Answer on the question #62759, Chemistry / General Chemistry

Question:

You need to treat 10 mscfd of sour gas that contains 10 volume percent hydrogen sulfide. Your amine can carry 1400 grains/gallon of acid gas comfortably. How many gallons/minute of amine do you need? There are 0.836 scf/mol. How many mol/day of H2S do you have? How many grams/day of H2S do you have? How many lbs/day of H2S do you have? Hint: there are 454 grams/lb. How many lbs/minute of H2S do you have? How many grains/minute of H2S do you have? Hint: there are 7,000 grains/lb. How many gal/minute of amine do you need?

Solution:

1. We have 10 mscfd of sour gas, where 10 volume percent is acid gas, so we have
$$10\ mscfd\ \cdot \frac{10\%}{100\%} = 1\ mscfd$$
of acid gas.

2. Then, we can calculate the mol/day of H_2S:
$$1 mscfd = \frac{1}{0.836\frac{scf}{mol}} \cdot 10^6 \frac{scf}{day} = 1.196 \cdot 10^6 \frac{mol}{day}$$

3. Then, we have to convert into grams of H_2S per day:
$$1.196 \cdot 10^6 \frac{mol}{day} = \ 1.196 \cdot 10^6 \cdot 34.0809 \frac{g}{mol} \cdot \frac{mol}{day} = 4.08 \cdot 10^7 \frac{g}{day}$$
4. Conversion from grams per day to pounds per day:
$$4.08 \cdot 10^7 \frac{g}{day} = \ 4.08 \cdot \frac{10^7}{454\frac{g}{lb}} \frac{g}{day} = 8.98 \cdot 10^4 \frac{lb}{day}$$
5. Conversion in pounds/minute:
$$8.98 \cdot 10^4 \frac{lb}{day} = \frac{8.98 \cdot 10^4}{24 \cdot 60 \frac{min}{day}} \frac{lb}{day} \ = 62.4\ lb/min$$
6. Conversion in grains/minute:
$$62.4 \frac{lb}{min} = 62.4 \cdot 7000 \frac{grains}{lb} \frac{lb}{min} = 4.37 \cdot 10^5 \frac{grains}{min}$$

Finally, to get the number of gallons per minute of amine:

$$4.37 \cdot 10^5 \frac{grains}{min} \cdot \frac{1}{1400} \frac{gallon}{grains} = 312 \frac{gallon}{min}$$

Answer: $312 \frac{gallon}{min}$