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Research Article

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Adsorption studies on *Mangifera indica* controlling of SO_2 pollution

V. Mary Priyanka[1], D. Sirisha[2] and N. Gandhi[2]

[1]Department of Biotechnology, Sri Padmavathi Mahila Visva Vidyalayam, Tirupathi, A.P
[2]Center for Environment and Climate Change, School of Environmental Sciences, Jawaharlal Nehru Institute of Advanced Studies (JNIAS), Hyderabad, A.P

ABSTRACT

The present study deals with the experimental investigations carried out for controlling SO_2 by using mangifera bark dust. It was found that the amount of gas adsorbed by mangifera bark dust is 98% at high concentrations. The experiments are conducted with respect to contact time, with respect to initial concentration of SO_2, and with respect to mangifera bark dust dosages. The component present in the mangifera bark dust is lignin and cellulose and many hydroxyl groups such as lumens' or phenolic compounds. The adsorption observed in the present conditions indicates physical adsorption. The percentage removal of SO_2 increased with increase in the surface area, greater the area greater is adsorption. The percentage removal of SO_2 increased with increase in mangifera bark dust dosage.

INTRODUCTION

Sulfur dioxide is a gas. It is invisible and has a nasty, sharp smell. It reacts easily with other substances to form harmful compounds, such as sulfuric acid, sulfurous acid and sulfate particles.About 99% of the sulfur dioxide in air comes from human sources. The main source of sulfur dioxide in the air is industrial activity that processes materials that contain sulfur, e.g. the generation of electricity from coal, oil or gas that contains sulfur. Some mineral ores also contain sulfur, and sulfur dioxide is released when they are processed. In addition, industrial activities that burn fossil fuels containing sulfur can be important sources of sulfur dioxide. Sulfur dioxide is also present in motor vehicle emissions, as the result of fuel combustion. In the past, motor vehicle exhaust was an important, but not the main, source of sulfur dioxide in air. However, this is no longer the case. Sulfur dioxide affects human health when it is breathed in. It irritates the nose, throat, and airways to cause coughing, wheezing, shortness of breath, or a tight feeling around the chest. The effects of sulfur dioxide are felt very quickly and most people would feel the worst symptoms in 10 or 15 minutes after breathing it in. Those most at risk of developing problems if they are exposed to sulfur dioxide are people with asthma or similar condition.

EXPERIMENTAL SECTION

Selection of Adsorbent

The present work, examines the possibility of using a well-known physicochemical method like adsorption for the removal of SO_2 from air. The initial screening studies have been carried by introducing a known amount of adsorbent into the aqueous solution of SO_2.It was found that mangifera bark dust has large capacity to adsorb SO_2. Mango bark dust is a waste material collected from the Timber industry. Mango bark dust is a bio adsorbent and it consists of lignin and cellulose and many hydroxyl groups such as lumens' or phenolic compounds. The composition of Mango bark dust is given by Cellulose – 36.5% and Lignin – 49.5%. The ligno-cellulosic components present in the Mango bark dust are responsible for complete adsorption observed in the present study. Mango bark dust is a cheap material and the adsorption capacity of the mango bark dust is high compared to other adsorbents, hence, it can be used as an effective adsorbent for removal of aq sol of SO_2. For the present studies adsorption techniques are selected because aq SO_2 and it is incombustible and it is present in very low concentrations. The experiments are carried with respect to contact time, with respect to initial concentration of SO_2 gas and with respect to mangifera bark dust dosages

Effect of Mangifera bark dust Contact Time

The initial (before adsorption) and final (after adsorption) concentration is determined at regular intervals of time i.e. 1, 3,5,10 and15 minutes. The results are given in TABLE 1 and FIG 1.

Effect of Initial aq.So_2 solution Concentration

Different concentrations of aqueous solution of SO_2 are mixed with a fixed amount of adsorbent. The experiments are carried out with contact time is fixed depending upon contact time experiments. The results are given in TABLE 2 and FIG 2.

Effect of Mangifera bark dust Dosages

Definite concentration of aqueous solution of SO_2 is made to pass through different amounts of adsorbent dosages i.e. 0.2gms, 0.4gms, 0.6gms, 0.8gms respectively. The experiments are carried out with the contact time of one hour is maintained.

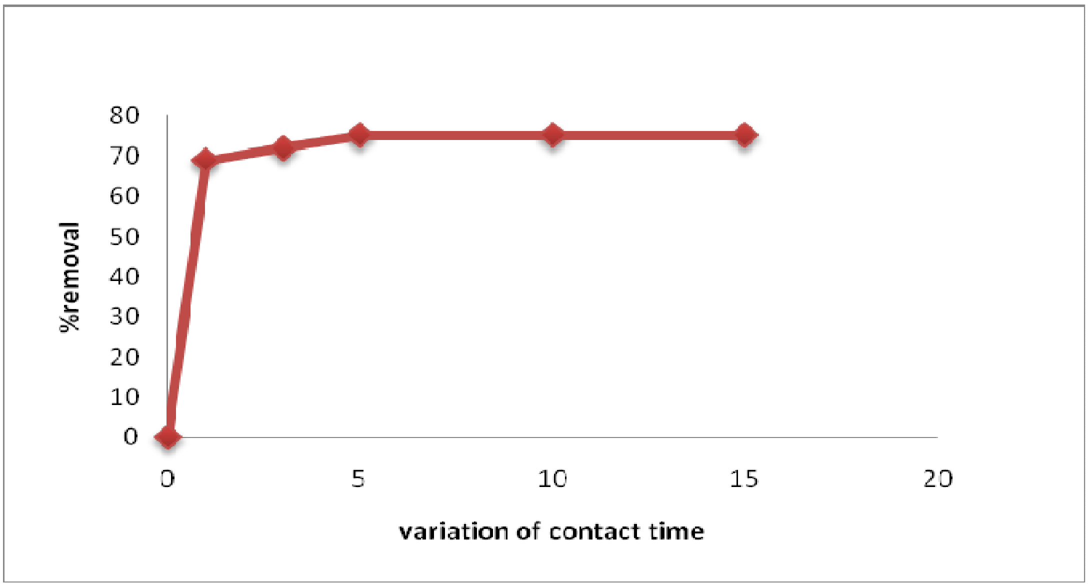
RESULTS AND DISCUSSION

TABLE 1: Variation of contact time between mangifera bark dust and SO_2

Amount of Adsorbent: 1gm
Volume of aqueous SO_2 sol.:100ml
Surface area: 9.96sq.cms

S.NO	Contact time (min)	Initial Conc. mg/m^3	Final Conc. mg/m^3	Amount of so_2 absorbed per mg/m^3	% Removal	%removal per sq.cm
1	1	104	23.4	80.6	69	6.92
2	3	104	24.7	79.3	72	7.22
3	5	104	26	78	75	7.53
4	10	104	26	78	75	7.53
5	15	104	26	78	75	7.53

FIGURE 1: variation of contact time



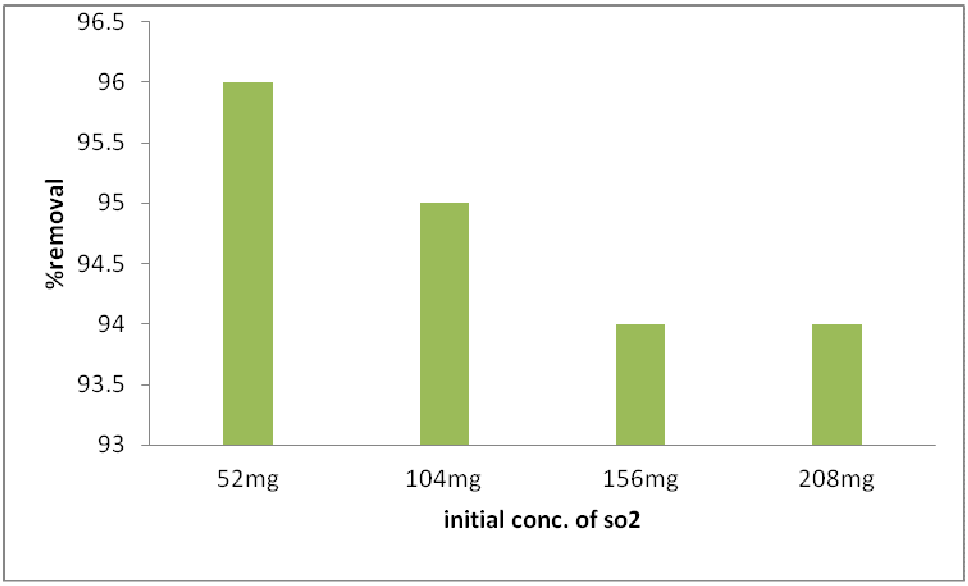
The optimum contact time for the removal of SO_2 is 15 minutes. From table 1 and it is observed that initially the adsorption of SO_2 increased with the increase in contact time. The percentage removal of SO_2 is increased with the increase of surface area. As the present studies are carried out at room temperature, the chemical adsorption is not taking place.

TABLE 2: Variation of initial concentration on mangifera bark dust

Surface area: 9.96 sq.cms
Amount of adsorbent: 1gms
Volume of SO_2 sol.: 100 ml

S.NO	Initial Conc. mg/m^3	Final Conc. mg/m^3	Amount of SO_2 Adsorbed mg/m^3	% removal	% removal per sq.cm
1	52	2.34	49.66	96	9.63
2	104	5.2	98.8	95	9.53
3	156	7.8	148.2	94	9.43
4	208	10.7	196.3	94	9.43

FIGURE 2: Variation of initial concentration



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The percentage removal of aqueous solution of so_2 decreased with increase in concentrations indicated by the table 2. The maximum percentage removal of so_2 is observed at the lower concentrations compared to higher concentrations.

FIGURE 3: Variation of mangifera bark dust dosages

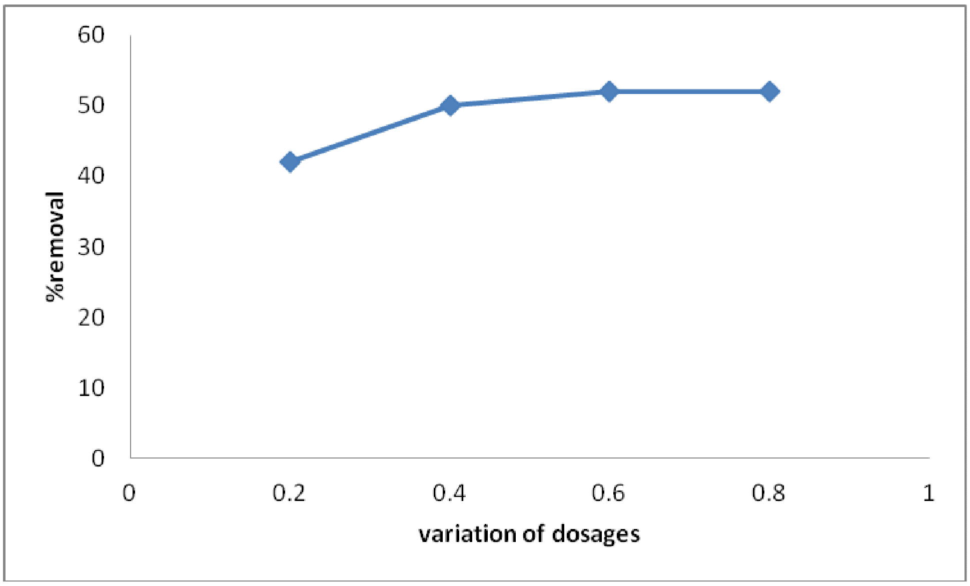

TABLE 4: Variation of mangifera bark dust dosages

Volume of Aq. Sol. SO_2: 100ml

Surface area: 9.96 sq.cms

S.NO	Amount of Mangifera bark dust in gms	Initial conc. in mg/m^3	Final conc. mg/m^3	Amount of SO_2 adsorbed mg/m^3	% Removal	% Removal per sq.cms
1	0.2	104	59.8	44.2	42	4.21
2	0.4	104	52	52	50	5.02
3	0.6	104	44.2	59.8	52	5.22
4	0.8	104	44.2	59.8	52	5.22

The percentage removal of the SO_2 increases with increase in mangifera bark dust (0.2, 0.4, 0.6, and 0.8). The rate of the percentage removal has been found to be rapid in the beginning which slowed as mangifera bark dust dosages is increased. In all the cases the optimum dose may be attributed to the attainment equilibrium between the mangifera bark dust and Aq.sol.of SO_2 at the existing operation conditions, rendering mangifera bark dust is capable of further adsorption.

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