GALAXY INTERNATIONAL INTERDISCIPLINARY RESEARCH JOURNAL (GIIRJ)
ISSN (E): 2347-6915
Vol. 12, Issue 5 May (2024)

EFFECT OF COMPOSITE ABSORBENT ON CORROSION OF CARBON STEEL

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ABSTRACT

It is studied speeds, corrosion of a carbonaceous steel of mark of item 10 with composite absorbents MDEA+DEA+ -nitrogen compound water-soluble polymer and it is found, that degree of saturation H_2S and CO_2 and temperature substantially is defined its corrosion by properties.

Keywords: methyldiethanolamine, diethanolamine, nitrogen-containing water-soluble polyelectrolytes, steel, corrosion.

INTRODUCTION

Recently, in the Republic, in the industrial enterprises of oil and gas processing, the main focus is on the search for methods for the purification of natural and waste gases of production from organic sulfur compounds, mercaptans, carbonyl sulfide (COS), carbon disulfide (CS2) and sulfides (RSR), as well as the creation of new types of highly efficient composite absorbents for gas purification. The Action Strategy for the Further Development of the Republic of Uzbekistan provides for the tasks: "Raising the industry by transferring it to a qualitatively new level, to further intensify the production of finished products on the basis of deep processing of local raw materials, mastering the production of new types of products and technologies." In this regard, research on the creation of composite absorbents and the development of highly efficient composite absorbents in various functional groups are important, increasing the degree of cleaning of acidic components of natural and exhaust gas emissions [4-5].

In connection with the planned pilot tests of the DEA+MDEA+AWSP composite absorbent at other gas processing plants (Mubarek and Shurtan), additional studies of their corrosion aggressiveness were carried out.

MATERIALS AND METHODS

Studies were performed in glass ampoules and autoclaves according to method [1,2-3]. The use of ampoules made it possible to obtain preliminary information with limited time and reagents, and autoclaves – information close to real conditions.

Test conditions: ampoule: T=130°C, saturation of AWSP with acid gases 0.6 mol/mol, contact time of phases 100 hour, concentration of DEA+MDEA+AWSP 40%. Mass

autoclap: T=130°C, ~1.0 mol/mol, phase contact time =360 hour, pressure.

P ~ 5 Mpa, amine concentration 30 wt% (Conditions Sh gas processing plant).

The test results are presented in Table 1 (ampoule experiments) as well as in Table 2 (autoclave experiments). Analysis of the data obtained in the ampoules shows that the corrosion rate S.10 in absorbents –DEA+MDEA, MDEA+DEA is higher if the absorbent is saturated with one H_2S than in the case of saturation with one CO_2. In the presence of H_2S and CO_2, the maximum corrosion rate began to be observed at a ratio of H_2S/CO2=(1.5-4): 1.

RESULTS AND DISCUSSION

The test results are presented in Table 1 (ampoule experiments) as well as in Table 2 (autoclave experiments). Analysis of the data obtained in the ampoules shows that the corrosion rate S.10 in absorbents –DEA+MDEA, MDEA+DEA is higher if the absorbent is saturated with one H_2S than in the case of saturation with one CO_2. In the presence of H_2S and CO_2, the maximum corrosion rate began to be observed at a ratio of H_2S/CO_2=(1.5-4): 1.

Table 1 Corrosion rate of S.10 in MDEA+DEA absorbent depending on from the composition of the absorbent
(T=130°C, absorbent saturation 0.6 mol (H_2S and CO_2)/mol,
F=360 h, concentration of amines in absorbent 40% wt)

№	Absorbent, Composition	Corrosion rate S.10, mm/year	
		H_2S/CO_2=3:1	H_2S/CO_2=2:1
1.	MDEA	0,059 0,057	0,054 0,052
2.	DEA	0,035 0,030	0,031 0,032
3.	20% MDEA+ 80% DEA	0,035 0,038	0,028 0,029
4.	40% MDEA + 60% DEA	0,041 0,042	0,035 0,033
5.	50% MDEA + 50% DEA	0,070 0,075	0,065 0,067
6.	60% MDEA + 40% DEA	0,073 0,078	0,075 0,073
7.	70% MDEA + 30% DEA	0,069 0,068	0,060 0,058
8.	80% MDEA+20% DEA	0,060 0,065	0,057 0,056

The results also show that the degree of saturation of the H_2S absorbent, CO_2 and temperature significantly determine its corrosive properties. Stainless steel is practically free from corrosion. Additive 1 wt % hexamethylenediamine to MDEA+DEA absorbent (60x40%), which showed the highest corrosion rate of steel grade S.12-1.0 mm/year, reduces it to 0.11-0.12 mm/year. This fact requires additional special research.

Table 2 Corrosion rate of carbon steel of S.12 grade in absorbent MDEA+DEA+AWSP (autoclave experiments)
(amine concentration 40 wt%; temperature 130°C; saturation of the amine ~ 1.0 mol/mol; H_2S/CO_2+2; 1, Pab.~5 Mpa; F=360 h)

№	Absorbent	Corrosion rate, steel, mm/year
1.	DEA	0,09
2.	MDEA	0,51
3.	MDEA + DEA (20x80%)	0,09
4.	MDEA + DEA (30x70%)	0,10
5.	MDEA + DEA (50x50%)	0,25
6.	MDEA + DEA (60x40%)	1,05
7.	MDEA + DEA (70x30%)	0,90
8.	MDEA + DEA (90x10%)	0,65
9.	MDEA + DEA (40x40%) + 15% AWSP	0,06
10.	MDEA + DEA (50x40%) + 10% AWSP	0,09
11.	MDEA + DEA (50x45%) + 5% AWSP	0,11

It has been experimentally determined that the corrosion rate of steel also depends on the MDEA/DEA ratio in the composite absorbent. Maximum aggressiveness was observed in the MDEA/DEA ratio interval =(40x60%) - (80x20%). This relationship can be traced both for the mixture of H_2S, CO_2, and individual gases - H_2S and CO_2.

The results of autoclave experiments are presented in Table 2 and figure 1 confirm an abnormal increase in the corrosion aggressiveness of MDEA+DEA solutions containing more than 40% MDEA. The addition of 5-15% AWSP to this absorbent reduces the corrosion rate of steel by 2 times, and the addition of 20% ~ by 3 times (Table 2).

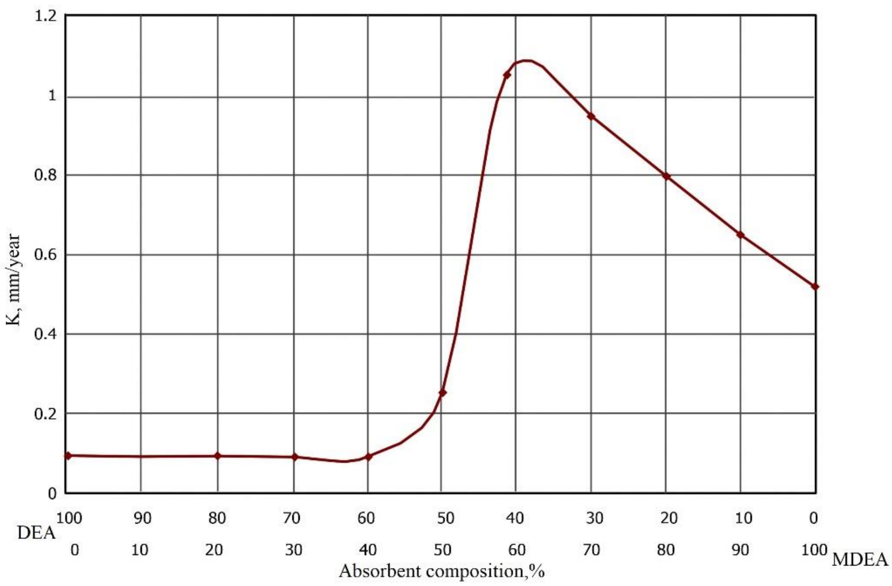

Figure 1. Corrosion rate (K) of grade 12 carbon steel in MDEA/DEA absorbent (α~1.0 mol/mol; t=130°C; P=5 MPa; H_2S/CO_2=2:1)

CONCLUSION

The results of autoclave experiments are presented in Table 2, confirm an abnormal increase in the corrosion aggressiveness of MDEA+DEA solutions containing more than 40% MDEA. The addition of 5-15% AWSP to this absorbent reduces the corrosion rate of steel by 2 times, and the addition of 20% ~ by 3 times (Table 2).

REFERENCES

1. Gafarov N.A., Goncharov A.A., Kushparenko V.M. Corrosion and protection of equipment of hydrogen sulfide-containing oil and gas fields. - M.: Nedra, 1998. p -241
2. Instruction on Gas Field Equipment Corrosion Control. Mingazprom. - M.: 1979. P- 90.
3. Lunin AF, Hussein Ahmed Hussein, Burdeynaya TN. Utilization of hydrogen sulfide from acid gases of amine purification .//Chemistry and technology of fuels and oils. - M.: 1993. №12. p-120.
4. Aripdjanov O.Yu., Khayrullaeva D.Z., Kholmatov Sh.F., Kayumov J.S. The current state of technology development for gas purification from sulfur compounds and its future prospects. Journal UNIVERSUM, technical sciences: №12(117). 8, DOI-10.32743/UniTech.2023.117.12.16381
5. Aripdjanov O.Yu., Kholmatov Sh.F., J.S.Kayumov Synthesis and testing of solutions of composite absorbent based on nitrogen- and amine-containing water-soluble polyelectrolyte in the purification of natural gas from sulfur-containing components / WoS International Scientific Research Journal (WoS) ISSN: 2776-0979, Volume 4, Issue 12, December, 2023.