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Cost effectiveness of phosphorus removal processes in municipal wastewater treatment

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1 **Cost Effectiveness of Phosphorus Removal Processes in**

2 **Municipal Wastewater Treatment**

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7 **ABSTRACT**

8 Meeting stringent phosphorus (P) discharge standards remains one of the major challenges for wastewater
9 utilities due to increased economic burdens associated with advanced (i.e., secondary, tertiary) treatment
10 processes. In a trade-off between higher treatment cost and enhanced P removal, it is critical for the
11 treatment plants to be able to select the most appropriate technology. To this end, established/emerging
12 high performing P removal/recovery technologies (e.g., Modified University of Cape Towne process,
13 Bardenpho process, membrane bioreactors, IFAS-EBPR, struvite recovery, tertiary reactive media
14 filtration) were identified and full-scale treatment plant designs were developed. Using advanced
15 mathematical modeling techniques, six different treatment configurations were evaluated in terms of
16 performance and cost effectiveness (\$/lb of P removed). Results show that the unit cost for P removal in
17 different treatment alternatives range from \$42.22 to \$60.88 per lb of P removed. The MUCT BNR+
18 tertiary reactive media filtration proved to be one of the most cost effective configurations (\$44.04/lb P
19 removed) delivering an effluent with total P (TP) concentration of only 0.05 mg/L. Although struvite
20 recovery resulted in significant reduction in biosolids P, the decrease in effluent TP was not sufficient to
21 meet very stringent discharge standards.

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