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Removal of Heavy Metal Mn^{+2} by The Adsorbent Wollastonite and Effect of pH

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ABSTRACT

Water, no doubt, is the first and foremost legitimate friend of living beings on the earth. Toxic heavy metals have been a chief reason of water pollution. Several unfortunate accidents due to heavy metal contamination in aquatic environment stepped up the awareness about heavy metal toxicity and attracted attention towards their studies. Out of these Minimata tragedy in Japan due to mercury poisoning (1953-1960) and Itai disease in Japan due to cadmium toxicity (1947) are immerable. Waste containing metals may come out of a variety of separate operations such as chemical, metal processing, electroplating, metal polishing, metal cleaning, paint manufacture, battery manufacture etc. The source of wastes in metal processing is quite in good number and also highly variable, both in quality and quantity. Metals can be had in source as particle of pure metals in suspension to metal ions and complexes in solution.

In the present study the adsorbent wollastonite is used to remove Mn (II) from the water of Sai river and also studied the effect of pH.

1. INTRODUCTION

Adsorption is one of the prospective process for removing heavy metal from water and waste water effluents. In advanced countries, the most common commercial adsorbent is activated carbon. However the use of activated carbon does not suit the high cost for developing countries like India. Research is on to find out, low cost absorbent for removing metal from waste. Such low cost adsorbents cover industrial solid waste like fly ash from thermal power plants, agricultural wastes/products, clay etc. Most works are concerned with fly ash as an adsorbent and adsorbent derived from agricultural wastes/ products. The effect of various yardsticks affecting the adsorbent such as contact time, pH, adsorbent dose, particle size of adsorbent, temperature, metal ion concentration has been evaluated.

The physico-chemical nature of adsorbents plays an important role in the study of the rate an extent or removal of pollutants from water and waste water by adsorption. The various constituents of flyash, wollastonite and china clay considerable from sample to sample, depending upon the source. Therefore, the characterization of adsorbents is essential to have a better understanding of the mechanism.

Wollastonite is a ceramic material and its diposites in India is approximately 25 million tones. It is generally used in ceramic industries for preparing smoother glasses, light weight ceramic products, comparatively low loss dielectric bodies. Filter for polyester resins. (Synder N.H and Koening 1952) and other ceramic goods. The ceramic material has been used as low cost adsorbents in water and waste water treatment

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(Pandey etal 1984, Mishra etal 1984, Pandey 1986, Singh etal 1988).

In the present study the removal of Mn (II) from river water has been done by using wollastonite as adsorbent.

2. EXPERIMENTAL

The quantitative estimation of Mn (II) was done by the usual method. Adsorbent concentration, temperature and adsorbent particle size were kept constant at different pH of the medium (from 4 to 9) for the removal of Mn (II) by Wollastonite. pH of medium was adjusted by using HCI or NaOH.

The time variation of adsoption of Mn (II) on Wollastonite at different pH values has given in tabular form and in figure.

Table : Time Variation of adsorption of Mn (II) on Wollastonite at different pH Values

Concentration = 1.987×10^{-4} M; Particle size < 53 μm; Temperature = 30+ 0.1° C

	pH = 4.0		pH = 5.0		pH = 7.0		pH = 8.0		pH = 9.0	
Time	Amount adsorbed mg/g	% Adsorp	Amount adsorbed mg/g	% Adsorp	Amount adsorbed mg/g	% Adsorp	Amount adsorbed mg/g	% Adsorp	Amount adsorbed mg/g	% Adsorp
10	.039	7.80	.061	12.20	.148	29.60	.159	31.80	.118	23.60
20	.064	12.80	.088	17.60	.230	46.00	.262	52.40	.172	34.40
30	.086	17.20	.113	22.60	.295	59.00	.326	65.20	.223	44.60
40	.106	21.20	.136	27.20	.330	66.00	.367	73.40	.263	52.60
60	.125	25.00	.156	31.20	.368	73.60	.400	80.00	.292	58.40
80	.140	28.00	.172	34.40	.394	78.80	.416	83.20	.314	62.80
100	.152	30.40	.186	37.20	.408	81.60	.426	85.20	.332	66.40
120	.152	30.40	.186	37.20	.408	81.60	.426	85.20	.332	66.40
140	.152	30.40	.186	37.20	.408	81.60	.426	85.20	.332	66.40
160	.152	30.40	.186	37.20	.408	81.60	.426	85.20	.332	66.40
200	.152	30.40	.186	37.20	.408	81.60	.426	85.20	.332	66.40

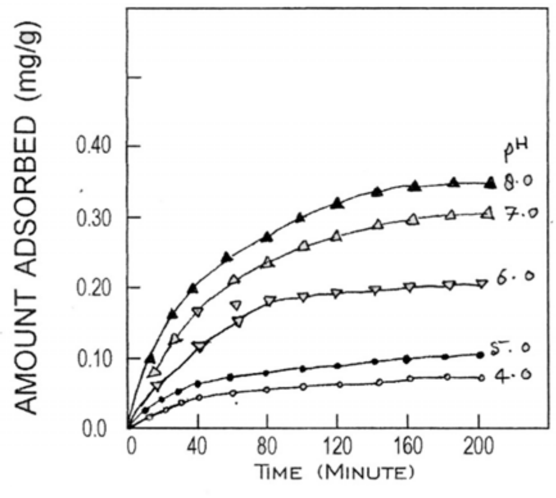

Fig : Time variation of Adsorption of Mn (II) on Wollastonite at Different pH values

3. RESULTS AND DISCUSSION

The adsorption of Mn (II) by the adsorbent Wollastonite has given in tabular from. The change in pH of solution has no effect on the basic nature of time growth adsorption curve and period of saturation. The time growth plot shows that removal is initially rapid and finally becomes constant due to the slow removal near saturation. The adsorption of Mn (II) increases from 0.152 mg/g to 0.426 mg/g by increasing pH from 4.0 to 8.0 and above pH 8.0 the adsorption was decreased from 0.426 mg/g to 0.332 mg/g at the temperature $(30 \pm 1)^0$C and the solution concentration 1.987 x 10^{-4} M by Wollastonite. Similar observations have also been reported by (Millward and Moore 1982), (Hena & Singh, 1992), (Sing et al 1994),

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(De & De 1994) and they found that the higher pH favours the adsorption.

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