ORIGINAL PAPER

DESULPHURISATION WASTE GASES FROM INDUSTRIAL PROCESSES

TIMUR CHIS[1]

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Abstract. *Both the processes of refining oil and gas processing and petroleum products and in phase storage and delivery of finished products, petro chemical plants generate emissions in the atmosphere, waters and along the ground. Therefore environmental management and pollutants has become a major activity in the development of refineries .*

The type and quantity of environmental emissions from refineries are usually cuantificate and so well known. The main pollutants generated by the petrochemical industry are oxides of carbon, nitrogen and sulfur, particulates (mainly generated from combustion processes) and volatile organic compounds.

This paper aims to introduce the reader to the study of sulfur recovery technologies from flue gases and numerical modeling of the effect of pH on the absorption of sulfur dioxide.

Keywords: *Sulfur dioxide, recovery, modelling.*

1. INTRODUCTION

Refining facilities are fully integrated industrial complex that manage huge amounts of raw materials at the same time and resource intensive energy and water [1].

Both the processes of refining oil and gas processing and petroleum products and in phase storage and delivery of finished products, petro chemical plants generate emissions in the atmosphere, waters and along the ground. Therefore environmental management and pollutants has become a major activity in the development of refineries .

The type and quantity of environmental emissions from refineries are usually cuantificate and so well known [2]. The main pollutants generated by the petrochemical industry are oxides of carbon, nitrogen and sulfur , particulates (mainly generated from combustion processes) and volatile organic compounds. Thus, for every million tons of crude oil processed (European refineries range from 0.5 to 20 million tons), refineries emit between 20,000 and 820,000 tons of carbon dioxide, nitrogen oxides T 60-700 , 103,000 particulate t, t 30-6000 50-6000 t sulfur oxides and volatile organic compounds . They generate between 0.1 and 5 million tons of waste water and between 10 and 2000 tonnes of solid waste per million tons of refined oil.

This paper aims to introduce the reader to the study of sulfur recovery technologies from flue gases and numerical modeling of the effect of pH on the absorption of sulfur dioxide.

[1] Ovidius University Constanta, Faculty of Applied Science and Engineering, 900527 Constanta, Romania.
E-mail: timur.chis@gmail.com.

2. MATERIALS AND METHODS

My experiment consisted of performing chemical analysis to highlight:
a. As a unchecked pH of an aqueous solution on contact with SO_2,
b. How evolving pH of a solution treated with SO_2 in its distillation process,

The first experiment aimed to follow pH variation depending on the amount of water absorption SO_2.

To SO_2 we used the following reaction:

$$Na_2SO_3 + H_2SO_4 = SO_2 + Na_2SO_4 + H_2O \quad (1)$$

I've distilled SO_2 in acidic by atrenare air.

I collected it in a solution of hydrogen peroxide, sulfuric acid is then converted that to dosed by acidimetry.

Balance equation:

$$20\ Na_2SO_3 + 10\ H_2SO_4 = 20\ Na_2SO_4 + H_{20} + 10\ SO_2 \quad (2)$$

Table 1. Evolution of pH solution by SO_2 adsorbtion.

pH	% molecular SO_2
3,0	6,06
3,2	3,91
3,4	2,51
3,6	1,60
3,8	1,01

Mathematical modeling is:

$$Y = 24.115\text{-}6.205\ X \quad (3)$$

Where Y is SO_2, and X is the amount of the solution pH.

SULPHUR WATER DISTILLATION

I distilled water sulfur a petroleum by distillation, following the pH of the solution obtained. The purpose of this experience is the final solution concentration of sulfur.

Mass of water previously treated with SO_2 = 46.68 g, pH = 1 (water SO_2) thus, the amount of sulfur is 17.91%.

Table 2. pH solution by SO_2 recovery

	time (min)	**pH**	**SO_2 recovery, % molecular SO_2**	**Temperature**
initially: first drop	8	2	11,705	98 ^{0}C
V=4 ml	10	2,5	8,6025	98 ^{0}C
V=7 ml	13	3	5,5	98 ^{0}C
V=10 ml	15	3,8	0,936	98 ^{0}C
V=20 ml	19	3,9	0	98 ^{0}C
V=25 ml	20	3,9	0	98 ^{0}C

As you can see we got by distillation SO_2 concentration in the first 10 minutes.
And in this case I wrote a mathematical relationship:
So the equation

$$Y = 19.835\text{-}1.114\ X \quad (4)$$

Where Y is sulfur recovered from the time X.

ACTIVATED CARBON ABSORPTION OF SULFUR

I distilled water sulfur a petroleum by distillation, then ran it through a charcoal filter, following the pH of the solution obtained.

The purpose of this experience is the final solution concentration of sulfur.

Mass of water previously treated with SO_2 = 46.68 g, pH = 1 (water SO_2) thus, the amount of sulfur is 6.06%.

Table 3.pH solution by SO_2 recovery

	time (min)	**pH**	**SO_2 recovery % molecular SO_2**	**Temperature**
initially: first drop	10 min	3	6,06	98 ^{0}C
V=10 ml	15	3,3	3,6385	98 ^{0}C
V=20 ml	17	3,5	2,3975	98 ^{0}C
V=30ml	19	3,8	0,536	98 ^{0}C
V=35ml		Constant pH=4		

And in this case I wrote a mathematical relationship:
So the equation

$$Y=12,463 – 0,613 \quad (5)$$

Where Y is sulfur recovered from the time X.

As seen activated carbon absorbs some of the sulfur dioxide drops delaying first 2 seconds and the amount of sulfur being 57% lower.

3. CONCLUSIONS

- The paper present a numerical model including the effect of absorption of sulfur dioxide on the pH;
- Experiments have revealed that the most useful in the recovery of sulfur dioxide is passing through activated charcoal;
- Also was studied the evolution of the pH depending on the amount of sulfur in the water.

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