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Removal of Phosphate from Pharmaceutical Effluent Using Obligate Aerobes Derived from Fruit Waste

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Abstract:

Phosphorus pollution is a major concern for soil and water management. Phosphorus in water is found in the form of phosphate.Phosphate removal from different effluents by using various parameters like, Effect of Contact Time, Effect of particle size, Effect of fruit waste, Effect of pH, Effect of alum, Effect of dolomite. Mostly the removal efficiency of phosphate is obtained from Biosorption. In this present study using obligate aerobes derived from fruit waste as an adsorbent for phosphate removal. The reaction time, optimum pH, effective dosage of alum and effective dosage of dolomite were optimized. As a result dosage of fruit waste 10.0gm/100ml, reaction time of 4hr 20min, pH of 8, by adding the alum to the effluent the reaction time is reduced from 4.20hr to 3 and also by adding the dolomite to the effluent the reaction time is reduced from 4 to 3.30hr under optimized conditions.

The phosphate concentration is decreased from 160ppm to 4.07ppm in 2.5hrs at optimum conditions using alum.

Key words: Phosphate; Effluent; Bio sorption; Obligate aerobes; Fruit waste

Introduction:

Phosphorus removal from industrial effluent can be achieved throughEffect of Contact Time, Effect of particle size, Effect of fruit waste, Effect of pH, Effect of alum, Effect of dolomite. Various chemical ammonium molybdate, sulphuric acid, hydrazine hydrate, potassium dihydrogen phosphate, NaOH, HCl. etc. are used in the above methods. Water bodies contain certain level of phosphorus in various compounds, which is an important constituent of living organisms. In natural conditions the phosphate concentration in water is balanced i.e. accessible mass of this constituent is close to the requirements of the ecological system. When the input of phosphorous through industrial effluent to waters increases the concentration of phosphate, which leads to the extensive algae growth, these organisms use great amounts of oxygen and prevent sunlight from entering the water. This makes the water fairly unliveable for other organisms. This phenomenon is commonly known as eutrophication. The algae die and decompose high level of organic matter. As a result the water bodies and fish die due the depletion of available oxygen in water. Eutrophication is also natural process that typically occurs as lakes age. However, human-

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caused, accelerated eutrophication (called "cultural eutrophication") occurs more rapidly, and causes problems in the affected water bodies, as described below. It is estimated that 50-70% of all nutrients reaching surface water (principally N and P) originate on agricultural land as fertilizers or animal waste. Urban and industrial runoff also contributes to eutrophication. Industrial effluent discharges mostly contribute to eutrophication. Too much phosphate can cause health problems, such as kidney damage, osteoporosis and hyperphosphatemia. Phosphate should be removed from the effluent according to the standards.

Materials and Methods:

1. Selection of Adsorbent: The adsorbent, fruit waste was collected from the local market of Visakhapatnam. Fruit waste was cleaned, dried for one week. Dried fruit waste was grinded and sieved into fractions of different particle sizes. Powdered fruit waste is stored in dry place
2. Optimization studies: Parameters like pH, Contact time of the Adsorbent, Dosage of the Adsorbent, and size of the Adsorbent were studied to obtain highest removal percentage from the pharmaceutical effluent and the procedures were as follows.
3. Chemicals used: ammonium molybdate, sulphuric acid, hydrazine hydrate, potassium dihydrogenphosphate, NaOH, HCl.

Results and discussion:

1. Effect of Contact Time:

Effect of contact time for the removal of phosphate from the effluent was shown below mention figure 1. The parameters to be maintained were time and the Adsorbent dosage fixed at room temperature and 2.5gm per 100ml and keeps it for stirring at 100RPM. The phosphate concentration is estimated for every half an hour. The phosphate concentration is estimated from half an hour to till it comes stable. With the increase in the time of contact phosphate concentration decreases till the removal reaches an equilibrium phase. Here in the optimization of the contact time, removal of phosphate concentration were getting stabilized after the completion of 4 hr.20 min observed .

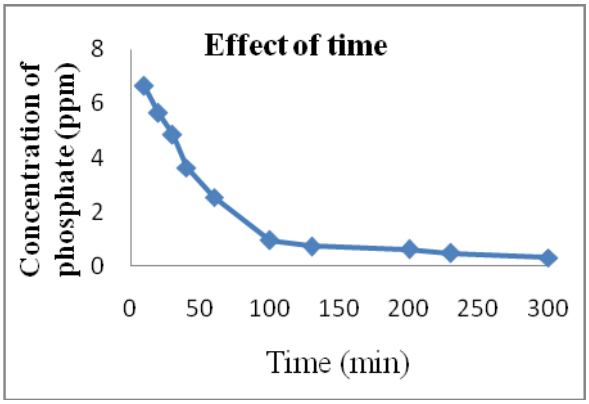

Fig. 1: Effect of contact time for the removal of phosphate

2. Effect of particle size:

Effect of different particle size of fruit waste for the removal of phosphate from the effluent was shown below figure 2. The parameters to be maintained were time and the adsorbent dosage fixed at room temperature and 2.5gm per 100ml and keeps it for stirring at 100RPM. The phosphate concentration is estimated for every half an hour. The phosphate concentration is estimated from half an hour to till it comes stable .With the increase in the particle size phosphate concentration decreases till the removal reaches an equilibrium phase. Here in the optimization of the mesh, removal of phosphate concentration were observed in the below table.

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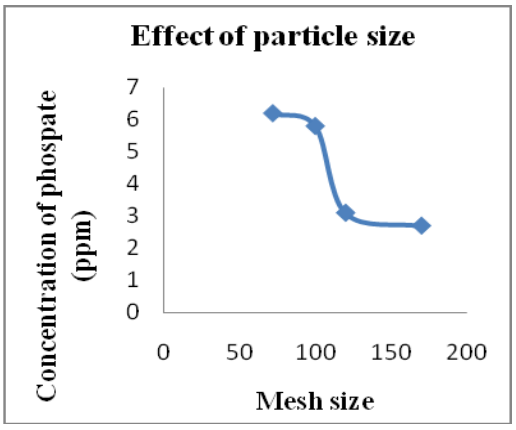

Fig. 2: Effect of different particle size of fruit waste for the removal of phosphate

3. Effect of fruit waste:

Effect of the dosage of fruit waste for the removal of phosphate from the effluent was shown below mention figure 3. The parameters to be maintained were time and the adsorbent dosage fixed at room temperature in 100ml and keeps it for stirring at 100RPM. The phosphate concentration is estimated for every half an hour. The phosphate concentration is estimated from half an hour to till it comes stable. With the increase in the different weight the phosphate concentration decreases till the removal reaches an equilibrium phase. Here in the optimization of the dosage, removal of phosphate concentration were getting stabilized at 2.5gms observed in the below table.

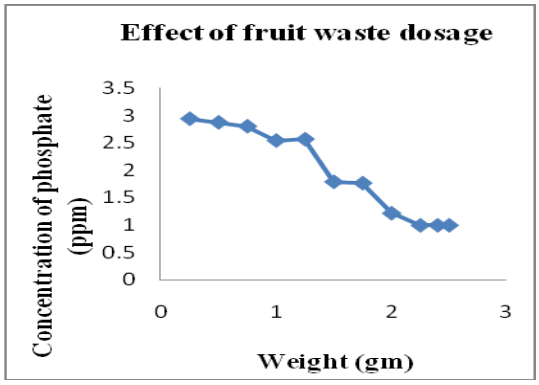

Fig. 3: Effect of the dosage of fruit waste for the removal of phosphate

4. Effect of pH:

The effect of pH time for the removal of phosphate from the effluent was shown below mention figure 4. The parameters to be maintained were time and pH and the adsorbent dosage fixed at room temperature and 2.5gm per 100ml and keeps it for stirring at 100RPM. The phosphate concentration is estimated for every half an hour. The phosphate concentration is estimated from half an hour to till it comes stable .The influence of pH was studied from the range of 2.5 to 9. With the increase in pH, there was a change in removal can be noticed.

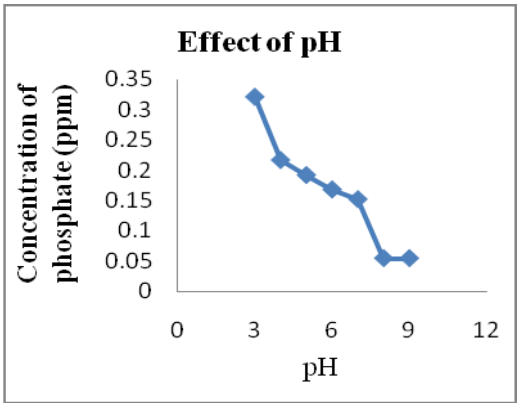

Fig. 4: The effect of pH time for the removal of phosphate from the effluent

5. Effect of alum:

Effect of alum for the removal of phosphate from the effluent was shown below mention figure 5. The parameters to be maintained were time, dosage, pH and the adsorbent dosage fixed at room temperature and 2.5gm per 100ml and keeps it for stirring at 100RPM. The phosphate concentration is estimated for every half an hour. The phosphate concentration is estimated from half an hour to till it comes stable .With the increase in the dosage of alum, time decreases till the removal reaches an equilibrium phase. Here in the optimization of the dosage, removal of phosphate concentration were getting stabilized

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at certain time after the completion of 2hr.30 min observed in the below table.

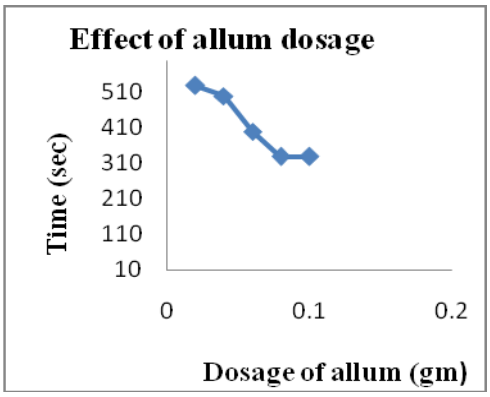

Fig. 5: Effect of alum for the removal of phosphate from the effluent

6. Effect of dolomite :

Effect of dolomite for the removal of phosphate from the effluent was shown below mention figure 6. The parameters to be maintained were time, dosage, pH and the adsorbent dosage fixed at room temperature and 3gm per 100ml and keeps it for stirring at 100RPM.The phosphate concentration is estimated for every half an hour. The phosphate concentration is estimated from half an hour to till it comes stable.With the increase in the dosage of dolomite, time decreases till the removal reaches an equilibrium phase. Here in the optimization of the dosage, removal of phosphate concentration were getting stabilized at certain time after the completion of 4hr.10 min observed in the below table.

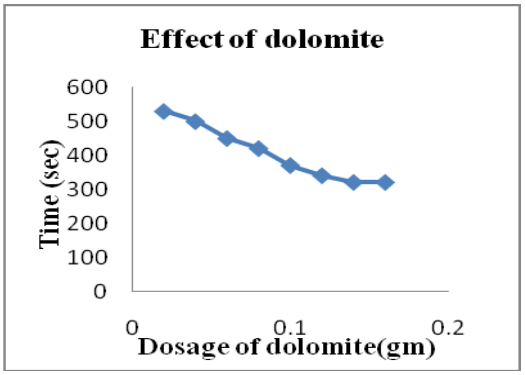

Fig. 6: Effect of dolomite for the removal of phosphate from the effluent

Conclusion:

There are wide range of technologies to remove the phosphate from effluents by using various methods like chemical precipitation, coagulation, electro coagulation method, electro dialysis method, electro dialysis method, Biosorption, adsorption and biological treatment methods.

The present study aimed to investigate the effective dosage of fruit waste, reaction time, and optimum pH, effective dosage of alum and effective dosage of dolomite were optimized. As a result dosage of fruit waste 10.0gm/100ml, reaction time of 4hr 20min, pH of 8, by adding the alum to the effluent the reaction time is reduced from 4.20hr to 3 and also by adding the dolomite to the effluent the reaction time is reduced from 4 to 3.30hr under optimized conditions.

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