Comparison of the effects of two remediation technologies on bacterial community from sediments of an urban eutrophic reservoir

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Introduction: The Ibirité reservoir is a tropical urban ecosystem (located in Southeastern Brazil) that has been suffering from eutrophication. The main causes of the reservoir's eutrophication are associated to the discharges of raw urban sewage and industrial effluents, which results in periodic cyanobacterial blooms. Internal fluxes of nutrients from sediments to the water column are also significant, reaching values like 105-137 mg cm^{-2} yr^{-1} of ammonium and 1.7-2.0 mg cm^{-2} yr^{-1} of orthophosphate [1]. Considering a future scenario in which the external sources are controlled, mesocosm *in situ* experiments were developed to compare the effects of two remediation technologies used to immobilize orthophosphate: Phoslock™ and calcium nitrate.

Methods: After 600 hours from the application of treatments, orthophosphate and total phosphorus concentrations were determined in the interstitial water [2]. The effect of Phoslock™ and calcium nitrate on bacterial community was assessed by most probable number (MPN) technique [2], through the quantification of bacterial groups like nitrate reducers (NRB), sulphate reducers (SRB) and iron reducers (IRB), as well as methanogenic archaea (MA).

Results: According to the results, Phoslock™ was more effective on orthophosphate immobilization, causing 58% and 55% reduction on orthophosphate and total phosphorus concentrations, respectively. Calcium nitrate application lead to lower reductions, which reached only 26% and 38% for orthophosphate and total phosphorus concentrations, respectively. Regarding the microbiological quantification, Table 1 shows that Phoslock™ application caused reduction in the numbers of viable cells of all the analyzed groups. As expected, calcium nitrate addition improved the number of nitrate reducers.

Discussion: Considering phosphorus immobilization, an important point should be highlighted: Phoslock™ undoubtedly presented a more significant phosphorus reduction. Nevertheless, the possibility of calcium nitrate application should not be discarded because if the period prescribed for monitoring the experiments were extended, similar reductions could probably be found.

Table 1 : Most probable number values (number of viable cells in 100 mL) comparing controls and treatments (Phoslock™ and calcium nitrate):

3 replicates, 95 % confidence				
Group	**External control (reservoir)**	**Internal control (mesocosm without treatment)**	**Mesocosm treated with Phoslock™**	**Mesocosm treated with calcium nitrate**
NRB	93×10^6	150×10^6	150×10^5	210×10^{10}
SRB	93×10^4	150×10^4	43×10^3	150×10^4
IRB	150×10^4	93×10^4	64×10^4	75×10^4
MA	43×10^4	93×10^4	20×10^2	75×10^3

The only explanation to the decrease in microbial numbers due to Phoslock™ application is the presence of lanthanum in the product's composition. Such element presents toxic potential and so it could provoke some adverse effect on the analyzed microbial groups. Further studies are required to confirm this. Still according to microbiological testing, nitrate intensifies denitrification process. Thus its application promotes the increase of nitrate reducer bacteria population, which explains the high MPN value observed for such group.

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References:

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