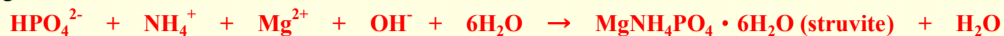


P-recovery in Japan – the PHOSNIX process

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INTRODUCTION

The PHOSNIX process is a technique to enable effective phosphate removal and recovery from the digester or returned water of sludge treatment process in the sewage treatment plant as granulated struvite. The MAP production plant for a sewage treatment works was introduced in 1998. Magnesium Ammonium Phosphate (MAP) is produced from phosphate and ammonium by adding magnesium under weak alkaline conditions.



Objectives

1. Lower phosphorus content in discharged water by reducing phosphorus load in the returned water.
2. Reduce consumption of PAC and poly-ferric sulfate together with the reduction of sludge originating from coagulants.
3. Produce chemical fertilizer (MAP) for resource recycling.

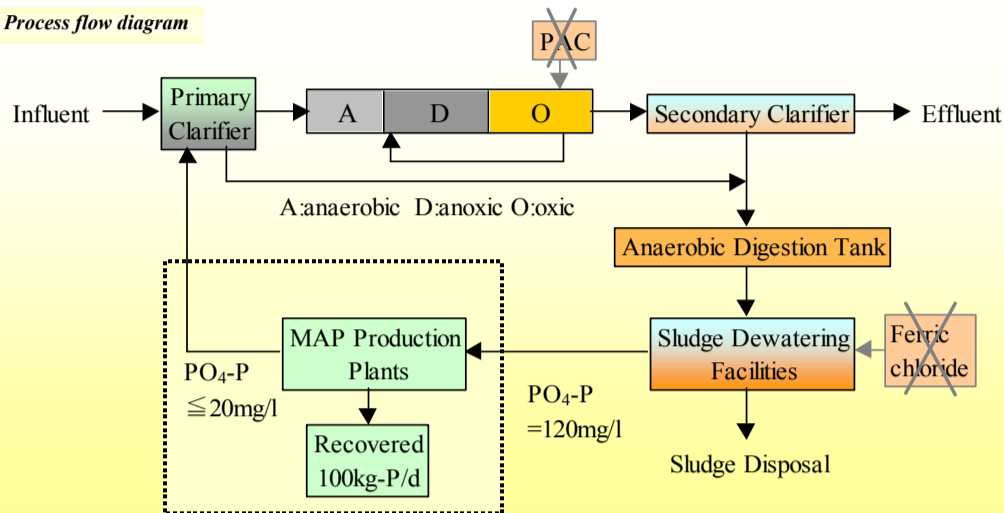
OPERATION OF MAP PRODUCTION PLANT

Influent to PHOSNIX	Filtrate
PO ₄ -P	100-150 mg/L
PO ₄ -P removal ratio	80-90%
Source of magnesium	Magnesium hydroxide
Mg/P Molar ratio	1
pH range	8.5- 8.8
Granule Formation Zone	1.4m φ x 7.3mH
Separation Zone	3.6m φ x 2.7mH
Treatment Capacity	1000m ³ /day
Stirring Method	Aeration
MAP Separation Method	Drum Screen
MAP Drying Method	Natural Drying

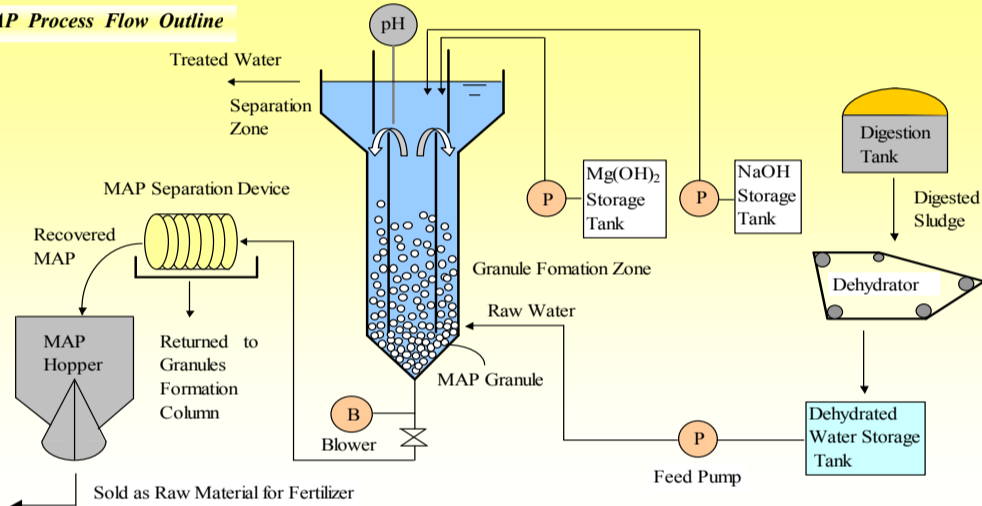
Before introduction of MAP process, about 70% of phosphorus load was originated from the returned water.

MAP PRODUCTION PLANT OF UNITIKA

Process flow diagram



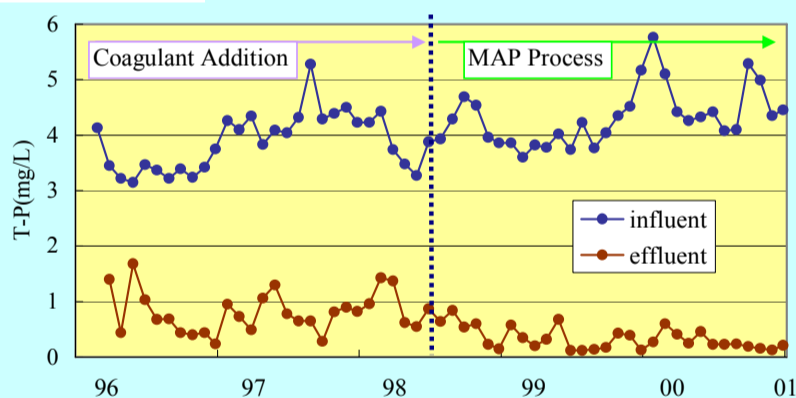
MAP Process Flow Outline



- (1) Returned water from sludge treatment process is fed at the bottom of the reaction column and magnesium is added, with adjusting the pH of the water from 8.1 to 8.8 being mixed by aeration.
- (2) Granulated MAP is fluidized as fine crystal by collisions within the Granule Formation Zone, it is grown up to 0.5-1.0mm granules in about ten days retention time.
- (3) The granulated MAP is drawn from the bottom of the reaction column and is separated to obtain product MAP. Fine granules of MAP in treated water are returned to the reaction column to provide seed crystal in order to continue the granulating process.
- (4) Recovered MAP is held in a hopper to reduce its water content and is released once the water content falls below 10%.



Effect of MAP process



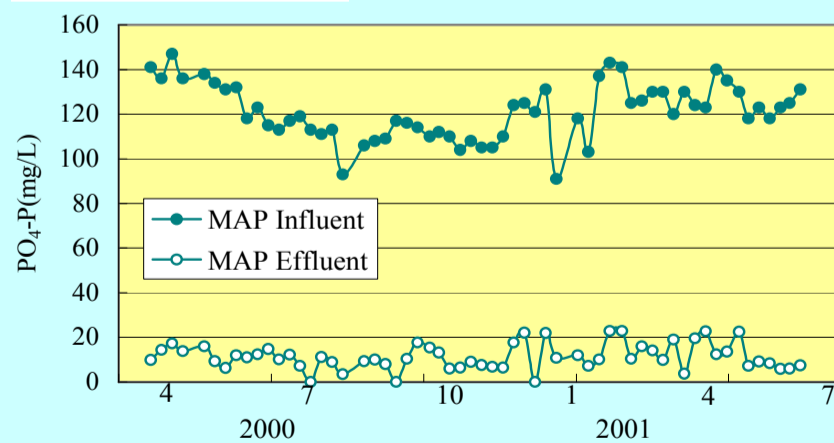
Composition of MAP recovered from sewage

	MAP from sewage	Theory
Ammonia-Nitrogen	5.70%	5.70%
Phosphorus	12.90%	12.60%
Magnesium	9.70%	9.90%
Arsenic	0.00%	-
Cadmium	0.00%	-
Nickel	N.D. (less than 0.01%)	-
Chromium	N.D. (less than 0.02%)	-
Lead	N.D. (less than 0.92%)	-



Content of ammonia-N, phosphorus and magnesium were similar to theoretical values and the concentration of hazardous heavy metals were less than the regulations for fertilizer. Fertilizer effectiveness with the use of MAP was tested and there were no significant difference from standard fertilizer and no abnormal effects were observed.

Phosphate removal by MAP reactor



ECONOMICAL COMPARISON OF PHOSPHORUS REMOVAL PROCESSES

		MAP Process	Coagulant Addition Activated Sludge Process
Operation Cost	1. Electricity	10,100 EURO/Y	900 EURO/Y
	2. Chemical	49,300 EURO/Y	102,000 EURO/Y
	3. Disposal of Sludge		95,400 EURO/Y
Sales Profit of MAP		Δ 32,100 EURO/Y (@210 EURO/ton)	
Total		27,300 EURO/Y	198,300 EURO/Y

CONCLUSION

The results are follows;

- (1) The MAP process whereby phosphorus load in the returned water is reduced exhibits the same or better treatment quality in comparison to the coagulant addition activated sludge process.
- (2) The recovered MAP contains almost no hazardous materials and shows equivalent or better fertilizer effectiveness than conventional chemical fertilizer in market.