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Recent Techniques in Removing Phosphorus from Wastewater

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ABSTRACT

Phosphorus is one of the major nutrients contributing in the increased eutrophication of lakes and natural waters, human excreta, food additives, detergents, corrosion inhibitors and industrial discharges are the main sources of phosphorus compoundsin sewage today the main commercial processes for removing phosphorus from wastewater effluents are chemical precipitation and biological treatment. Phosphate removal is currently achieved largely by chemical precipitation, which is expensive and causes an increase of sludge volume by up to 40% an alternative is the biological phosphate removal (BPR) the aim of this study was to investigate the feasibility of phosphate removal from synthetic wastewater by calcium chloride addition in order to determine optimal operating conditions (PH &Ca/P molar ratios) and to study the influence of the ionic composition of a synthetic solution on calcium phosphate precipitation it is Ca/P ratio 1.5 PH more than Alum or polyaluminiumchloride, In systems where PH controls is an important factor.

Introduction :-

Nutrient salts are most important components of wastewater these consist mainly of Phosphorus and nitrogen which are responsible for one major international problem known as eutrophication of lakes & water ways. It has been generally understood that

Phosphorus is the limiting nutrient in lakes & waterways seeders is one of the countries in the EU that imposes lower limits for the discharge of Phosphorus in recipient water bodies. The maximum limit of Phosphorus in most waste water treatment plants is between 0.3 & 0.5 ingle total phosphorus as monthly or quarterly mean value in the water leaving the treatment plant, depending on the sensitively of the recipient water body. This calls for better waste water treatment technologies and more research is still being undertaking in this area. It is however clear that with conventional wastewater treatment only about 20% to 30% of Phosphorus is removed (Henze 1995) presently, there has been a trend towards combining biological and chemical phosphorusremoval method to achieve better results.

Result and Discussion:-

New technology is used for the removal of Phosphorus in waste water. When treating the waste water with magnesium onside. When the waste water is treated with magnesium onside, struvite (magnesium ammonium phosphate) (MAP) is formed which can be applied as a fertiliser in agriculture, resulting in a closed Phosphorus cycle. The ANPHOS technology has been implemented on a full scale at the waste water treatment plant at the kruiningen site Nitrogen and Phosphorus supply to fresh water negatively affects water quality and ecosystem balance this process known as eutrophication this can lead to increased wastewater treatment costs a reduction in the biological diversity & recreational value of natural water bodies in waste water containing relatively high concentrators of nitrogen& Phosphorus these elements are difficult to remove economically to reach the appropriate compliance limits by biological methods.

Phosphorus must be removed from wastewater as too high concentration may lead to an eutrophication effect & rapidly deteriorating water quality. Main sources of Phosphorus compounds in sewage come from human excreta and detergents. Average amount of Phosphorus from urine & faeces are about 1.0 & 0.59 P/cap day. Chemical precipitation with the use of aluminium and iron salts and lime was the chosen technology. Chemical precipitation in full scale sewage treatment the addition of chemical precipitation agents and removal of produced floss by sedimentation flotation or filtration is the main process technology. many combinations with chemical & biological methods

are possible for phosphorus removal the system choice depends on many factors and better evaluation methods are needed life cycle analysis (LCA) may be an interesting tool to evaluate the systems is still a need for optimization of different methods and more important to evaluate the Phosphorus cycle in rural areas.

Experimental:-

There are two types of processes to remove Phosphorus.

1) Biological Phosphorus removal:-

In biological Phosphorus removal there is an anaerobic state sufficient to create volatile fatly acids (VFAs) such as acetic &propionic in advance of a aerobic (Mixed liquor) zone during anaerobic treatment phosphorus is removed into waste streams. But in case of aerobic treatment the released phosphorus & much more is taken by phosphate accumulating organisms (bacteria)

Bundgaard & Hollander (1978) tested biological nitrification and deification with chemical phosphorus removed by simultaneous recitation with ferrous salts they operated a Bio-Cerrito ordination ditch at the condition F/M ratio 0.19 BOD19 MLVSSd, MLSS = 4100glm^3, SDT = 12 days. They achieved an effluents concentration of 0.89 plm3 in the effluent but did not observe parallel biological & chemical phosphorus removal.

2) Chemical Phosphorus Removal:-

Iron is used for the chemical phosphorus removal processes in the form of ferric chloride (Fecl3), ferrous chloride (Fecl2) and ferrous sulphate (Feso4) Phosphorus that is dissolved in wastewater like sugar in water, is hard to remove we found that a Nano media made with waste Iron can easily absorb & removed Phosphorus. In case of iron 816.47gm of iron is required to remove 453 gm. of phosphorus (as P) Iron works over a wide PH range Iron salt solutions contain some trace metals up to 75-100 mg/L depending on the product.

Ferric chloride (Fecl3)

$$FeCl_3 + PO_4 \longrightarrow Fe_3(PO_4)_2$$

$$Fe^{+3} + HCO_3 \longrightarrow FeOH_2$$

34.5% of ferric chloride solution = 589.67gm of Iron per 3.785 lit.

Aluminium Salts:-

Aluminium Salt (Alum) is also used in Phosphorus removed processes it having Aluminium sulphate (alum) Al2(SO4)3 poly-aluminium chloride (PAC), aluminium chloride (AlCl3), aluminiumchlorohydrate, & sodium aluminates ($Na_2Al_2O_4$)

$Al^{+3} + PO_{4-3}$ - $Al(PO_4)$

$Al^{+3} + 3HCO_3$ - $AlOH_3$

28% $AlCl_3$SOln = 267.629 of aluminium per 3.785 Lit.

70% PAC solution = 254.01 of aluminium per 3.785 Lit.

Lime:-

Chemical equations for lime removal of Phosphorus are given. Lime dosage is more influenced by alkalinity than Phosphorus concentration the PH must be raised to 10.5 for Phosphorus removal to occur.

$Ca(OH)_2 + HCO_3$ - $CaCO_3 + 2H_2O$

$5Ca_2 + 4OH + 3HPO_4$ - $Ca5(OH)(PO4)_3 + 3H2O$

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