

# Bio-solids from Bugolobi Wastewater Treatment Plant, Uganda do not meet the minimum standards for land application

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## INTRODUCTION

Land application of bio-solids is the cheapest and most convenient method of disposal of bio-solids worldwide (Evans, 2009; Rawlinson 2012) but it was unclear if the bio-solids in Uganda met the minimum standards for safe disposal by land application.

## OBJECTIVE

Establish the impact of ageing on quality and safety of bio-solids from Bugolobi Wastewater Treatment Plant (BWTP see Fig. 1) for land application.

## METHODOLOGY

Nine out of 14 beds in each of the four blocks (Block 1: fresh bio-solids; Block 2: settling bio-solids; Block 3: maturing bio-solids and Block 4: mature bio-solids) at BWTP (Fig. 2) were randomly sampled for quality and for bio-safety.

For quality, bio-solids were analysed for electrical conductivity (EC); N, P and K concentrations and their respective stocks; organic matter (OM) content and bio-solid organic carbon (BOC) stocks. For bio-safety, bio-solids were screened for *E. coli* and *Salmonella*.

Data were subjected to ANOVA after checking for normality and equal variance assumptions, using Genstat statistical package 14<sup>th</sup> edition. Means were separated using Fischer's protected LSD at two standard deviations.

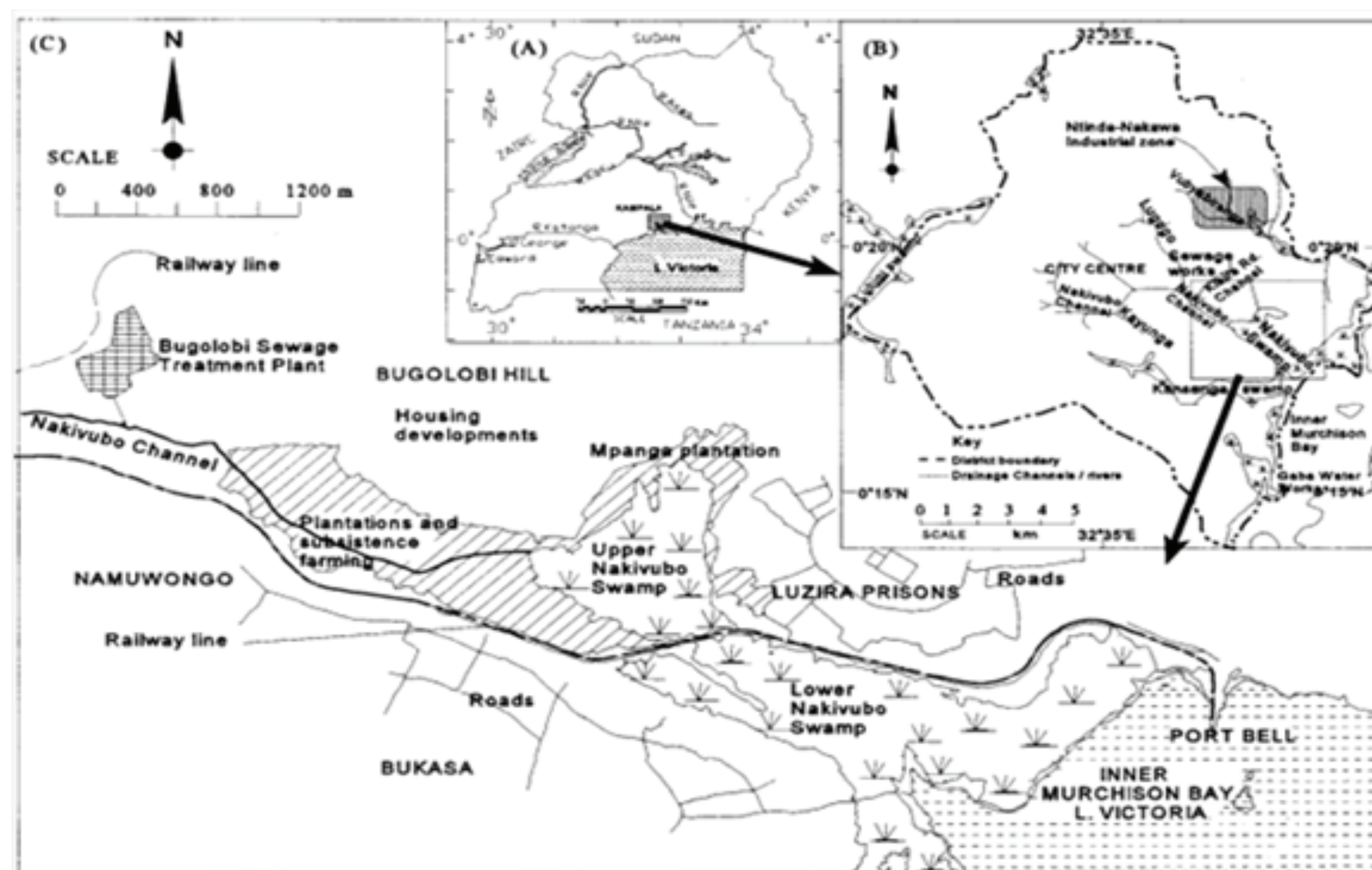


Fig. 1: Location of Bugolobi Sewage Treatment Plant. Inset A is the Map of Uganda showing the location of Kampala City whereas Inset B shows the extent of Kampala City, with the Nakivubo Swamp, Murchison Bay and the location of the Bugolobi Sewage Treatment Works.

1	3	5	9	7	1	3	5	9	7
2	4	6	8	2	4	6	8	2	4
Block 1					Block 2				
1	3	5	9	7	1	3	5	9	7
2	4	6	8	2	4	6	8	2	4
Block 3					Block 4				

Table 1: Sampling plan for biosolids at Bugolobi Wastewater Treatment Plant Kampala, Uganda on March 27, 2014

## RESULTS

Ageing of bio-solids had a significant impact on EC and *E. coli*. The EC was highest in mature bio-solids ( $4556 \pm 173$ )  $\mu\text{S cm}^{-1}$  and smallest in fresh bio-solids ( $3494 \pm 124$ )  $\mu\text{S cm}^{-1}$  (Fig. 2). These EC values exceed the maximum permissible limits.

Similarly, microbial counts were highest for *E. coli* in the mature sludge ( $3946 \pm 86$ ) '000'  $\text{CFU g}^{-1}$  and smallest in the fresh bio-solids ( $633 \pm 22.9$ ) '000'  $\text{CFU g}^{-1}$  (Fig. 3).

Out of the 36 bio-solid samples, one tested positive for salmonella, implying that the bio-solids are neither safe for land application nor general release into the environment.

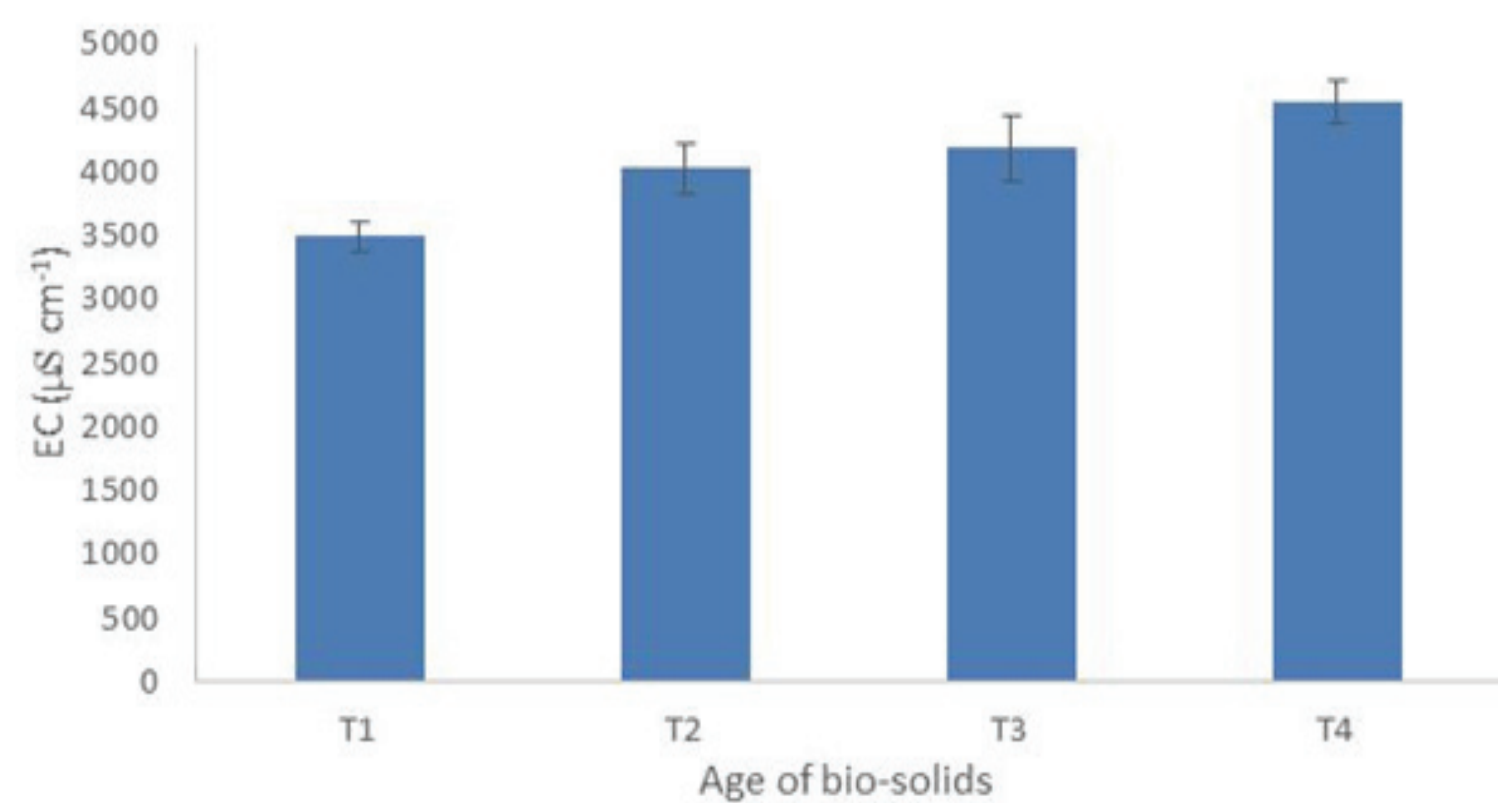


Fig. 2: Effect of age of bio-solids from Bugolobi Wastewater Treatment Plant (x-axis) on electrolytic conductivity, EC (y-axis) as of March 27, 2014. T1, T2, T3 and T4 denote: fresh, settling, maturing and mature bio-solids, respectively.

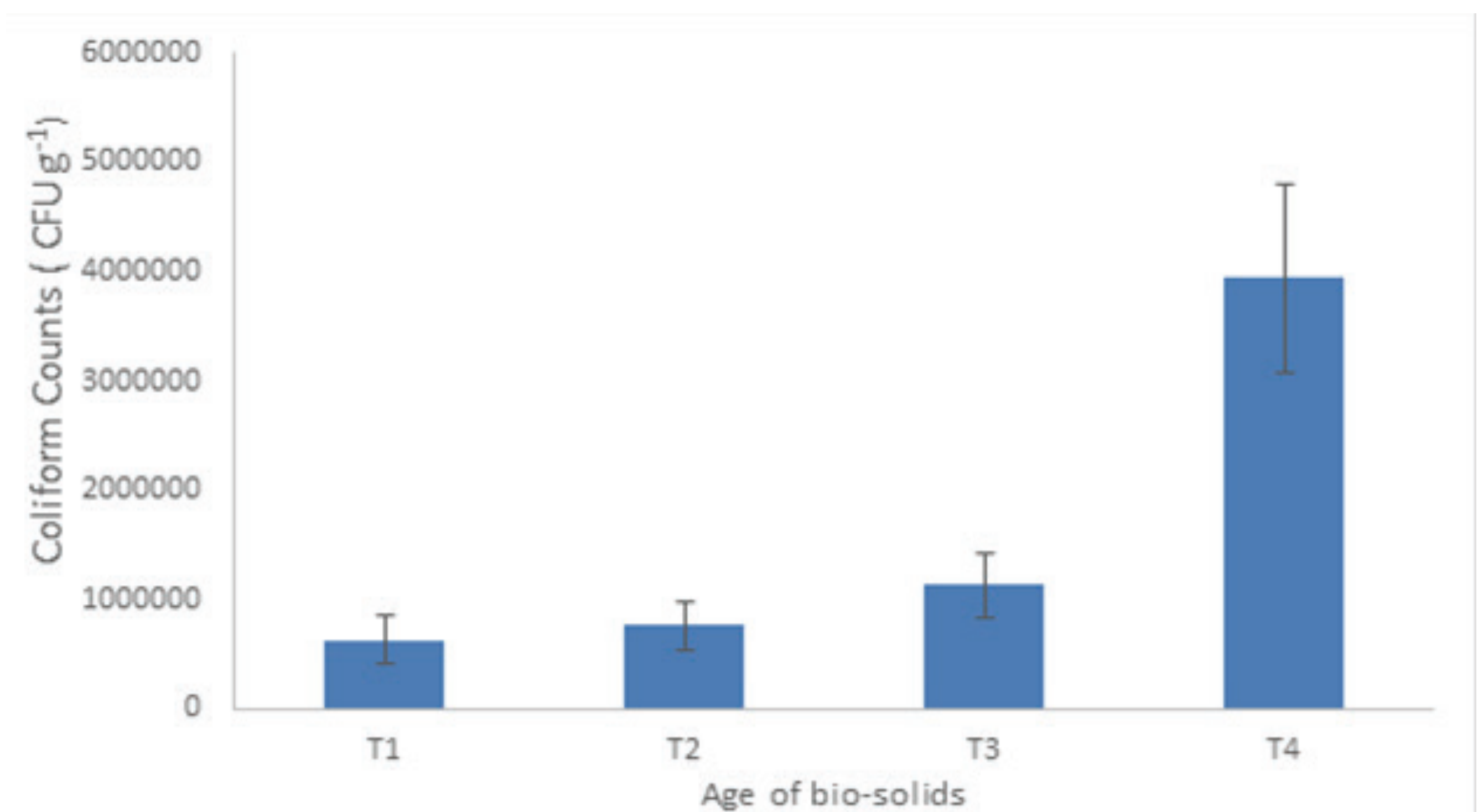


Fig. 3: Effect of age of bio-solids from Bugolobi Wastewater Treatment Plant (x-axis) on *E. coli* x (y-axis) as of March 27, 2014. T1, T2, T3 and T4 denote: fresh, settling, maturing and mature bio-solids, respectively.

## CONCLUSION

In their current state, the bio-solids from the Bugolobi Wastewater Treatment Plant do not meet the minimum standards for land application and general release into the environment until they have been desalinated and disinfected to eliminate or lower potentially pathogenic organisms such as *E. coli* and *Salmonella sp.*

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