA, as a tertiary amine, is easier to

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regenerate so that the amount of CO_2 residues in a renewable absorbent is much lower than the previous one.In the case of MEA - ~0.01 mol/mol and ~0.1 mol/mol, respectively. On the other hand, MEA (DEA) reacts with carbamate formation with CO_2 and MDEA - these properties, which have only been studied through the carbonic acid formation stage, have their own characteristics in the nature of the ongoing corrosion processes.

The most susceptible to corrosion at the plant are saturated absorbent lines, Amine recuperative heat exchangers, boilers and desorbers line. Corrosion is exacerbated by an increase in the saturation level of the absorbent with H_2 and CO_2, an increase in its temperature and an increase in the rate of linear flow [6]. The experience of using alkanolamines allows the use of low carbon steel as the main structural material; in the most corrosive places - stainless steel (saturated Amine lines, boilers, heat exchangers, desorber containers, etc.).

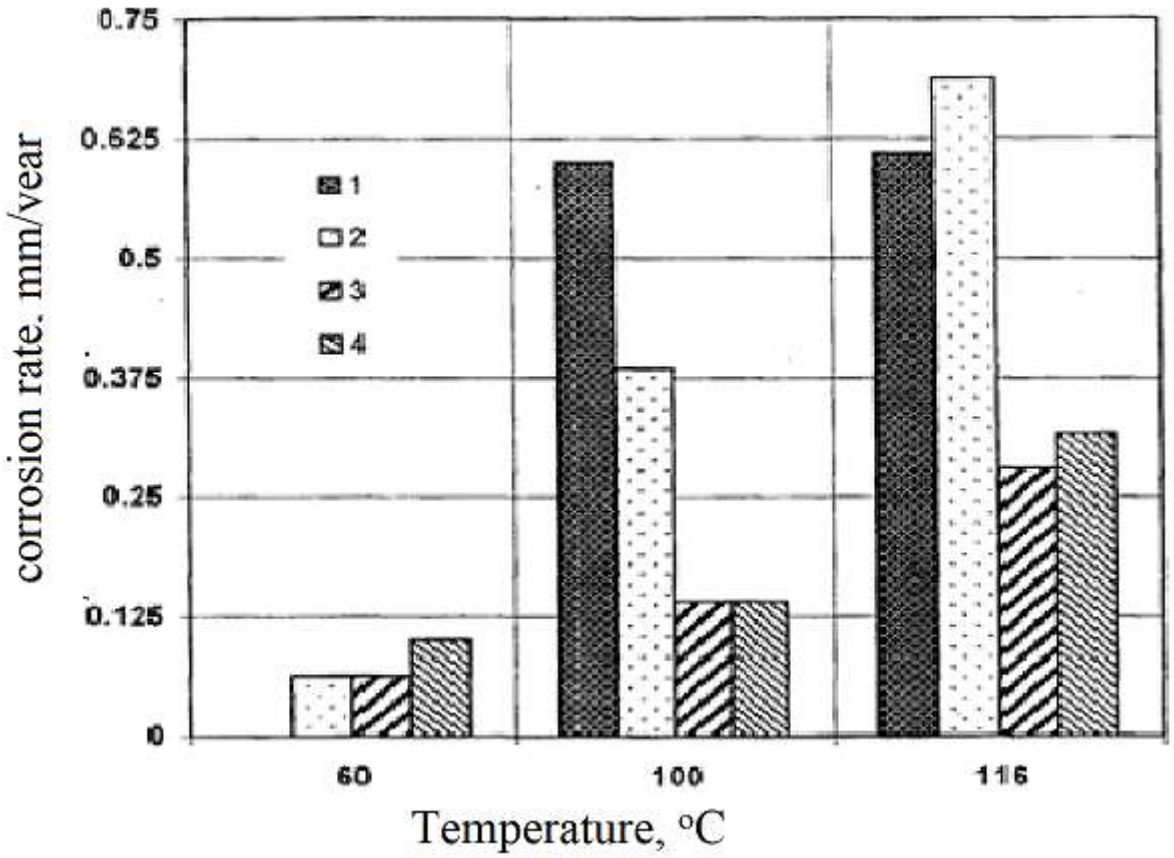

image. 1. The dependence on the rate of carbon corrosion when treated with a 20% solution steel Test at different temperatures DEA in an environment of acidic gases of different composition. Temperature, °C

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1-H_2S only; 2-CO_2 only;3-3s:002=1:3; 4-02 SDA questions:C02=3:1.

The typical corrosion rate of carbon steel in MEA treatment facilities is -0.1 mm / yr . MDEA is 0.003-0.048 mm per year in cleaning devices. In addition, in different installation places it is :

Metal sample installation location	Corrosion rate, mm/year
Steam return line from the boiler	-0,048
Input to the desorber capacitor	-0,038
Acid gas outlet from the separator for irrigation collection	-0,030
In front of the saturated amine supply control valve	-0,005

(MDEA concentration-weight 25%; Amine saturation level 0.46 mol of acidic gases/mol; boiler temperature of saturated Amine -123 ^C; crude gas content % volume: H_2S - 0.002; CO_2 - 2.82). At the same time, there is almost no information in the literature about the rate of metal corrosion in suction compositions based on MDEA - MDEA + DEA, activated MDEA and others.

As for the corrosiveness of the products of thermochemical changes of ethanolamines, there is no clear information about them. Specifically, diethanolpiperazine (DEP) and dimethylhydroxyethylethylenediamine (DMHEED) are used as MDEA activators to eliminate selectivity over CO_2 [38]. At the same time, special anti-corrosion studies were carried out only with DEP [38].

The addition of 2.5% DEP to 30% DEA was found not to affect the corrosive properties of the absorbent (80^OC PH_2S = 20 bar). The modification replaces hydrogen sulfide with raw gas and DEA with MDEA with the same results. At the same time, the presence of organic acids, TSS increases the corrosive properties of absorbent substances.

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